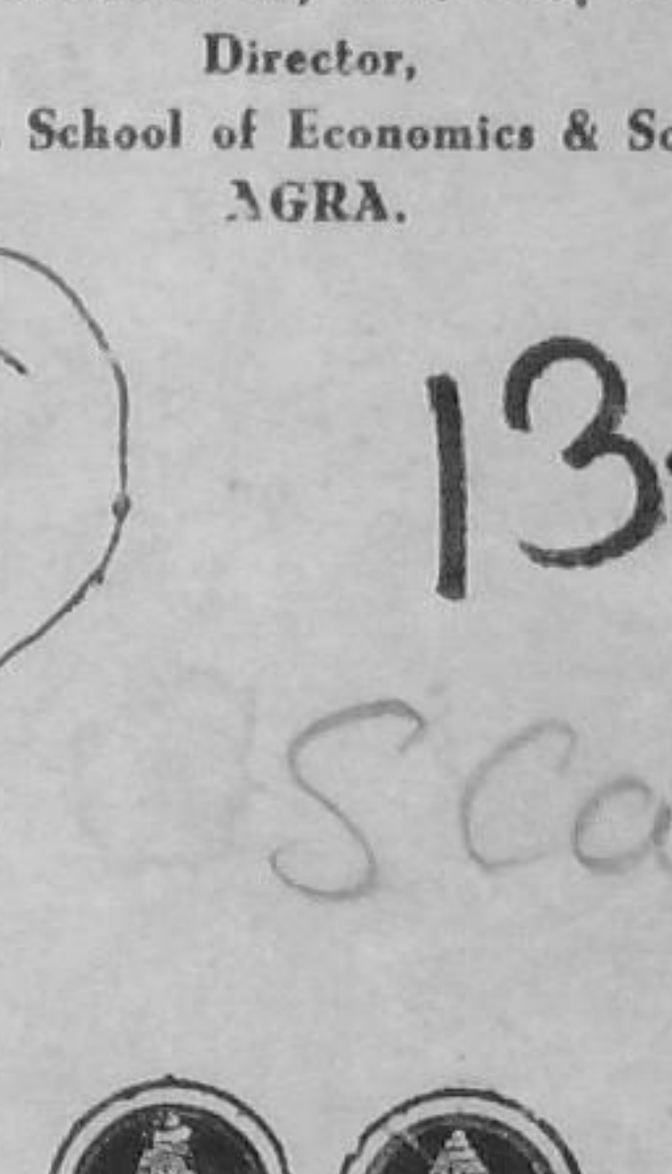
Agricultural Economics

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LAKSHMI NARAIN AGARWAL,
EDUCATIONAL PUBLISHERS,
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To

Dr. Radha Kamal Mukerjee

from whom

the author has drawn

inspiration.

FOREWORD

Agricultural Economics is taught and studied in India as an appendage to urban-industrial economics, of which the type and pattern are set by the economic history and institutions of Western Europe and America. This kind of approach is responsible not only for the lack of scientific understanding and interpretation of the social and economic problems of the Indian country-side, but also for the indifference, nay fatalism with which we look upon the present trends of rural decay, desocialization and disintegration as inevitable. It is for this reason that this brief and fresh introduction to the study of Agricultural Economics coming as it does from Dr. D. S. Chauhan, who has had a long and valuable experience of field agricultural research, is to be heartily welcomed by the scientific circles.

The net output at factor cost from agriculture in India is estimated at about 48 per cent by the National Income Committee. But agriculture is not merely an occupation but also a mode of living; and hence the enhancement or lapse of its values apart from income or employment has both direct and indirect effects upon general economics and policies far beyond farming as a business. Yet even within the limited field of the agricultural occupation we have the insistent problems that are crying for solution, such as the optimum size of the holding, the optimum cropping system, the optimum utilization of cattle power and the optimum farm management on which rests the whole success of the Five Year Plan on its agricultural sector. These have been skilfully dealt with

by Dr. Chauhan. He makes out a strong case for proper land utilization that today holds the major key not only for successful population adjustment but also for withstanding the social and economic perils of erosion and dessication. Today the Great Indian Desert is eating into the vitals of the soil and the population of Uttar Pradesh. On account of the cumulative effects of the expansion of loose sands set free by the disappearance of scrub jungle and grass, over grazing and browsing by cattle, sheep and goats for generations and heavy erosion, especially along the flanks of the Jamuna and its tributaries, what may be called, the 'man-made desert' or the 'Dust Bowl of India' has now established itself over about a thousand square miles of land once smiling in plenty. Topographical surveys indicate that from the north to the south Ferozpur, Patiala, Mathura and Agra are the vulnerable lines across which the desert invades the Ganges valley in a great convex arc at a rate of half a mile per year during the last half a century and swallowing up about 50 sq. miles of fertile land per year. It may be estimated that the gullied lands in U. P. cover at least 500 sq. miles and are not merely useless but constitute a serious danger to the adjoining good lands. Almost 20 per cent of the tracts along the Jamuna and the Chambal in Uttar Pradesh is now intersected and denuded by ravines comprising a vast waving sea of aching desolation and waste fringing and attacking one of the most prosperous parts of India. The U. P. due to man's recklessness, ignorance and hunger-drive, which are accelerating the processes of wind and water erosion in a semi-arid tract bordering the Great Desert, is committing 'regional suicide' in the south-west. The conservation of soil and the conservation of water which are intimately associated with

each other together touch the entire field of man's exploitation of the earth and thus a scientific bio-physical programme involves the highest amount of co-ordination of man's uses of trees, grasses, soils and waters in the back-ground of his popolation pressure and standard of living. I would expect that the team-investigations of the B. R. School of Economics and Sociology, Agra, under Dr. Chauhan's expert guidance will show the way for the recovery of the Agra–Mathura region on the basis of integration of methods and materials from the different fields.

Researches into soil and water conservation, land reclamation and agricultural intensification and extension cannot succeed if these be undertaken piecemeal. These have to be carried out in total setting of the emerging agricultural economic science concerned with the techniques of farm production, the patterns of farm management and the standards of farm work and living in their dynamic reciprocity with the complex of economic, social and cultural transformations. The entire trend of culture and technology in India is working against the country-side and agriculture. Today the Indian village is victimized by the city. The rehabilitation and progress of the country-side depend upon the success with which we can introduce a dispersed type of industrialism on the basis of hydel power and motor transport and set up certain intermediate "rurban" habitations that combine the social values of the village with skills and technologies of the city. The Five Year Plan is unhappily silent about these aspects of economic integration and development. Dr. Chauhan has made a strong plea for rural industrialization on a decentralized basis that will lead to the diversification of employment, improvement of farm technology and the reorganizatian of rural credit and

While making the book interesting to the non-specialists and at the same time to provide something for the specialists, the style, instead of maintaining the specific and distinctive characteristics of either, has become a mixture of readableness and exactness. The exactness of statements and precision attempted for the sake of the specialists make the style prolix at places. The interspersed digressions and the language loaded with long sentences have been adopted to make the statements exact without being obscure. But it so appears that clarity attempted for the sake of the specialists has become, at place, confusing to the general reader. It looks like the vision of an orchard or forest becoming obscure when one approaches too close or actually moves amongst the trees.

The author is most indebted to Dr. Radhakamal Mukerjee who has been a source of inspiration. Besides, acknowledgements of gratefulness are due to a very large number of authors on whom he has drawn considerably for thought and substance. Some of the names are being referred to but many more remain unmentioned. The author is conscious of their obligations. Thanks are also due to Mrs. Sushila Kumari Chauhan, who has helped considerably in reading the proofs and preparing the index. Lastly, we thank our Publishers for their remarkable patience in bringing out this book.

D. S. Chauhan.

Agra, Nov., 1952.

CONTENTS

FOREWORD.
PREFACE.

CHAPTERS.

I. THE SUBJECT-MATTER. ... 1–11

DEFINITION.
SCOPE.
NATURE.

II. IMPORTANCE OF AGRICULTURE. ... 12–25

AGRICULTURAL FUNDAMENTALISM.
PLACE OF AGRICULTURE IN NATIONAL ECONOMY.
IMPORTANCE OF AGRICULTURE.

III. SPECIAL FEATURES OF AGRICULTURAL ECONOMY. 26–56

DIFFERENCE BETWEEN AGRICULTURE AND INDUSTRIAL ECONOMY.
AGRICULTURAL ENVIRONMENT.
INTERDEPENDENCE OF AGRICULTURAL AND OTHER ECONOMIES.
THE LAW OF DIMINISHING RETURNS.
INTENSITY OF CULTIVATION.

IV. TYPES OF FARMING AND THE PROBLEMS OF SELECTION AND VALUATION. ... 57–95

CLASSIFICATION OF FARMS.
FARMING AS AN OCCUPATION.
SPECIALIZED VS. DIVERSIFIED FARMING.
PROBLEMS OF SELECTION.
VALUING THE FARM.

V. RURAL LIFE AND ECONOMIC TRANSITION. 96–157

THE VILLAGE COMMUNITIES.

PRESENT ORGANIZATION OF VILLAGES.
SOCIAL ENVIRONMENT AND AGRICULTURE.
ECONOMIC TRANSITION AND AGRICULTURE.
RURAL–URBAN RELATIONSHIP.
VILLAGE PANCHAYATS IN U. P.

VI. FAMINES AND FAMINE RELIEF. ... 158–200

FAMINES.
HISTORY OF FAMINES.
FAMINES IN MODERN TIMES.
EFFECTS OF FAMINES.
MEASURES AGAINST FAMINES.
PLAN OF MODERN FAMINE CAMPAIGN.

VII. RESOURCE UTILIZATION. (LAND RESOURCES.) 201–264

RESOURCE ASSESSMENT.
LAND–USE PATTERN.
SOIL CONSERVATION.
FORESTS.
LAND RECLAMATION AND AGR. EXTENSION.

VIII. RESOURCE UTILIZATION CONTINUED. (WATER AND POWER RESOURCES.) 265–350

RIVER TRAINING.
PROTECTION AGAINST FLOODS.
IRRIGATION.
POWER RESOURCES.
CO-ORDINATED POLICY OF RESOURCE UTILIZATION.

APPENDIX A. Changes in the sale value of land.
APPENDIX B. The Community Concept.

CHAPTER I.

The Subject-Matter.

Definition. The scientific study of Agricultural Economics as a separate branch of Economics is of recent origin, though books on agriculture used to be written long beforehand and many important problems of agricultural economics have been given considerable thought and have been solved through organized effort.[1] All this literature is of a different nature which is not generally considered as agricultural economics in the modern conception of the term. However, even in the recent approaches to the subject there is no unanimity of thought, and the definitions given by various authors differ both in nature and scope. By way of example, a few of them are given below :

1. "Agricultural Economics is that branch of agricultural science which treats of the manner of regulating the relations of the different elements comprising the resources of the farmer whether it be the relations to each other or to human beings in order to secure the greatest degree of prosperity to the enterprise." (Jouzier)

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1. The beginning of the study of agricultural economics is generally traced back to the 9th decade of the last century or roughly towards the close of the 19th century. At the same time we are told that agriculture is the oldest occupation ; customs, traditions and even legislation regarding land system, taxation, exchange and international trade, irrigation, price administration and relief etc., have existed since the ancient times ; economy of most of the countries of the world till the middle of the last century was founded almost exclusively on agriculture ; and the treatment of agrarian problems is seen in almost all the important treatises on political economy by classical writers. Thus, we find a considerable thought and effort being given to agrarian economy since long. Then how to reconcile these two apparently opposite ideas ? Really speaking, when it is said to be a recent study the implication is that the application of modern

2. "Agricultural Economics deals with the principles which underlie the farmer's problems of what to produce, how to produce it, what to sell and how to sell it, in order to secure the largest net profit for himself consistent with the best interest of the society as a whole. More specifically agricultural economics treats of the selection of land, labour and equipment for a farm, the choice of crops to be grown, the selection of livestock enterprizes to be carried on, and the whole question of the proportions in which all these agencies should be combined. These questions are treated primarily from the view-point of costs and prices. It deals not only with economics in production but also with problems of justice in distribution of wealth amongst various classes....."—

3. "Rural problem is divided into four general aspects. The industrial aspect or agricultural economics has to do with the relation of the farmer with other elements of the industrial system, such as land tenures, means of transportation, methods of marketing, system of taxation, credit institutions and protective and stimulative legislation."

(American Farm Management Association.)

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economic thought and analysis and the technique of research to the administration of agricultural economy so as to put it on the status of an independent scientific approach, teaching and study of it at the university level, *i. e* , appointment of professors exclusively for agricultural economics and the inclusion of it as a separate subject for post-graduate studies and research, and the writing of books exclusively on economic and social problems of agriculture and peasants etc., are recent developments. Agricultural economy as such, as an organic doctrine based on adequate experimental data scientifically collected and logically analyzed, did not exist until the end of the last century when thought was stimulated in Western Europe, England and America by the agricultural depression. In fact the earlier treatment of the problems of agriculture as indicated above is not considered as the study of agricultural economics in the modern meaning of the term. It is because agricultural economy in early times has been studied by technical agriculturists rather than by professional economists, and the earlier economists while dealing with problems of agriculture dwelt on general economic problems apart from the specific character of the sector under consideration (*e. g.*, discussed general problem of price-fixing even though investigations were concerned with agricultural products) and even while studying agriculture as a human activity (*e. g.*, in historical approach) and in their sociological approach (*e. g.*, life of peasants and problems of farm-work) they rarely conceived of anything other than abstract problems of little practical value.

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2. Taylor.

4. "It may be defined as the science in which the principles and methods of economics are applied to the special conditions of agricultural industry."—

5. "Agricultural Economics may be defined as the application of general economics to the craft and business of agriculture."—

6. "Agricultural Economics is the study of relationships arising from the wealth-getting and wealth-spending activities of man in agriculture."—

The first three definitions identify agricultural economics with farm management and hence, they are limited in scope. The other three are better because of being more comprehensive in comparison to the first three. But they neglect the social aspect. Hibbard's idea is more akin to Marshall's conception of economic activities and hence, it is also limited; and Gray's definition, though it covers a wider scope, is not explanatory and is characterized by vagueness. Really speaking, a definition loses its charm on being explanatory since in that case it necessarily becomes lengthy; and brevity often sacrifices comprehensiveness. It is very easy to criticise a definition from one point of view or another but

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Secondly, there is an impression that the systematic study of agricultural economics as a separate branch of study has originated in the U. S. A. and that the terminology such as 'rural economics' and 'agricultural economics' has also originated there. These are wrong impressions, and have gained ground most probably because the literature of the countries of Western Europe specially Germany and Italy, has not been sufficiently studied. In America, though a few earlier contributions are found, T. F. Hunt (1892) is the outstanding pioneer in the field of agricultural economics who put rural economics on the list of courses recommended in 1896, and the most popular book for the students of agricultural economics in U. S. libraries was 'Progress and Poverty', by Henry George written in 1880. Besides, the terminology referred to above is seen in English literature prior to its use in the U.S.A., and in England there is also available a rich literature by Caird (1850 and 51), Prothero (1888), Cobden (1846) and even much earlier to them by William Marshall and Young at the close of the 18th and the beginning of the 19th century. American thought is considerably influenced by, and American students at the close of the 19th century found many of their basic principles explained in, German literature, by Thaer, Thunen, Roscher, Sering and Goltz. This shows that prior to America, England had a considerably rich literature in agricultural economics and

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4. Gray, 5. Howard, 6. Hibbard.

very difficult to give one which may be free from the defects found in the previous ones. But while describing the subject-matter and the scope a brief definition is not indispensable nor is it necessary for students to remember any particular one. Very often definitions are criticised because a few lines torn off the original text do not convey the exact sense and the full scope covered by the author. This is the case with Taylor whose ideas and treatment of agricultural economics covered a much wider scope than indicated by his definition which is generally quoted. Perhaps the purpose can be served by omitting a brief definition in the beginning and the students may find it easier by first dealing in a bit detail with the nature and scope of the subject-matter and then come to a concrete definition.

Scope. Agricultural economics is not the application of the general theory of economics to the business of agriculture but as is indicated by the term itself, is a specific aspect of the social science of economics. It is, therefore, necessary to have at the very outset a clear understanding of general economics. In this regard it is to be noted that the scope of economics has widened from 'Price Economy' to 'Welfare Economy'. Economics instead of being defined in the words of Marshall that it "is a study of mankind in the ordinary business of life ; it examines that part of individual and

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that America borrowed considerably from Germany. Again, even prior to England, Germany and Italy had advanced far in this study. At the close of the 19th century every important German University had its professor who taught subjects concerning fields now designated as agricultural economics when there was no chair of agricultural economics in any English University, and the contributions of Thaer (1798) and Thunen (1826) are said to be the outstanding contributions in agricultural economics. Similarly, Italy was remarkably rich in such literature contributed by Cato, Varro, Columella, Pliny and Virgil And the influence of Italy on British thought and practice is proved by the fact that prior to the introduction of modern agriculture the British system of farming was termed as 'Virgilian Agriculture.' Besides, during the 19th century Italy had fine contributions made by Carlo Castaneo, Iacini and Valenti.

social action which is most closely connected with the attainment and with the use of the material requisites of well-being," and thus, being considered to be a study of 'material welfare,' and economic activities being considered to be a particular group of human activities distinguished from non-economic activities, it is now more popularly defined in the words of Robbins that it is a 'science which studies human behaviour as a relationship between ends and scarce means which have alternative uses". It is a study of a particular aspect of human activities. The problem of economics is how to satisfy multifarious wants with scarce means. The background is that wants are unlimited and the means to satisfy them are scarce. A complication has been introduced by the characteristic of means that they can be put to alternative uses. The objective is to attain the greatest satisfaction or the maximum social welfare. Here is the subject-matter for economists, and their task has been described in short as that of selecting or choosing or economising. Agriculture on the other hand, is the science and art of cultivating land and raising of livestock, and is not only a mode of livelihood but a way of life also. A combination of these two ideas, of economics in general and of agriculture in particular, gives a clue to our subject-matter.

Agriculture, in general, is governed by a number of forces. Some of these forces are physical and are treated by physicists, chemists, geologists and soil specialists, etc. Some others are biological forces which are studied by plant and animal physiologists, pathologists, geneticists, entomologists and bacteriologists, etc. Another set of forces are economic and sociological forces which are characterised by relationships arising amongst men on account of agriculture being followed as a vocation and a way of life. It is with these relationships that agricultural economists deal. In other words, while

satisfying the multifarious wants farmers come in contact with others. These contacts are the natural characteristics of modern economic life, which the economists say, arise on account of specialization and commercialization of production, division of labour and combinations of widely scattered and distinct factors of production. With the progress of civilization these contacts are becoming more numerous and complicated, weaving around an individual a network of inter-relationships some of which are supplementary, some complimentary and others competitive. They involve :

(*i*) relations between different enterprises indicating the choice of farming as an occupation, and between different branches of the same occupation indicating a choice between growing of crops or raising of livestock, or even in growing of crops, between cereals and fibres,

(*ii*) relations between different factors of production presenting a problem of right combination and substitution,

(*iii*) commercial relations between farmers and the people to whom they sell or from whom they buy goods and services, and,

(*iv*) relations of value between the different factors of production and the final product, involving cost and price relationship.

Agricultural economics covers all the four branches of economic life of the agricultural community : production, exchange, distribution and consumption, and for practical purposes or for detailed treatment it can be divided into these four branches. With special reference to agriculture it studies : what to produce, how to produce and how much to produce ; what to sell, where to sell and at what price to sell ; what to distribute, among whom to distribute and on what basis to distribute ; what to consume and how much to consume. To be specific it includes the choice of farming

as an occupation, the choice of farm and livestock, of machinery and labour, of crops and cropping system, the size of the unit of production, the grouping of the factors of production, intensity of culture, manuring, irrigation, soil conservation, selling of agricultural products, land system and rent, agricultural finance and rate of interest, wages and employment, prices, costs and profits, standard of living and National Dividend, etc.

In all the cases the basic problem is of economising or of efficiency, i. e., choosing the most profitable enterprise and operating it at the optimum scale, combining the different factors of production in the most economical proportion, buying and selling most advantageously, regulating all the activities involving value to the best interest, and in short, directing all the activities to the best advantage. The task of the agricultural economist is to point out what is best to do in the economic interest of the agricultural community under given conditions, what is technically termed as valuation of phenomena by social standards or human standards. It is worthwhile to note that this does not coincide exactly with maximum return in money or product, or maximum satisfaction in consumption. That is a limited ideal. Monetary aspect, call it the problem of pricing or of profits, is a basic and very important aspect of our science but not the whole of it. It is the basic economic motive, but is a means to an end and not an end in itself. It provides a will, an urge, a purpose, and a driving force for higher motives—the service of mankind or of society. The study of agricultural economics does not end in attaining maximum return in money or maximum indvidual satisfaction of the farmer. The social interest cannot be overlooked. Individual interest is sacrificed for the community interest. The results have to be judged not from the maximum profit but from the general

happiness of life. The ideal is the maximum social welfare.

Besides, the subject is in evolutionary growth. New problems arise under new circumstances which call for fresh solutions, and emphasis shifts from one problem to another according to changed conditions. The 'line fence conception'* of agricultural economics has now widened so as to include all the economic and social problems of the farm community. The cost analysis of individual crops and farms, formerly attempted with a view to discover the relative importance of various factors in the determination of farm profits, is now used in connection with regional adjustment of production from a national point of view; and serves as a basis for national policy. The study of foreign trade in agricultural commodities has evolved from the economic advantages to different nations and the idea of the comparative cost to the present activities of International Emergency Food Council and the Food and Agricultural Organization. The study of land economics has developed from merely resource description to directional measures as a means of dealing with public problems of resource conservation. The study of farm labour and rural welfare has advanced from community studies to the distribution of national labour force, social security and public utility services. Similarly, considerable development has been made in research in marketing and price analysis, statistical research, soil conservation, enumerative surveys and attitude studies in determining public policy, etc.

Nature. In order to concentrate attention on a particular branch the domain of economic activities has been divided into several provinces which are distinguished from one

*The conception that the field of agricultural economics should be restricted to those things which could be acted upon by the individual farmer within his own line fence.....This was the early American view. (B. W. Allin, Journal of Farm Economics, Aug., 1918).

another by some qualifying terms such as land economics and labour economics, household economics and public economics, rural economics and municipal economics, etc. It will be wrong to imagine that any one of them is absolutely exclusive of another. Such a thing is not possible specially in social sciences. At higher stages the problems are inseparably interlinked, and at the highest stage they merge into one. Hence, the principles and practices of agricultural economics are not any specific group of general economic theories and practices which are applicable exclusively to agricultural environment or refer to the economic aspect of the behaviour of agricultural community, and not applicable to other conditions and communities. It is to be remembered that economics is not a doctrine, it is a way of approach, a method. Agriculture is largely governed by physical and social conditions which vary from time to time. Farmers cannot follow specific rules since each time they have to adjust to soil, climate, market and many other conditions. Adjustment being a constant problem they have to follow some guiding principles for directing the activities under certain circumstances in accordance with a definite purpose. These guiding principles indicate a way of approach in which the basic problem is that of 'economising,' and hence, they are not exclusive. The principles and practices of agricultural economics likewise are not exclusive.

Agricultural economics is an applied science. It does not mean that it studies only the application of the general theory of economics to the field of agriculture. But it is an applied science in the sense that it is a systematic knowledge and the methodical pursuit of knowledge, analysis, organization and of their results in agriculture for the purpose of stabilizing, adjusting and changing them. It is not a pure

or naturalistic science in the sense of 'knowledge for the sake of knowledge,' *i. e.*, pursuit of knowledge with reference to certain phenomena or facts having nothing to do with 'values', or assessment of phenomena or facts by social standards. But it has both a theoretical and practical aspect. In the former case it includes the knowledge which governs the systems of economic behaviour and relationships, and in the latter case the results are used for manipulative or directive purposes.

Some early writers have identified agricultural economics with farm management, and some have even treated it as a branch of farm management. Recently some have insisted that they are two different subjects and must be treated by different specialists. These differences have arisen mostly amongst American thinkers. Agricultural economics and farm management had separate starts, and the latter, which generally grew out of the department of agronomy had an early start. The early courses were based mainly on the books by Cato and Varro, Daubeny, Heitland and Xenophon. Later on, when scientific study was started, the beginning was made with cost studies in relation to prices, which was incidental to the introduction of new crops and was stimulated by low farm prices during 9o's of the last century. Later on the attempts were made to studying the best methods of farming and the study of agriculture as a social activity aimed at best national interest. It is mainly due to the early start that the study of farm management became more prominent. There has been a change in the terminology also. Now it is generally accepted that agricultural economics covers a wider scope and farm management is only one of its aspects.

Lastly, it has to be remembered that economic ideas and ideals, policies and measures, institutions and activities are

governed by the cultural, political, and social structure of the community. They are not entirely identical under capitalistic and socialistic orders. A student of agricultural economics will, therefore, seek in vain an identity in these things under different systems.*

With this scope and nature of the subject in mind let us now attempt a definition. *Agricultural Economics is an applied science in which the thought, process, analysis and organization of economics are studied in relation to the specific forces and relationships, arising out of agriculture being followed as a vocation and aswell as a mode of life, under a particular political, social and cultural set-up. Thus, it is on the one hand a special branch of the general study of agriculture and on the other a particular branch of general economics but fundamentally it is a social science.*

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*Life shows a series of levels of organization ranging from the nucleus and cell, the organ and organism, the sociological and psychological entity. Laws found at one level cannot be applicable at other levels. Community organization changes under the influence of internal forces and the pressure of external environment. Economic life, therefore, is partly evolved out of the environment and is partly the result of conscious adjustment of the environment by the community. Economic institutions therefore, bear a mark of relativity, *e. g.*, the change from free trade to protection, from laissez-faire to planned economy and the individualism of olden type giving place in England and America to a new economic order with community as a focal point of industrial effort.

CHAPTER II.

Importance of Agriculture.

Agricultural Fundamentalism. There is a group of thinkers (Barker, Wilson, Barsodi and Humphries, etc.) commonly said to be having an orthodox view, which holds that agriculture is par exellence the fundamental industry. The usual explanation is that since it feeds the world agriculture is the basis of the existence of human race. It is indispensable for providing raw material for many industries and provides a considerable part of the materials for trade, hence it is the foundation of manufacture and commerce. It is the first settled occupation and even to-day it is by far the most important and numerically superior industry, since roughly 2/3 of the world population depends on it. The beginning of Industrial Revolution was made earlier in agriculture and it made the revolution in industry possible. The rapid increase in world population was made possible by a great increase in agricultural production. Barsodi goes to the extent of saying that "there is not only something wrong with modern agriculture but that there is also something wrong with modern life,"* and thereby he suggests that modern life which is becoming more and more mechanical, commercial and artificial should be adjusted to rural and agricultural

*Baker, Barsodi and Wilson, Agriculture in Modern Life, quoted in Readings in Agricultural Economics, by the Indian Society of Agricultural Economics, 1950.

life which is more natural. Rural population occupies a basic place in the social structure, and it is the source of human race. Farmers are in a peculiar sense and degree of basic importance to society. Agriculture furnishes the basis and substance of prosprity in other fields; and Humphries holds that "If agriculture in the widest sense can be made prosperous, then the whole world will very shortly become more prosperous as well." It will never be possible to have a civilization wholly urban and industrial which may neglect agriculture completely. Hence, agriculture is said to be fundamental in the sense of absolutely controlling other businesses. These thinkers believe that without the basic contributions of agriculture all the rest of the fabric of our civilization would topple into ruins. Hence, they have a faith in agricultural fundamentalism.

Soundness of this faith is challenged by another group of thinkers popularly known to be having the modern view. J. S. Davis is one of the most popular representative of this group, and he holds that 'The wealth and welfare of nations depends upon many complex conditions. To-day agriculture is not uniquely basic, and the prosperity of a nation depends largely on other factors than the work of those who till the soil "[1] This is supported by the following arguments : The study of economic history shows that economic progress, broadly speaking, tends to be accompanied by a decline in the relative importance of agriculture. This is true, if not universely, of most nations in most periods and of the world as a whole. To-day we find in the countries of more advanced standard of living a trend towards a gradual decline of the place of agriculture in their national economy. This is visible in the falling ratio of agricultural wealth to total

1. J. S. Davis, Agricultural Fundamentalism, reproduced in Readings in Agricultural Policy, Edited by O. B. Jesness, 1949.

national wealth, *i.e.*, falling percentage of agricultural income to national income, falling index of the net output of agriculture as compared with that of industries, declining rate of increase in rural population as compared with the urban population and the absolute contraction of numbers engaged in agriculture leading to a falling ratio of agricultural population to the total population, and the decrease in the per capita demand for agricultural efforts.

These are the extreme views. A more balanced view is taken by others like Karl Brandt, H. R. Tolley and P. Chew, who after considering both eastern and western countries and agricultural and industrial communities, assign to agriculture a status equal to that of other sectors of economy. They hold that one part of the country cannot be happy and prosperous if another part is in distress. K. Brandt holds that "farmers are a vital part of the arterial system of circulation through which flow the goods and services of the national economy. The nation depends on properly functioning farms as important sources of primary materials, foods and fibres. Yet the farms cannot be treated as an independent object of policies, nor can they be made prosperous in emancipation from the remainder of the economy. Nor can the conditions creating mass unemployment and decreased output in cities be cured by maintaining or restoring economic well-being to the farmers alone."*

A still better explanation is given by T. W. Schultz, W. W. Wilcox, Food and Agriculture Organization, and the Royal Institute of International affairs, London. By explaining the complex nature of the modern economic society they emphasise the interdependence and the close relationship of the various sectors of economy or groups of the society instead of

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*Karl Brandt, Report of the committee on Parity Concepts, U. S. A.

saying which is fundamental or which is more important. They say that the size is not the supreme test of importance, as the height or weight of a man is no indication of his importance or prestige. The quantitative tests such as the physical volume of output, the amount and the ratio of income to total income and the number of persons engaged in it, etc., are misleading in this regard. At lower levels of economic development economic activity may be compartmentalized, but as a country makes an advance the interdepence of various sectors increases, and their relationship becomes more close. In its economic evolution when a country grows to a specialized production and a relatively free exchange of goods it becomes impossible to say which part is more important, since it is the mutual stimulous and the reciprocal behaviour of different parts which make the progress possible. The nature of modern economic society is becoming more complex than ever before. This implies a gradually lesser degree of self-sufficiency of different sectors, or a lesser degree of self-contained economy, or a greater degree of dependence on each other. In this ever changing relationship we cannot establish the fundamentalism of any.

It is true that farming is the first settled occupation, that it employs a large section of population, that it produces food which is the basis of life, that it provides materials for trade and manufacture, and that in terms of output it is the most important. But man does not live by bread alone specially in more advanced countries. "When we say that it is in any sense more a generator of income in modern society than other occupations, we fail to understand the true nature of modern economic society...An efficient agriculture made up of farm families with a high standard of living and a high buying power per person contributes much towards a high

national income and the economic well-being of the nation, but the same can be said for each of the other group...It is impossible to say which is most important in modern economic society."[1] Though agriculture will continue to produce food,[2] the basis of life, it does not prove that it should be considered to be the most important of all occupations. An efficient agriculture providing an adequate and stable farm income and attaining increasingly regular sufficiency of food is no index of economic progress of a nation. Progress in modern times is indicated by an adequate leisure and an adequate provision of the means enjoying that leisure, *i. e.*, consumption of goods and services that make life rich and wholesome, in short worth living. To this maximum satisfaction all occupations and sections contribute. In the economic society which is organized like this it is neither easy nor desirable to demarcate the essential and the non-essential sectors, nor can they be rated in order of their importance.[3] Really speaking, it is futile now to argue the

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1. W. W. Wilcox, Farm Prosperity.

2. Synthetic chemistry has made considerable progress and we find laboratories producing a number of organic compounds. The chemists to-day very well understand the composition of food substances of our diets. But at present we cannot imagine a time when growing of crops and raising of livestock will be substituted by factories producing the commodities now furnished by farms. That will never come, though it may be partially achieved after a long time.

3. Man has to be fed and food production has been the most fundamental and permanent concern of man. The profound importance of agriculture, therefore, dominated the thought of man from the very beginning, and thinkers made agriculture the only key to economics. During the early times all the nations have mostly been concerned from day to day with the problem of bread. It is only during the 19th century that a small section of mankind has attained freedom from concern over feeding themselves. But it is true of only a small section of the world population. Even at present 3/4 of the working time of the whole world is spent in making a living possible. Though civilization has advanced to a stage when the thought is not wholly dominated by the question of bread, even to-day for the under-developed regions of the world the problem is otherwise. These rigions include 2/3 of the world population, and there the human life is at sub-human level, and there is a problem of bread. With reference

relative importance of land, labour and capital. It is highly problematical whether these factors of production, while functioning in the real world, can be sorted into neatly cut and divided, either three or more mutually exclusive, categories.

Place of Agriculture in National Economy. Our country is one of the four ancient homes of civilization. These ancient civilizations were mainly agricultural in character. Our country too has been an agricultural country from times immemorial. Though our cottage industries attained a high water mark of excellence and earned world-wide reputation in the past, we were even at that time primarily an agricultural people. Inspite of the steady and gradual industrialization during the modern times, specially after the First World War, agriculture even to-day retains the role of being by far the most important occupation and the most outstanding mode of national life. The place of agriculture in our economy at present, as shown by the First Report of the National Income Committee, 1951, can be estimated from the following table.

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to these facts the talk of agricultural fundamentalism in the sense that it should be given the primary importance in policy and programme, is not wholly baseless. But those who hold that the progress of these regions depends on the degree of industrialization do not consider agriculture to be fundamental in the sense that it should be given priority one. Really speaking, it is the surplus in agriculture which is the basis for building up further. At least in this sense agriculture is fundamental in India at present.

Items.	Net output at factor cost.		No. of persons Engaged.	
	Rs. (abja.)	%	Earners & Working depen-dents (lakhs.)	%
A. Agriculture.	41·5	47·6	905	68·2
1. Agr , Animal husbandry and Ancillary activities.	40·7	46·7		
2. Forestry.	·6	·7		
3. Fishery.	·2	·2		
B. Mining. Manufacturing & Hand trade.	15·0	17·2	187	14·1
4. Mining.	·6	·7	38	·5
5. Factory establishments.	5·8	6·6		13·6
6. Small enterprises.	8·6	9·9	149	
C. Commerce, Transports & Communications.	17·0	19·5	107	8·0
7. Communications.	·3	·3	12	1·8
8. Railways.	2·0	2·3		
9. Organized Banking & Insurance.	·5	·6	95	6·2
10. Other Commerce & Transport.	14·2	16·5		
D. Other Services.	13·8	15·9	128	9·7
11. Professions and Liberal arts.	3·2	3·7	50	3·8
12. Govt. Services (administration)	4·6	5 3	36	2·7
13. Domestic Services.	1·5	1·7	42	3·2
14. House Property.	4·5	5·2		
Total. Net domestic product at factor cost.	87·3	100 2	1327	100·0
Net earned income from abroad.	—·2	—·2		
Net national output.	87·1	100·0		

In order to have a comparative idea data relating to some countries is given in the following table. The selection of the countries is made so as to represent highly industrial, mainly industrial and mainly agricultural countries.

A. National Income at factor cost by industrial origin. (%)[1]

Countries.	Agricul-ture.	Manufactur-ing and Construction.	Govt.	Trade.	Transport & Communica-tions.	All others.
U. S. A. (1949)	9·9	36·8	8·8	19·8	8 0	16·4
Canada. (1947)	15·7	38 7	7·6	15·2	10·1	12·7
France. (1948)	21·1	37·5	...	13·9	14·2	13·3
Denmark (1949)	21·9	38·0	7·8	...	7·2	25·1
Greece. (1946)	40·9	19·8	8 0	20·9	2·8	7·6
Turkey, (1948)	43·0	12·7	10·1	30·0		2 2

B. Occupational distribution of the gainfully occupied population. (%)[2]

Countries.	Agri., fore-stry & Fishing.	Manufacture Construction & Mining.	Govt.	Comm-erce & Finance.	Transport & Communica-tions.	All others.
U. K. (1938)	7·1	46·3	11·5	16·8	7·4	10·8
U. S. A. (1940)	19·3	31·2	12·2	19·6	5·8	11·9
France. (1931)	24·5	41·0	10 5	14·2	5·0	4·8
Denmark (1929)	28·9	32·6	9·4	12·6	5·9	9·3
Canada, (1941)	29·2	31·8	10 0	14·0	6·5	8·5
Romania. (1930)	63·5	12·3	9·3	5·3	2·8	6·8
China. (1931)	70·0	10·0	...	5·0	8·0	7·0
Turkey. (1935)	70·2	13·6	8·2	4·5	2·5	6·0

Importance of Agriculture. It has not only been the main source of livelihood but also a tradition and the most common way of life, and has been enjoying since times immemorial a place of pride in our economic and social life. The situation has been reflected in our festivals, literature, customs, ceremonies, songs and dances. To be specific the importance of agriculture can be explained from several points of views.

1. It is by far the most important source of employment

1. United Nations, National Income Statistics, 1938-48. 1950, pp. 211-215.
2. Colin Clark, The Conditions of Economic Progress, 1951, pp. 398-9

and of livelihood. More than two-thirds of the total population depends directly on agriculture. If we add hunting and pastoral occupations the percentage increases to about 70. Besides there are menials and artisans in villages whose livelihood depends on the cultivators and thus they are supported by the produce of the land. Agriculture is also found to have been combined with some cottage industries and also with some urban pursuits. And a considerable amount of trade and transport are concerned with agricultural produce. It has generally been estimated that more than 90% of our rural population depends directly or indirectly on agriculture.

2. It contributes a major share to the national wealth. It was estimated that in 1931-32 the percentage of contributions to national income was: Agriculture 53, Industry 17, Services 22, and others 8. During 1948-49 India produced goods worth Rs. 3942 crores of which agriculture contributed Rs. 2193 crores or about 55%. The National Income Committee has estimated the net output at factor cost from agriculture to be Rs. 41·5 out of a total of Rs. 87·1 abja or about 48%. Besides, agricultural conditions are said to reflect directly and influence considerably the public budgets.

3. It contributes considerably to our exports. Though the percentage has declined recently, even at present about 45% of our total exports are raw materials and other agricultural commodities which value more than Rs. 200 crores. These exports earn foreign exchanges for us with the help of which we import capital goods for our development plans and other necessary commodities.

4. It produces raw materials for our industries. Some of our biggest industries, e. g. cotton, jute and sugar, for their raw materials, depend on agriculture. Again, agriculture provides the

bulk of the demand or the main market for industrial goods.

5. It is the source of food for the entire population. Food situation having deteriorated we at present depend for part of our food supply on imports. But that is a precarious position and the country has to be self-sufficient in this respect. Clothing like food is likewise agricultural in origin. Therefore, for both food and clothing, the two primary necessaries of life, we have to depend on cultivation.

6. The gradual ruralization of the country, and the absorption of the seasonal unemployment created by some industries show that agriculture is the shock-absorber, and is the last refuge for employment for all workers. Thus, the working population falls back on agriculture as the source of livelihood when it fails to get employment anywhere else.

7. Agriculture resembles a public service. It aims at permanent preservation of the productive capacity of natural resources. Though the individual farmer is guided by private interests, he produces the basic necessities of life and his interest is mostly a public interest.

8. Agricultural population occupies an important place in the social structure of our country. It provides labour for industries and man power for army. Because of the characteristic resistance of rural culture to change it has maintained the old culture and traditions. The agricultural community has preserved our cultural identity and the social heritage. In cities under the influence of commercial and urban civilization the social life is under going a fast change which is more often disorderly. Agricultural community exercises a stabilizing influence by permitting only a gradual change.

9. Agricultural community promotes social as well as political security. Economic upheavals, strikes and social disorders in their worst forms do not fully influence

the farm population. In the days of political upheavals it constitutes a reservoir of national patriotism. The urban community which is a heterogeneous ethnic and cultural hodge podge and the culture which is generally commercial-cum-industrial, are at present a great menace to international peace and good will. Contrary to it rural community and culture promote peace and good will.

10. As explained in Chapter V, though agriculture is not very encouraging as an occupation from the pecuniary point of view, it is quite stable and is less susceptible to disturbances in the financial world. As a mode of living it is simple and happy. Though rural areas do not provide some conveniences which towns and cities do, but the cost of living is much lower. And even during the depression farmers are not faced with unemployment. It is observed that agricultural communities are most peace-loving communities and agricultural life is the most contented and peaceful life. That the two oldest and biggest agricultural countries of the world, India and China, have never fought each other inspite of being neighbours, is an important fact in world history.

The situation is best summarised in a Chinese proverb which says that economic life is just like a tree whose roots are represented by agriculture, stem by industry and branches and leaves by trade and commerce. It is, however, worthwhile to note that this important role of our agriculture has to continue in future, though not exactly to the same extent, and the country will remain mostly an agricultural country for pretty long in future. The reasons are as follows:—

First, the present occupational distribution showing an overwhelmingly large proportion of population depending

on agriculture is unbalanced. But the major part of the population is bound to remain agricultural for very long, and a considerable part of it for ever. Rapid industrialization is linked by serious handicaps, and it cannot absorb a very considerable portion of the present and the growing population. Under a balanced occupational distribution the percentage of population depending on agriculture is suggested by some to be 45, and by others 50 to 60. Whatsoever it may actually be, a change from the present state of affairs will be very slow. Generally, with the development of transport, industrialization and an overall economic progress the percentage of agriculturists begins to decline. In the early days the % of farmers in England and U.S.A. was more than 75, but now it has been reduced to less than 10 in the former and less than 25 in the latter. Such a state cannot be expected in India for a pretty long time, because agricultural communities are conservative in character and the capacity for development in the under-developed communities is very limited. It involves a change in the national psychology, overcoming long established traditions and modifications in the mode of life and the method of working. These are stupendous tasks specially in an illitrate and poor country. Secondly, the share of agriculture in the national income in future is supposed to be more than that of any other occupation. Even the Bombay Plan which is said to be the capitalists plan, the shares of the national income are suggested to be : Agriculture 40%, Industry 35%, Services 20% and others 5%. Thirdly, to meet the shortage of food and to place the country on a sound food economy we require about 10 million tons of more foodgrains. Our increasing population further adds to the food requirements. For increasing the standard and to meet the adequate nutritional demands better types of foods are necessary. Besides, there will be greater

needs for seeds and feeds.* Fourthly, for increased industrialization there will be greater need for raw materials. And also for enhancing the volume of our exports we shall have to depend on more of agricultural produce. Lastly, for balanced economic development adequate attention will have to be paid to agriculture. Therefore, for the prosperity of industry and commerce and for the general prosperity prosperous agriculture is basic.†

This shows that for considerable time to come agriculture has to remain the most important industry. The United Nations, its specialized agencies and the Technical Bureau have specially emphasized and are intending to give priority to agricultural schemes in the development of underdeveloped areas. Similar schemes characterize the plans made by The Planning Commission for the economic development for the next 5 years. A very important role of

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*The Bombay Plan imagines the target for agricultural production to be 130% and the Kharegat Plan to be 200%. The Advisory Planning Board suggests an increase of 10% in cereals, 20% in pulses, 50% in fruits, 100% in vegetables, 250% in fats and oils, 300% in milk, fish and eggs. Again, we require 55% increase in fodder and 400% in oil cakes. The Planning Commission in their broad objectives of the agricultural programme during the next five years suggest an increase in the production of food by 7·2 millions, of cotton by 1·2 mil. bales, of jute by 2·06 mil. bales, of sugarcane (gur) by 6·9 lakh tons and of oil seeds by 3·75 lakh tons.

†Is agricultural prosperity basically important for general prosperity? Really speaking the position depends upon the economic pattern of a given society and the relative strength of different sections. Prosperous peasantry means wider and more effective demand for industrial goods, greater industrial profits and greater volume of industrial employment. On the other hand, agriculturists would be prosperous if other sections of the people are able to pay well for the farm produce. The movement is circular. However, the international relations and the condition for foreign trade may influence this state of affairs. But exports pay for imports. We can have a foreign market for our goods simply by creating a home market for foreign goods. Therefore, the surplus of goods and services are the basis of prosperity. One can buy only when one has to sell something, and one can buy more only when one can sell more. Poor persons or nations are poor customers. In our country agriculturists are in the overwhelming majority. If they have more to sell they will buy more, and there will be wider scope for industrialization and also greater volume of imports. Their prosperity means the prosperity of the whole nation.

agriculture in our economy, therefore, will continue for considerable time to come. Numerically it will be the most important occupation and shall contribute the most significant share to the national wealth. And further it will remain basic for all economic progress. Though after sufficient industrial advancement the percentage of people depending on it and its share in the national income may not be major, yet they will always be quite significant.

CHAPTER III.

Special Features of Agricultural Economy.

I. DIFFERENCE BETWEEN AGRICULTURAL AND INDUSTRIAL ECONOMY.

Agriculture presents a close combination of a science, a craft, a business and a way of life. In all these respects it is characterized by certain peculiarities of its own. The geographical and the sociological environment under which production is carried on, the process of production and the complexity of production, etc., impart agriculture certain characteristics which make it substantially different from other occupations specially industry. These differences are responsible for the difference in the basic assumptions which ultimately reflect in the economic relationships and economic behaviour of farmers rendering agricultural economy distinct and slightly different from industrial economy.*

Nature of Agricultural Activity. Agriculture is a sort of replacement of nature's favourite plants by the cultivated plants of man's choice, and hence, it is a sort of man's

*This should not be interpreted in the sense that agricultural economics is something absolutely distinct from industrial economics, or that it has got a theory of its own. Really speaking the science of economics, which has now become as accurate as any other science, is a special technique, a way of approach, a method, which may be called the general framework of economic theory, governing economic behaviour of mankind. And it is equally applicable to all types of economies But when one proceeds from the mere outline to the concrete problems, to explain the economic life, to frame policies and measures for improvements, and to establish standards, one finds that the basic assumptions being different agricultural economy is slightly different from industrial economy.

imposition on nature, and a constant battle against it. Farmers have to work constantly with nature and make a maximum use of land in relation to other factors of production. Agricultural activity is, therefore, directly influenced by the geographical environment, and the part played by nature being more prominent in agriculture than in any secondary or tertiary occupation, the Law of Diminishing Returns is more applicable to the former than to the latter.

The process of production in agriculture is biological. Growth of plants or of animals takes a natural course and it is not possible, except at a highly disproportionate cost,* to speed up the pace of production as it is possible in manufacturing.

Agriculture being a partnership between man and nature is characterized by uncertainty. The overwhelming importance of physical factors limits the scope of human endeavour, and the results, therefore, depend on conditions beyond the control of man. Crops being exposed to several hazards, *e. g.*, failure of rainfall, floods, hail storms, diseases, pests and stray animals, etc., production cannot be controlled as in industry. Even if the crops mature well, the time lag between investment and return being pretty lengthy, business fluctuations bring about considerable variations in farm incomes. Besides, it is far more difficult to measure the element of risk in agriculture than in industry, and hence, agricultural insurance is more difficult than other types of insurance.

On account of uncertainty agriculturists cannot capitalize the future as the industrialists can do, because the estimates of earnings are highly conjectural. Again, the use of borrowed capital involves longer time and greater risks, rendering

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*Glass-house culture is not economical ; and only few crops in India are supposed to permit vernalization.

the problem of agricultural finance much different from that of industrial finance.

As compared to industry which is of localized nature and has generally larger units of production, agriculture, as a general rule, is scattered fairly widely and is typically carried on by family units under small-sized units of production. As a result of it the organization of producers even on a reginoal basis, much less to say on national and international basis, is rendered very difficult. It leads to a greater degree of competition amongst agriculturists and the general economic theory of perfect competition is more real in agriculture than in industry. The individual small farmer is unmindful of, and often disregards the influence of the variation of his own produce on agricultural prices. This is hardly true of industry.

Small scale production being the general feature of farming, the economic analysis pertaining to large-scale production and division of labour which is characteristic of industry is much less applicable to agricultural enterprise.

Productive effort in farming is highly stable. It is partly due to sluggish movements in it, partly due to the lack of adaptation of agricultural investment to other uses, and partly to the reluctance of farmers to abandon farming even in bad times. Unlike industry in which movements of output are more sensitive to price variations, adjustments of production are much less smooth in agriculture, with the result that it offers less resistance to depression and equally less expansion under price incentives. Price disparity during the Great Depression of thirties and the lack of expansion during and after the World War II are examples of it. Thus, the ordinary measures to meet the situation of depression and boom or of glut and scarcity in industrial sector prove

much less effective in agricultural sector which calls for special measures.

Agriculture is a way of life as well as a means of livelihood. Therefore, sociological, psychological and sentimental considerations influence its organization. Moreover, it is followed by less efficient and more conservative people which impart it an inflexible character.

Agriculture is just like public service. It aims at conservation of human and natural resources and not their exploitation or robbing of nature. Farmer produces the basic necessity of life and works with the national resources. His interest is essentially public interest and is very much unlike that of an industrialist who is mainly guided by private profit. Agriculture provides national security and preserves social stability. While framing agricultural policies this fact has to be kept in mind.

The attitude of farmers is much different from that of businessmen. They do not anticipate the fears of idle plants and idle workers. Even during the depression they do not face unemployment, but on the other hand, work harder and try to increase the output to maintain the income.

Nature of Agricultural Output. Farm products are generally joint products,* *e. g.*, cereals and straw or stock, lint and cotton seed, and wool and mutton. As in industry where several products might be produced by the same machinery, in agriculture it is not possible to separate the costs attributable to various products. And it becomes very difficult to consider the supply of such farm products in isolation.

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*The word 'joint-products' is also applied to a number of commodities produced in a typical rotation where the output of one can easily be increased by expanding that of another. Here, the reference is to a combination of different processes on a mixed farm. To make things simpler and more plain it will be better to use the word 'several final products.'

A typical farm generally grows several food crops, a few oil seeds and sometimes some fibre crop also. Variety of production on each farm is a general rule and specialization an exception. Every seller, therefore, has very small quantities of several commodities to sell. Besides, production being widely scattered in small units, the problem of marketing of farm products is rendered more difficult, the chain of middlemen becomes very lengthy, and the cost of marketing becomes very high.

Though agricultural production as a whole, due to certain 'self-compensating' features of its aggregate supply, is highly stable, there are wide yearly fluctuations in the output of individual product or individual producer. Thus, even when agricultural prices as a whole are stable, prices within agriculture often vary and induce shifts in the use of resources.

Due to small-scale organization and scattered nature of production the supply of agricultural produce shows less flexibility and adaptability to new economic conditions. It shows a considerable time lag in response to price variations, and the adjustments of supply to price changes are much slower than in the case of industrial products. Besides there is another peculiarity in the adjustment of agricultural production. During the short period it shows almost 'one-way flexibility', since in response to increased demand the supply may increase, though slowly and slightly, but the reaction to falling demand and lower prices is very much sluggish and generally does not bring about a comparable contraction.

Agriculture being a seasonal industry the output presents glut at harvest time and scarcity in the off season. This irregular nature of the supply puts special burden on the means of transport, the channels of normal trade, and the credit

institutions at certain times of the year. This gives rise to special problems of marketing and finance, much different from those of industrial goods the supply of which is more regular.

The quality and character of agricultural production is governed much by soil and climatic conditions which differ from locality to locality. The result is that supply is not of the uniform quality. It makes standardization more difficult and marketing more imperfect.

Partly due to a considerable time lag in the adjustment of supply to price variations and partly due to a comparatively more rigid cost structure, agricultural prices decline more rapidly than those of manufactured articles, and when the former decline it becomes more difficult to restore them. Farmers under such circumstances suffer a double loss. Their money income or the purchasing power declines comparatively more than that of other sections of the population. They sell at relatively low prices and buy at higher prices.

Agricultural output is generally of perishable nature; and like industrial output cannot be stored for long. It has to find a market soon. Partly because it is difficult to postpone the consumption and partly because of small scale production, the role of middlemen between the original producer and the final consumer is of special importance in agriculture.

Agriculture being primarily concerned with the production of food which is a basic necessity of life, the demand for its products is less elastic than that for non-agricultural products.*

*Ordinarily, it is expected that with the improvement in the standard of living the demand for agricultural production should increase less rapidly. This is true of developed countries. In our country the standard of living is very low and the overall production is short of the total requirement. Any improvement in the standard of living will, in the beginning, increase the demand for food sufficiently rapidly.

Thus, it is noticed that on account of these differences in the nature of agricultural activity and the peculiarities of agricultural output, the economic problems of the farm community are characteristically different fram those of other communities specially industrial. These differences impart some distinguishing features to agricultural economics which may reflect in price analysis and policy, nature of saving and investment, organization of production, establishment of equilibrium between demand and supply, degree of competition amongst the producers, nature of risks, incomes, wages, costs and profits, etc.

II. AGRICULTURAL ENVIRONMENT.

We have a glorious history behind us. Not only the art, culture, literature, religion and philosophy but also the economic wealth which was the result of agriculture and industry, was proverbial. But at present in economic order we are almost at the bottom of the list of nations, and measured by modern economic tests we are an under-developed country. Agricultural environment greatly differs from one part of the country to another, and if accuracy of details is preserved it would be difficult to generalize. There is a considerable difference in the agricultural environment of millet growers in arid Rajasthan, of the sugarcane growers of the upper Doab of Uttar Pradesh, of the rice growers in Orissa and Madras, and of the cultivators on the foothills in Assam. However, taking the country as a whole, and taking into account the common features, one can imagine a certain pattern. There is a high pressure on land and considerable land hunger. Agriculture is followed by nearly 70% of the people on individual family basis. It is small scale subsistence type of farming mainly devoted to cereal cultivation. Most of the work is performed by human hand,

most of the finance is provided by village money-lender and most of the transactions are local. Standard of general health is considerably low and so is productive efficiency. Most of the farmers have no surplus to sell, many others have only small, while only a few have fairly good amounts to spare. Their purchasing capacity is correspondingly low. Productivity per capita, income per capita, nutritional standard and general standard of living are considerably low, and the struggle for existence is correspondingly hard. Poverty, hunger, disease and death are common features. And in this way agricultural life flows in a traditional pattern.

Agricultural community (detailed discussion in ch. V) is comparatively ignorant and illiterate. They have a narrow outlook and circumscribed vision. Their talks are confined to their crops and animals, and their knowledge is limited to the local surroundings. There is a lack of initiative and urge for improvement. The lack of adaptability makes them suspect the new ways of life and methods of production, leading to immobility in respect of both occupation and place. But conservatism is not peculiar to our farm community. Agricultural civilization as such and its traditions and institutions are conservative. And this is common to all agricultural communities of the world whether we talk of under-developed countries like China, Egypt, Mexico, Brazil and Indonesia, or of highly advanced and developed countries like the U. S. A., U. K., Germany, France, Denmark, Australia and Argentina. There is, however, one noteworthy feature. The Harijan Movement, the political independence and the establishment of rural democracy are slowly bringing about some consciousness amongst the masses and a change in the social values. The recent land reforms are providing momentum to the wave of revival,

But these things are only in an embryonic stage and their speed will depend on the political climate in the country. The seeds have, however, germinated.

The volume of employment and production exhibit stagnation. The population increasing at an yearly rate of one percent brings about a deterioration in the economic situation which has become more pronounced during some past years.

The following table shows the trend of agricultural production and the income per capita during the recent past. (Index of production based on the average of 36—37 to 38—39=100, and income in Rs.)*

Years.	Production							Agr. Income per capital (Rs.)
	Rice	Wheat	Food Grains	Fibres	Oil Seeds	Mis.	General Agr.	
39-40	98	104	99	90	106	102	99	49
40-41	88	98	95	111	111	107	98	53
41-42	92	91	93	105	94	112	95	86
42-43	99	99	103	78	98	117	102	86
43-44	109	90	107	87	104	116	106	104
44-45	102	97	104	55	107	112	101	112
45-46	96	84	95	56	97	124	94	107
46-47	104	67	97	53	100	121	96	122
47-48	98	76	98	56	101	122	97	129
48-49	95	73	93	52	94	—	92	148

This shows a state of haulting decay so far as production is concerned and a decline in the general standard of living, as indicated by the real income per capita. Besides there is a limited scope for employment and very few job-opportunities in rural areas. The resources both human and material await utilization. The desirability of their better utilization has generally been accepted and the magnitude of dorment resources very often lulls us in a sense of security and complacency. That the development of these resources is an uphill task, involves tremendous investment and is fraught

*Records and statistics, vol. No. (Eastern Economist, Delhi.)

with considerable financial, technical and administrative limitations, has been only very recently realized.

The agricultural environment, therefore, has hardly anything encouraging. Village is supposed to be a place for the less intelligent, and agricultural profession is supposed to be meant for the poor and the illiterate. The middle class wants to migrate from villages to towns and thus recede the pace of economic progress. There is not much of incentive and initiative amongst those who are left there, and neither there is sufficient scope for economic progress at present. The general poverty leads to deficit economy which in its turn leads to further poverty and debt, and thus, the vicious circle runs from which farmers do not find a way out. The present situation is, therefore, a sort of challenge to the people and to the Union and the State governments.

One of the interesting studies is to find out whether the real fault lies with the people or the defect is inherent in the environment. The rate of variation in culture and civiliza- tion depends upon biological inheritance, physical environ ment and cultural endowment. All the three play a part in every human action. For the time being anyone of them may acquire predominating importance as we find cultural acti- vities looming large in some highly developed western count- ries. It does not mean that civilization lessens the effects of environment. Really speaking the effects are not so direct as on the savage people, but they are just as strong. And it is believed that the mastery over nature is measured in terms of obeying it or adapting to it. Taking the world as a whole climate seems to have established a basic pattern of civilization upon which other factors simply impose some variations with different degrees of magnitude. The geographical pattern of civilization shows that the efficiency of physical environment and the degree of civilization have a high degree of positive

correlation.* And the physical environment largely determines the habitability, occupations, mode of life, method of working, dress, diets, health, houses, transport, ideas and ideals. Our geographical environment is, really speaking, less stimulating and less favourable for human activities as compared to that of the temperate regions. It is our environment which is mostly responsible for the present state of economic backwardness.

An objection is sometimes raised that how under almost the same physical environment a high degree of civilisation was possible in ancient India. It should be noted that it was located in geographically more favourable parts of the Ganges and the Indus valleys. Under similar circumstances almost similar civilizations developed in China, Egypt and Mesopotamia. They were different from modern civilization. It does not mean that environment is wholly responsible for our present backwardness. There is no doubt about the fact that the political climate in the country after the Arab invasion has not been very congenial, and the foreign domination specially during the last 300 years, has been to some extent responsible for retarded growth. But what has China achieved ? We too without any foreign domination would not have been very much different. It does not mean that a better economic condition could not be possible in the past, and that there is no bright hope for the future. The environment is capable of affording a better standard than our present one and also a higher degree of civilization, but the basic differences are bound to be reflected in future.

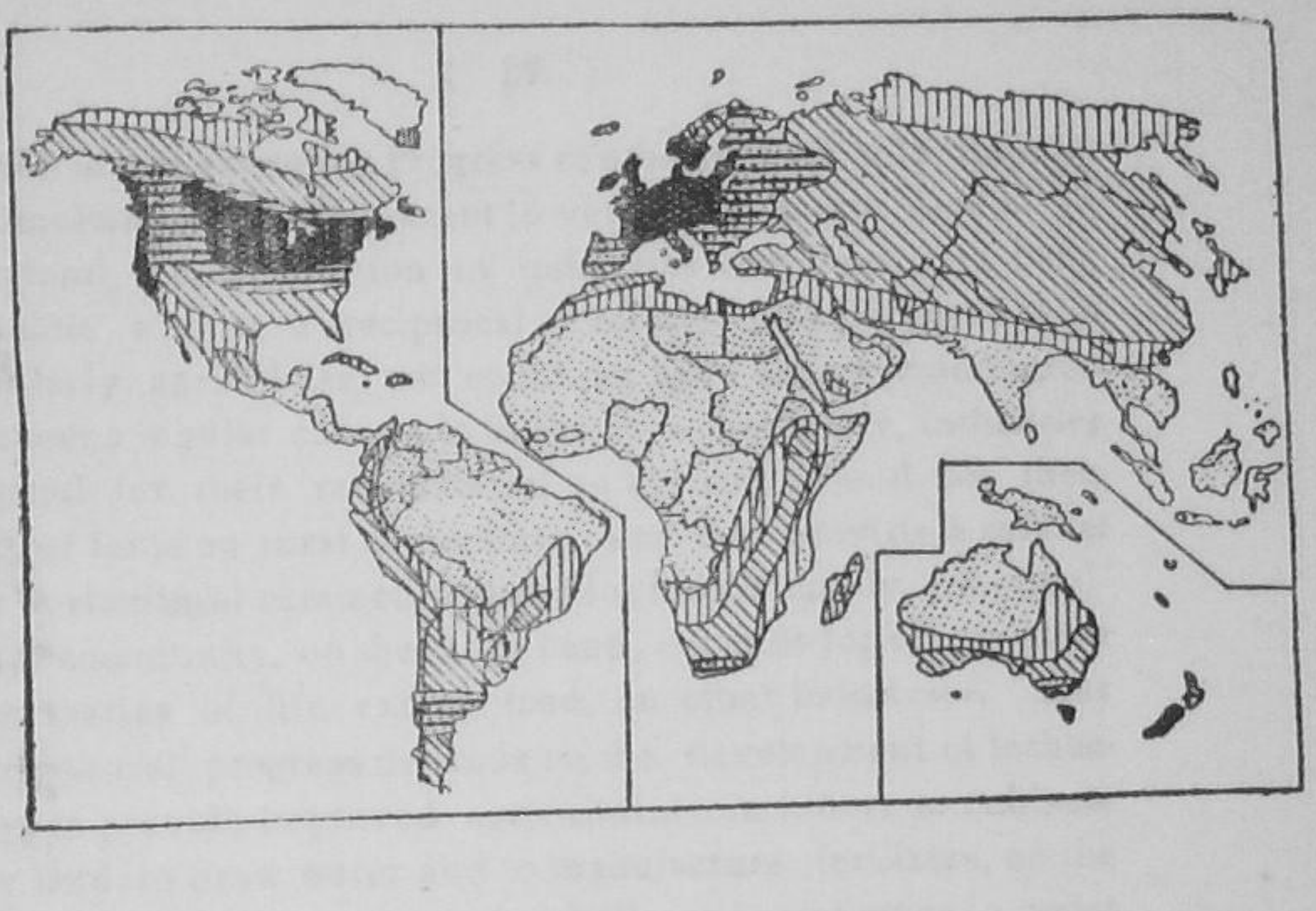
III. INTERDEPENDENCE OF AGRICULTURAL AND OTHER ECONOMIES.

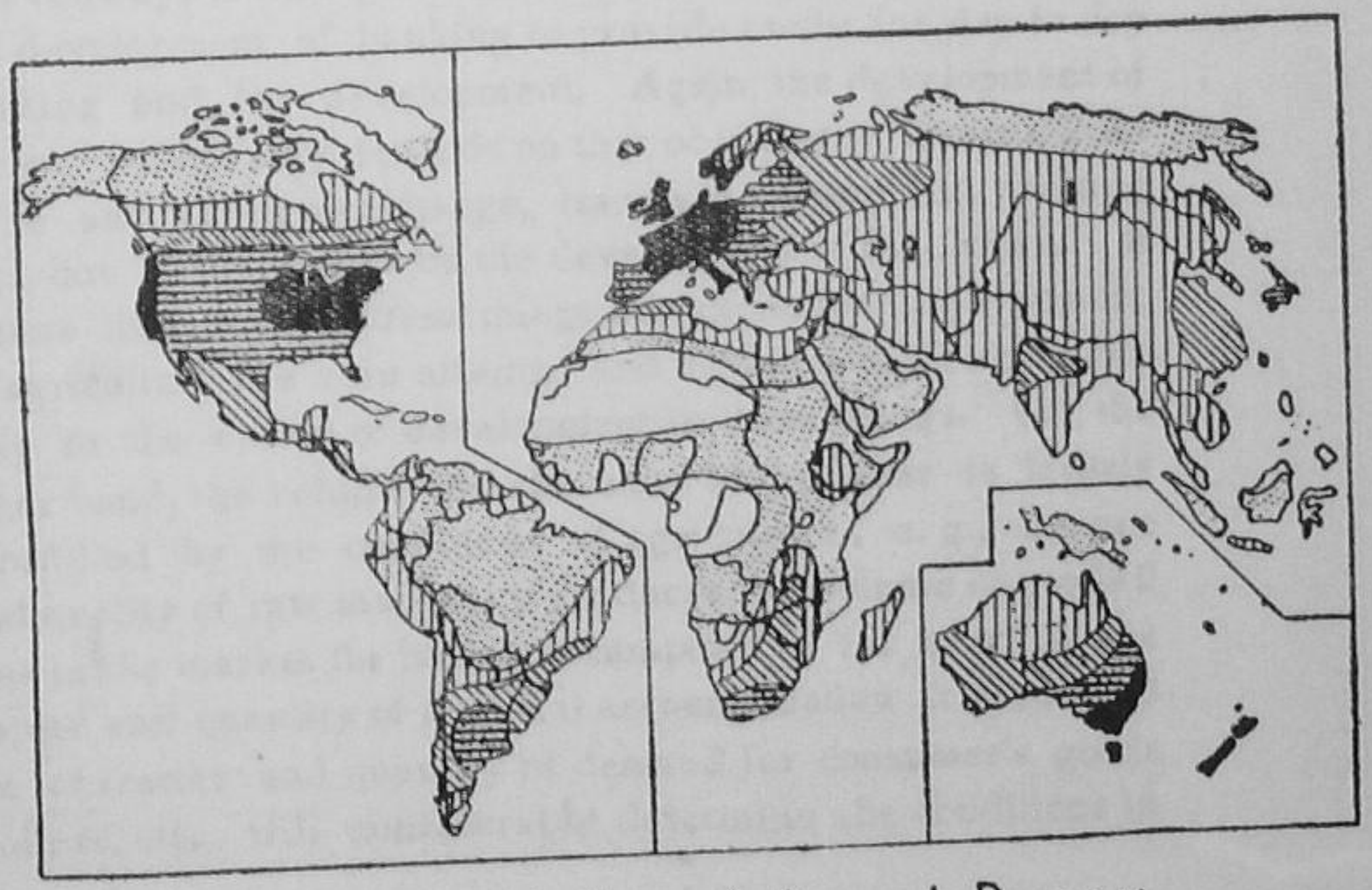
One of the important lessons of economic history of the

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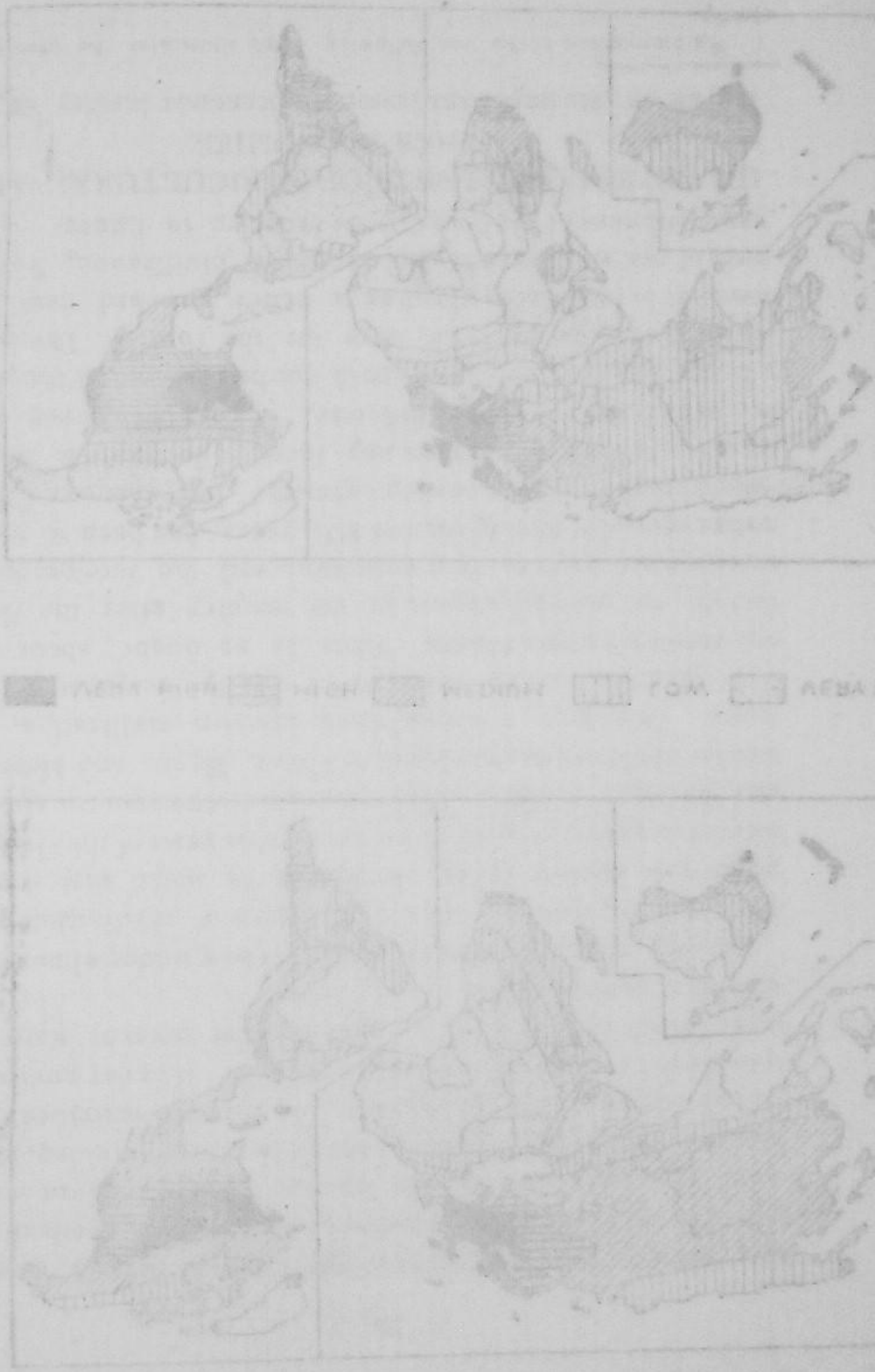
*A comparison of the two following maps illustrates the idea more clearly.

1 World Distribution of Climatic Efficiency.





2 World Distribution of General Progress.



world is that economic progress can be attained only through a simultaneous development in various economic fields. In England, the Revolution in industries could not have been possible without a reciprocal revolution in agriculture, and similarly agriculture too could not have been revolutionzed without a similar change in industries. Generally, industries depend for their raw material on agriculture and for their labour force on rural community ; and they provide a market for agricultural commodities and for labour supply. Agricultural community, on the other hand, depends for all the other necessaries of life except food, on other industries. Our agricultural progress depends on the development of technology to provide improved agricultural machinery to cultivate the land, to draw water and to manufacture ferilizers, on the development of power to industrialize the rural areas in order to absorb the surplus labour from agriculture and to provide a subsidiary income to farmers, on the development of roads and railways to transport the farm produce to markets, and on the development of banking to provide credit for day to day working and for development. Again, the development of agriculture not only depends on that of industry, international trade and foreign exchange, transport, power and banking etc., but it is limited by the development of the latter. It means that unless these things are expanded, development in agriculture is a vain attempt, and the latter will be possible only to the extent of development in these things. On the other hand, the volume and character of the latter is largely controlled by the conditions of agriculture., e. g., the type and quality of raw material it produces, the volume of goods it puts in the market for home consumption or for exports, the nature and quantity of financial accommodation it needs and the character and quantity of demand for consumer's goods it offers, etc., will considerably determine the conditions in

industries, foreign trade and banking, etc.

This interdependence of one sector of economy on another leads to an important feature that the repercussions of the problems of one sector are not confined to that particular sector alone, *e. g.*, a depression in industry is bound to create depression in agriculture. The volume of employment, the level of earnings, price level and the conditions of living and working, in short, the economic conditions of one group exercise a controlling influence on those of the other groups, changing a previous balance and again striving to establish a fresh equilibrium only to be dislocated soon. This results in a perpetual shifting of resources and men from one occupation to another. And in this way, the action and interaction continues establishing a causal relationship and reciprocal behaviour between different segments of national economy.

With the development of civilization and economic progress this interdependence has been increasing. And so will it do in future. In agriculture, there is a change from self-contained subsistence type of farming and village economy to specialization of production, production of cash crops for the market and to national and even international economy. This implies more dependence on buying and selling and the nature and volume of production and consumption being oriented by the market. The growing importance of exchange in modern economy makes agriculture, and so also other industries, vulnerable to actions in other segments of economy. This has got both advantages and disadvantages. The advantage is that through this mutual relationship a higher, better and fuller economic life has been made possible, and the chances for the future progress have been made more bright and the scope is enlarged. The disadvantage is that different groups are exposed, in addition to their own individual risks, to those of other groups, *e. g.*, the

stability of farm income is disturbed not only by the agricultural hazards and their consequent variability in farm production, but also by the fluctuations in demand and thus by trade cycles. Besides, the economic problems are becoming more complicated and difficult. But with the march of civilization and economic progress the problems have to be more complicated. The advanced man soon finds a solution for every complexity. On the whole, these disadvantages can be greatly controlled. And this interdependence can serve as mutual help and cooperation leading to a balanced distribution and fuller utilization of human and material resources, and thus creating a spiral for more civilized and better economic life.

But there is one important thing to note. Agricultural economy is not an isolated affair. And similarly no other economy is. Some of the problems of agriculture are its own problems, *e. g.*, the size of the unit of production, land tenure, irrigation and manure etc. But quite a large and sufficiently important are the problems of inter-relationship between agriculture and industry, trade, foreign exchange and transport, etc., *e. g.*, the volume of employment, price level, influence of foreign market, level of earnings and the rate of savings and investment, etc. It implies that remedies for most of the problems of agriculture do not lie in agricultural sector alone. And similarly, the remedies for the problems of any particular section are also not confined to it. Economic problems of every group are many-fold and the remedies are likewise multi-sided. Progress in any isolated segment of economy is not possible. It has to be made a coordinated part of the general and overall economic progress of the whole country.

IV. THE LAW OF DIMINISHING RETURNS.

Land and its importance in agriculture. In Economics

the term land* is interpreted to mean 'materials and the forces which nature gives freely for man's aid in land and water, in air, light and heat.' It includes all the forces and resources of nature for which science can discover any useful application, but which are not the result of human effort.

Importance of land is obvious. It provides man room for action, and is, therefore, the primary condition of everything that a man can do. Inspite of the scientific development the world as a whole, is still so poor that it must devote a major part of the resources to the production of necessaries, mainly food. Nearly 2/3 of the world's population is residing in under-developed countries in which agriculture is by far the most important occupation, and most of the people depend on land. Even in the world as a whole, agriculture is numerically the most important occupation at present, and in agriculture land is the basis and the most important factor of production. It affords standing room, supplies mineral products and supplies conditions and materials for plant growth. The chemical constituents of the soil in combination with seed, produce the plant. Life and growth are affected by geographical constitution of the soil and the forces of nature which are associated with land surface, such as rain, air, sunshine, light, heat, and atmospheric pressure, etc. They are very important in the process of crop production and slightly less in live stock. But they can be affected only to a minor extent by man.

It is worth-while to note that with the growth of population and the social progress, the absolute importance of this primary requisite increases, because the increased population makes fresh demands, and the new discoveries and the development

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*Instead of a general term 'natural resources' or 'materials' economists use the term land in a very wide sense. It is because under the existing legal institutions it is through the ownership of land or rental that possession of natural materials is obtained or access to natural forces is gained.

of science and technology point out new uses for these objects. But the increase in the quantity of wealth is due largely to the efficiency in the form of human efforts, and hence, the relative importance of resources as a factor of production decreases. Again, in the process of social evolution human society is passing from the Etiological to Ecological and then to the Epharmological stage, and man's powers over nature are gradually increasing. In the earlier stages primary industries, and in them the part played by nature, are more important; but later on secondary and tertiary occupations gain more importance, and in them the part played by man becomes more prominent, and the relative importance of nature declines. The following tables and the accompanying diagram may serve as an illustration.

Trend in the Distribution of Working Population by Types of Employment.

Countries.	Primary.	Secondary.	Services
U. S. A.			
1870	54	23	23
1910	32	31	37
1945	20	30	50
Gr. Britain			
1871	15	49	36
1911	8	46	46
1950	6	48	46
Japan			
1872	85	5	10
1912	62	18	20
1947	55	23	22

Primary industries include agriculture, forestry, fishing and hunting. Secondary occupations include mining manufacturing, electric power and building construction. Services or tertiary occupations include the rest, i e., trade, transport, communication, domestic, public and professional services.

Relationship between occupational distribtiution and economic growth. (Economic growth is measured in terms of Real Income per head.)

Countries.	% of working population engaged in different sectors*			Real Income per head of population. International units per 2500 hrs †
	Primary.	Secondary.	Tertiary.	
U. K. (1950)	6·0	48·0	46·0	584
U. S. A. (1945)	20·0	30·0	50·0	545
Australia. (1933)	20·8	31·1	46·1	521
Germany. (1939)	26·0	41·5	32·5	343
Canada. (1941)	26·3	27·9	45·8	529
Denmark. (1940)	28·5	30·8	40·7	347
France. (1936)	35·6	30·9	33·5	358
Japan. (1947)	52·6	23·3	24·1	139
Poland. (1931)	64·3	16·9	18·8	117
India. (1948)	68·2	14·1	17·7	64
Romania. (1930)	78·7	7·2	14·1	102‡
Yugoslavia. (1931)	78·7	11·1	10·2	102‡

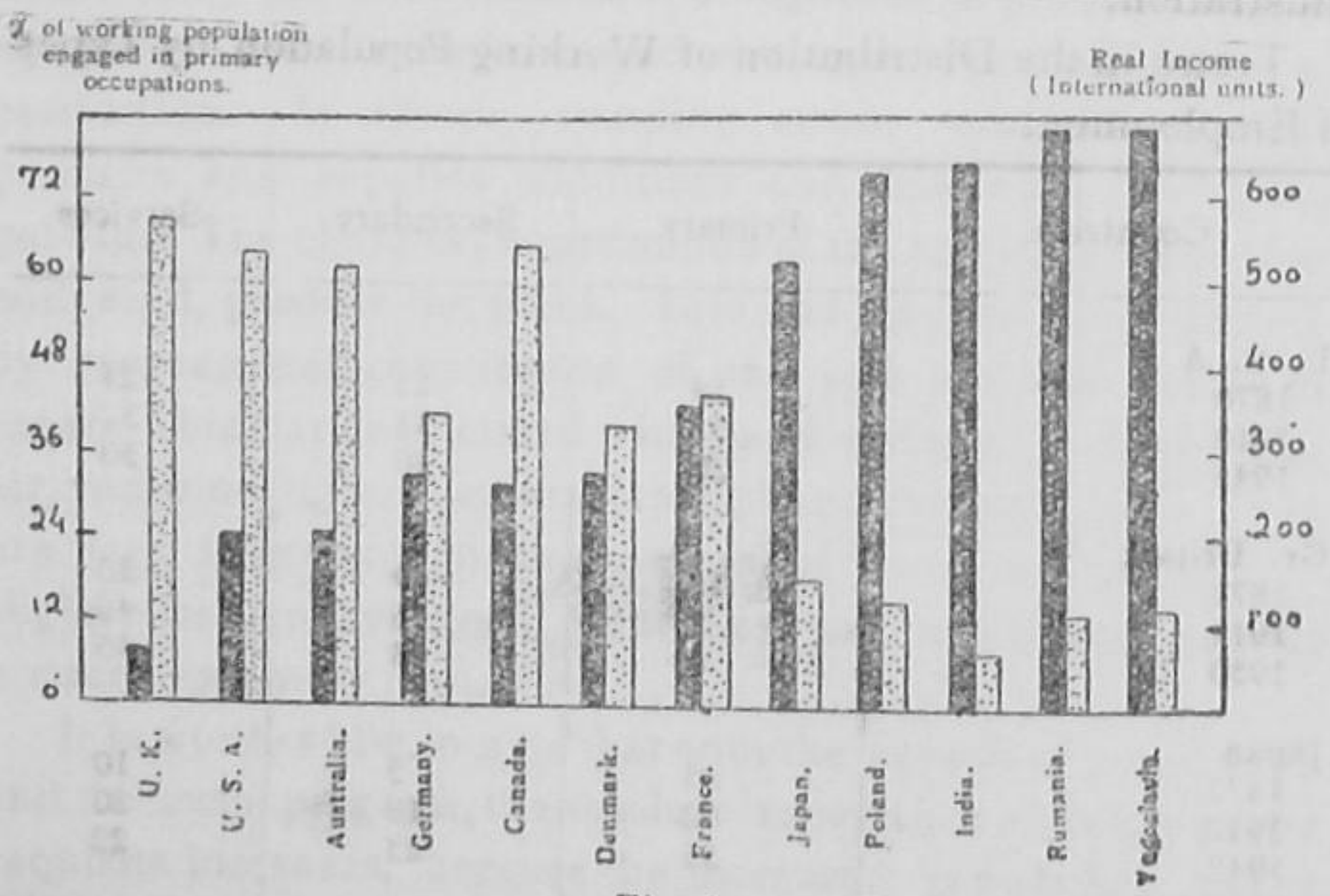


Fig. 1.

* Compiled from National Income Statistics, U. N. O., 1950, and Statistical Year Book, U. N. O., 1948.

† Colin Clark, The Economics of 1960.

‡ Real Income per head for the Balkan States.

Productivity of Land. Productivity ordinarily means the capacity of yielding a certain amount of output as a result of investing a certain amount of labour and capital. It depends basically on the fertility of land. But the development of exchange economy makes the value of land as a factor of production dependent also upon the relationship of its situation to other forms of productive activity from the side of both buying and selling. It means land is valued not only for its fertility but also for its good situation. Really speaking, the location greatly influences the physical and chemical characteristics of land, and the physical conditions vary from place to place. Besides, the social conditions, *e. g.*, the character of the people and the market conditions also influence production and sale of commodities, and hence, the value of land. In economic analysis productivity means the value producing power; and it is determined by capacity multiplied by efficiency. Capacity of a given area is measured in terms of the units of labour and capital which can be absorbed by it or can be associated with it with optimum results at a given stage of economic development. Economic efficiency* is the ratio between the effort put in and the result obtained. It is the value of the product per unit of labour and capital spent on it. Capacity is measured in terms of input per unit of land, and efficiency is measured in terms of output per unit of input. Thus, in estimating the productivity of land both the factors: the physical conditions and the location, have to be taken into account, *e. g.*,

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*In economic analysis efficiency may be calculated in terms of physical products or in terms of value. While analysing the efficiency of movable instruments of production the former is a better basis for comparison because of the difference in value at different places. But in the case of the immovable instruments of production value of the product is a better basis of comparison.

Case No.	Capacity units.	Output per unit.	Productivity.
A.	10	1·5	15·0
B.	12	1·4	16·8

Capacity ratio. 5 : 6

Efficiency ratio. 15 : 14

Productivity ratio. 25 : 28

Thus, we find that productivity primarily depends upon two factors: natural and locational. The Gangetic plain is more fertile than the arid and the barren tracts. And the difference is what the nature has brought about. Again, a plot of lesser fertility in the vicinity of a city may yield more value than one which may be more fertile but distant. Besides, man in his own way has tried to improve the productivity of land by tempering with nature, *e. g.*, clearing of forests, draining marshes, irrigating barren lands, judicious selection of plants, careful sowing, proper rotation, manuring and weeding, etc. If left alone nature would have yielded much less. But there is limit to man's control over nature, and modifications by man can go only to a small extent. However, the productivity can be increased through artificial increase in the fertility, improvement in the means of transport, improvement in land system and the development of townships, etc.

The Law of Diminishing Returns. It is a common experience in farming that increased applications of labour and capital to a piece of land, or successive additions of land, generally result in less than proportionate results. The diminishing tendency of the extra return obtained as a result of the application of successive doses of labour and capital or successive additions of land, is termed in economic theory as the Law of Diminishing Returns. It is also known as the Law of Diminishing Marginal Returns, or the

Law of Varying Productivity, or the Law of Proportions. In a simple form the law is stated that "An increase in the capital and labour applied in the cultivation of land causes, in general, a less than proportionate increase in the amount of produce raised unless it happens to coincide with an improvement in the art of agriculture." (Marshall).

It is not necessary that the tendency of diminishing return may always be visible from the beginning. If the land is under-cultivated, *i. e.*, the amount of investment in the form of labour and capital is less than the quantity required for normal performance of the agricultural operations, the marginal return as a result of further investment may increase for some time. It is also possible that after increasing for some time it may remain constant and then may begin to decline. But there is no doubt about the fact that ultimately the law of Diminishing Returns is bound to operate. It is sometimes stated that the law of Increasing and Constant returns are the two temporary phases operating previous to the tendency of Diminishing Return. The following example and the diagram may illustrate the point.

Doses of labour and capital	Total output (mds.)	Marginal output (mds)	
1	80	80	Increasing returns.
2	180	100	
3	330	150	
4	490	160	Constant returns
5	650	160	
6	795	145	Diminishing returns
7	915	120	
8	1005	90	
9	1065	60	
10	1080	25	

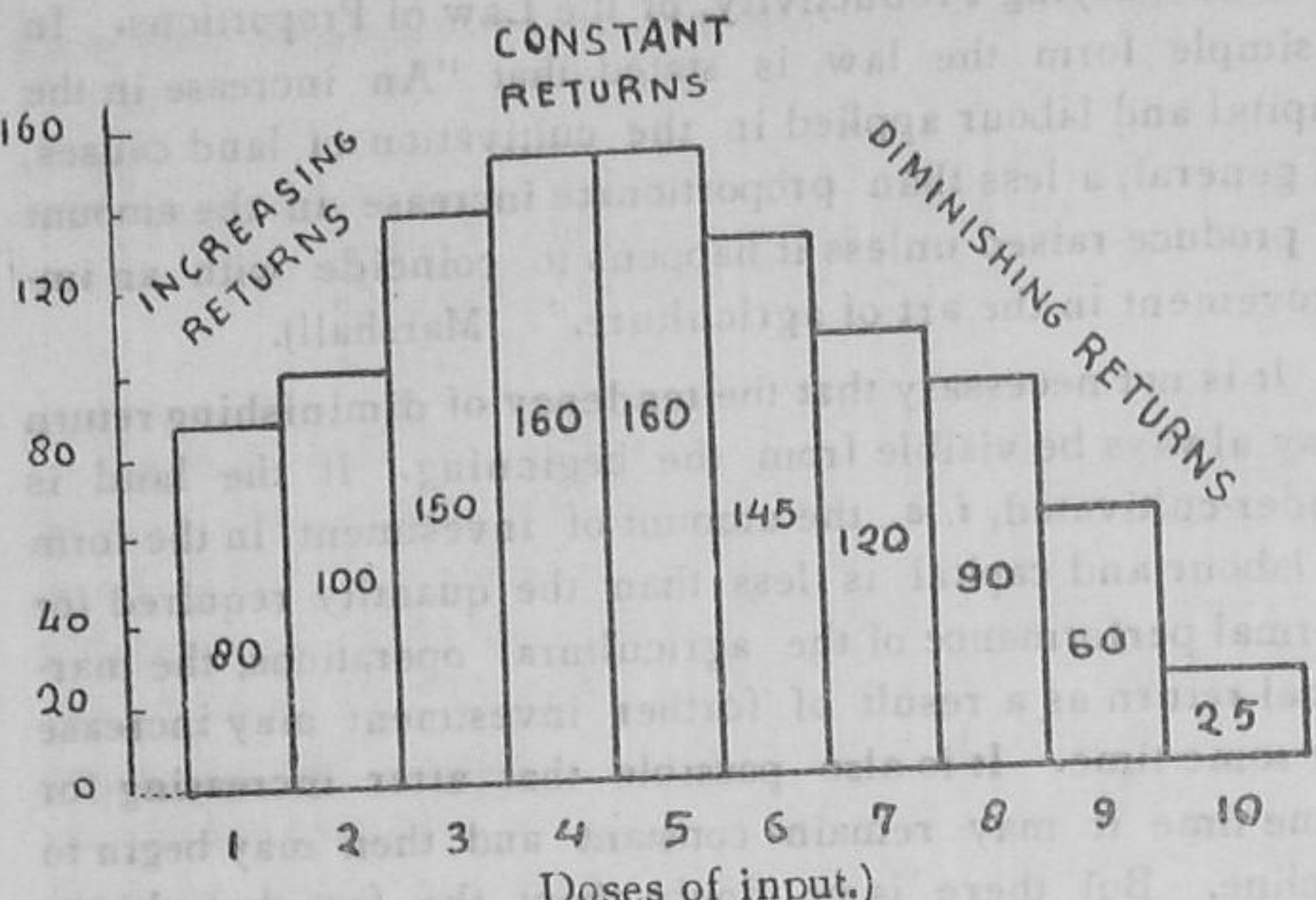


Fig. 2.

This explains in a very simple form the working of the laws of returns. But it must be noted that the laws refer to the produce and not to the value of output. Secondly, diminishing returns do not indicate that the produce diminishes. The total produce increases. But the increase is at a continuosly diminishing rate. Thirdly, the decrease in produce is not the result of a decline in the fertility of land after continuous cultivation. While stating the law it is assumed that for the time being the fertility of land remains constant. And lastly, land is not a limited factor of production in the absolute sense of the term. At the same time neither of the factors of production is unlimited in quantity. Really speaking all factors are variable, but there is a difference of degree. Land is relatively more limited than other factors of production.

Experience has taught farmers how much land they can cultivate successfully. Ordinarily, in farming, one can neither succeed on a very small area nor on thousands of

acres. Farmers have a fairly clear idea of what can they do. Therefore, they try within moderate limits. Similarly, they have understood the folly of over cultivating a single acre or over feeding their stock. Hence, they practise moderation. It must be noted that perhaps no body begins with the 1st column and no body carries production to the 10th column. Mostly farmers will begin with the 3rd and will stop near about the 6th or the 7th. Major part of the production will be carried within these limits. The theoretical analysis of the limits to which production will be carried on is very interesting. If we imagine all land to be equally fertile a farmer would cultivate that much area which, with the amount of labour and capital available, would give maximum output per unit of input. In this case, each acre will be cultivated to the point till it begins to show decreasing returns, or ceases to show increasing returns as a result of additional investment. This area will be the most profitable one to cultivate because either more land is used less intensively or less land is cultivated more intensively, the marginal return as per unit of input would be less. Secondly, if we take land to be varying in fertility, as it really is, all units will not be cultivated to the same point at which returns begin to diminish. It is because in case of all the lands being cultivated with equal intensity marginal return on more fertile land will be greater than on the less fertile one. And it would be advantageous to cultivate the more fertile land more intensively than the less fertile land. It means that so long as the marginal return on more fertile land is greater than the marginal productivity of the less fertile land greater investment will be made on the former, and it will be profitable to cultivate them beyond the point at which Diminishing Returns begin to appear. But in the process of intensifying production, owing to the law of Diminishing

Returns, a point will be reached at which the marginal productivity of more fertile land will be less than that on the less fertile one. Then it will be equally profitable to cultivate the less fertile land also. The best state of cultivation, or the best distribution of labour and capital would be one which yields equal marginal product on all cultivated lands. This shows that the point at which the returns begin to diminish is not the determining point or the limit to which cultivation should be extended or intensified. The producer will go further till the marginal productivity on different lands becomes more or less equal. In brief, the point of diminishing returns is not the limit of cultivation except on marginal land.

In the efforts to increase production the tendency of diminishing returns operates whether more land is cultivated extensively or lesser area is cultivated more intensively. In the former case, the producer will go on adding inferior lands so long as the value of the output is more than the expenses of cultivation. He stops when the addition in income is equal to expenditure. This is known as the marginal land which is just worth while to cultivate. In the latter case, he will stop further application of dozes of labour and capital when he finds the extra income just covering the extra expenses. This dose is known as the marginal dose which is considered just worthwhile to be invested. The margin is said to have been reached when the cost and the income become equal. Thus, in agriculture, we find a twofold idea of margin. The idea of marginal land associated with extensive cultivation and that of marginal dose associated with intensive cultivation.

There is a tendency of bringing more and more of land under agriculture because of the increasing costs of intensifying. There is likewise a tendency of restricting the area, and devoting the available resources of labour and capital to more fertile lands on account of lesser yields on inferior

lands, or increasing costs of cultivating them. If the difference in the fertility of different lands is greater, the total area cultivated would be less than if they differed only slightly. Similarly, if on the more fertile land the marginal returns, as a result of intensification, decline rapidly, less fertile lands would soon be drawn under cultivation than if they decline only slowly. Again, if the marginal returns, as a result of the successive dozes of capital and labour applied to land, decline faster they will be used less intensively than if the returns declined only slowly. It is, however, worthwhile to note that though the total return of labour and capital from more fertile land is greater than that on the marginal land their marginal return is the same on both more fertile and inferior lands. It is because more fertile land is cultivated more intensively until its marginal return declines to that obtained from the least fertile land under cultivation.

The average returns will be higher for some farmers than for others. The higher limit depends upon their ability and the lower is determined by a worthwhile commercial return if the deficit is not intended to be compensated from wages. But all farmers, from the best to the worst, will be pushed to invest till the last addition brings in returns just equal to costs. Thus, at the point of margin all farmers are equal and all farms are alike.

The tendency of diminishing returns is common to all types of industries extractive and manufacturing. It is said to be universal in the process of production. The word universal in this connection implies not that it appears, or is visible, in all cases of production and at all times, but it means that in all forms of production the output as a result of the successive input will sooner or later be less than proportionate, and it will not be worth-while to go beyond a certain limit. The difference in various industries arises on

account of the difference in the degree of supremacy of nature or the part played by it in them. It is often remarked that the part played by nature in production corresponds to diminishing returns and the part which man plays conforms to the law of increasing returns.

It will be a wrong conclusion to say that the law of Diminishing Returns is characteristic of agriculture in which nature plays a greater role, and the law of increasing Returns is characteristic of manufacturing in which the ingenuity of man plays a supreme role. Really speaking, the difference is that of degree only; and agriculture is relatively more prone to it. There are reasons for it. Agricultural production is limited by the supply of mineral substances, *e. g.*, nitrogen and potassium, etc., and every crop reduces their quantity. Time and space put another type of limits on production. It takes months for the seed to be transformed into crop and years for animals to grow to maturity. Every plant requires space in the soil and air. Specialization in the process of production cannot be carried too far because every worker is expected to do a number of jobs at the same time. Supervision cannot be very effective because of operations being spread over a wider area. Scope for mechanization is relatively limited because of the need of human hand for the delicacy of operation and for the attention to individual plants. Thus, the economies of large scale operation are not open to farmers on a very wide scale. Climatic conditions sometimes interrupt the operations and also exercise a determining influence on the quality and quantity of prod uce. A considerable part of the process of agricultural production is natural where man is not the master of the situation but simply helps nature in doing its work. Hence, in agriculture the tendency of Diminishing Returns sets in earlier than in manufacturing where human ingenuity has a greater and

more significant role to play in planning and in execution. An expert manufacturer may not allow that stage at all. Similarly an expert farmer can postpone it for pretty long. Science has provided immense powers to man to change his environment. Even in agriculture science and technology seem to have held the tendency of Diminishing Returns, specially in progressive countries. The fact that food consumption has increased but the population depending on agriculture has gone down, lends support to such contensions. But nature can be controlled only partially. The inherent characteristics of the environment and its original properties cannot be changed completely; and this interference is at considerable costs. The tendency of diminishing returns is bound to operate ultimately.

The above discussion leads to a conclusion that whenever any factor of production is fixed and the other cooperating factors vary, the total output increases at a diminishing rate. It means the combination of a variable factor with a constant factor results in diminishing marginal returns for the variable factor. The operation of the law is due, therefore, to the scarcity of a particular factor of production. But the actual relationship is a joint one, because the quantity of one factor of production for most profitable combination will depend on the quality and quantity of other factors. Besides, all the factors of production are variable with a difference of degree. The law of proportions simply refers to a principle of combination of factors. Any variation in one or more factors of production will charge the combination causing relative scarcity of one and relative excess of another factor.

The law of Diminishing Returns assumes that the land is already utilized in the best known manner, that the amount of labour and capital applied is adequate, and that the methods of cultivation remain the same. Any improve-

ment in the methods of cultivation and farm management, in cultivation of virgin lands, and the greater investment of labour and capital for the development of full powers in the case of under cultivation, may lead to increasing returns. These are said to be the limitations to the law of Diminishing Returns. Further, the tendency of diminishing returns can be counteracted for the time being by some positive methods. Modern implements, manures and fertilizers, better irrigation facilities, judicious cropping, better management, improvement in transport and marketing, and above all improvement in the human factor, in short science and technology which improve the quality of land and can make it yield more, can hold the law in check temporarily.

V. INTENSITY OF CULTIVATION

Human efforts are generally directed towards wresting maximum results from nature. The methods adopted can broadly be put under two classes. In old settled communities having comparatively dense population, land is supposed to be a comparatively limited factor. Cultivators generally have small farms, and in order to make the best of them they work hard, try to grow more than one crop, practise judicious cropping through rotations and mixtures and invest more capital in the form of seed, manures, irrigation and improved tools, etc. This is commonly termed as intensive cultivation. In comparatively new countries, or where population is sparce efforts to maximise production lead to bring greater areas under cultivation instead of concentrating on increased efforts devoted to smaller areas. Land being ample the size of farms is relatively bigger, and the increased use sometimes results in wasteful use of land. This is termed as extensive cultivation. The point of distinction is the increased use of particular factors of production. Increasing application of labour and capital distinguishes intensive agri-

culture from the extensive one which is characterized by the increasing use of land.

Ordinarily, the intensive method implies small farms and the extensive method large farms. Where vast lands are available farmers follow extensive method and where land is scarce they cultivate it more intensively. But it is not always the case. The term intensity refers to the degree of investment per unit of land. In the U.S.A. and Canada where farmers use modern scientific developments investment per acre is more than that on small farms cultivated by more primitive methods in China and India.

Is our agriculture intensive or extensive? There are many cases clearly illustrating the two types. But that does not describe the general character. Small size of farming is the general rule. And equally conspicuous is the low investment per acre. In the total farm investment land values form more than 2/3 share. And if cost of family labour is added to it, both form more than 3/4 share, and all other investment hardly forms 1/4 share of the total investment.* Though there is an excessive labour in agriculture even these small farms are under-cultivated due to the inadequacy of capital and equipment. Ordinarily, the ability of the farmer, the area of land, the volume of family labour and to some extent the quantity and quality of capital are fairly fixed factors at least for the time being. And hence, our cultivation is more of an extensive type than of intensive one.

Factors affecting the intensity of cultivation. The intensity of cultivation is affected by several factors.

(1) *Ability of the Producer :* In order to make a proper combination of different factors of production ability of the

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*Ramphal Singh, Income and Standard of Living of Farmers, 195-, an unpublished thesis, Dept. of Agr. Eco., B. R. College, Agra.

producer counts most. He is an indispensable agent. His personality is associated with agricultural operations as a vital part of an organism, and the return is limited by it.

(2) *The Quantity and Character of other factors of Production :* Availability and the efficiency of land, labour and capital determine the degree of their use and the combination for producing the best results.

(3) *Agricultural Prices :* Price fluctuations occur frequently and in varying degrees. The abnormal situation thus created may be temporary, or the tendency to return to the previous balance may be realized only partially, or the abnormal situation may continue and form a new norm, a readjustment in the combination of factors generally takes place.

(4) *Variation in Capital Costs :* If prices, rent and interest are assumed to be constant, and capital costs vary, producers will find it advantageous to change intensity conversely with such costs, reducing the use of capital when they rise, and increasing when they fall.

(5) *Variation in Wages :* Intensity varies inversely with wage rates, if other things remain the same, because it will be advantageous to farmers to make less use of labour when it is more costly and vice versa. But in actual practice the case is not so simple. The changes in prices, wages and cost of capital lead to substituting one factor for another. Again, the result of such changes may be a new balance similar to the previous one though not absolutely identical.

(6) *Pitch of Rent :* Rent generally, though not always, reflects the degree of intensity, since higher rent means greater costs which can only exist if there is greater return per acre.

(7) *Stage of Economic Growth :* The prevailing economic and social conditions will determine the volume of demand,

employment, pitch of industrialization and the pressure on land, etc., such things in turn will reflect upon the intensity of agriculture.

How can the optimum degree of intensity be visualized and approached? The most simple answer is to have the most advantageous combination of land, labour and capital, and let it continue. There can, of course, be an optimum combination of factors but it is difficult to arrive at, and still more difficult to continue. The method of arriving at the proper degree of intensity of cultivation is to try the various combinations at different levels by changing the different factors alternately and simultaneously. The process seems theoretically simple but is practically impossible, since it involves four variables. Every situation in order to determine the right amount of a particular factor of production will assume a combination of the remaining factors. It will be difficult to say whether the unsatisfactory result was due to the wrong quantity of a particular factor, or due to the wrong combination of the remaining factors. To say that a particular factor is in right or wrong amount is to decide one question independently of others. In actual practice the experiment is only partial because the major premise will not bear analysis. Even if we suppose that a laboratory method determines the right proportions on a trial farm and the results are theoretically demonstrable, this combination cannot serve as a practicable measure on farms of smaller or bigger size. The problem of proper degree of intensity of cultivation, therefore, cannot in actual practice be solved through accountancy method or methematical calculations. The experiments, however, do advance useful suggestions for movement in a particular direction.

Our growing population, the scarcity of farm products, and the desire to increase the standard of living, will, in future, put

greater demands on agricultural resources. Resort to new lands for cultivation being limited (explained in chapter VII) the most important method of increasing the supply of agricultural production is through intensifying our farming more and more. This implies a greater part to be played by labour, capital, equipment and management in future than in the past. But both in the process of intensification and extension the return per unit of social and economic costs is sure to decline sooner or later. The depressing effects of the law of Diminishing Returns will necessitate an improvements in the human factor in farming and in other equipment, which is termed as capital or technology.

CHAPTER IV.

Types of Farming and the Problems of Selection and Valuation.

I. CLASSIFICATION OF FARMS

What is a Farm? ***It is a piece or pieces of land operated as a single unit of agricultural enterprise under one management.*** In our country the term 'farm' is not so commonly used as the term 'holding,' and very often the two terms are found to be used as synonyms. Really speaking 'holding' is a legal concept indicating parcel or parcels of land held under one lease, engagement or grant, or theka, or in the absence of any such lease etc., under one tenure. The word 'farm' indicates the actual unit of operation. Dimentionally they may or may not coincide, and very often they do not.

Types of Farms. The phrases types of farming or systems of farming apparently appear vague, since they bring to the mind a bewildering variety of agricultural enterprises both in respect of growing of crops and of raising of livestock. Generally, these terms are used interchangeably. But really speaking the latter is a broader term. It generally denotes the nature of production or the combination. The former has been more commonly used in the classification of farms

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Type-of-farming area denotes the territory within which a particular product or combination of products is found on most of the farms, or even in the case of intermingling that is the most common system of farming The term '*combination*' denotes not only the products which are combined but also the proportion in which they are combined, *e.g.*, potato-tobacco farm means more income is from potato than from tobacco, and the tobacco-potato farm means the reverse of it.

specially on the basis of the share of gross income received from different sources. But this is not a commonly accepted terminology in our country indicating clear cut distinction. However, a classification of farms can be made on several bases.

1. *According to the nature of the produce.* Broadly speaking agriculture may be divided into two classes; (*a*) crop farming, and (*b*) livestock raising.

2. *According to size* (*measured in terms of area*). In terms of area they are generally classified into: (a) *small*, (b) *medium-sized*, and (c) *large*. Sometimes a detailed classification is attempted, such as: (a) *small*, (b) *medium-small*, (c) *medium*, (d) *medium-large*, and (e) *large*. These terms convey different ideas in different countries, depending upon the total cultivated area, the number of people following agriculture and the prevailing size of the unit of production. The distinction is more marked in countries of small-scale farming on the one hand and those of large-scale farming on the other. In our country, in the case of the threefold classification farms upto 5 acres may be considered small, 5-15 acres as medium-sized and those of above 15 acres as large. In the latter case those upto 5 acres as small, 5–8 acres as medium-small, 8–12 acres as medium-sized, 12–15 acres as medium-large and those above 15 acres as large.

3. *According to value of products, or income.* Broadly they are classified into: (a) *Specialized farms*, when the major source of income is from a single crop or one industry. There may be crop speciality, such as cotton farm, wheat farm and sugar cane farm, etc., or animal speciality, such as sheep ranch, poultry farm and piggery etc. (b) *General farms*, when the income is from several sources, *i. e.*, when not even 40% of the income is from one particular source. It presents a combination of agricultural enterprises, which may

be closely related, each being necessary for the profitableness of the whole undertaking, such as dairying combined with growing of fodder; or it may combine several departments, each producing its independent share of the income, such as a farm producing sugar cane, vegetables and dairy products. An extreme form of combination may be of several industries on the same farm, such as cereal cultivation, fruit farming, vegetable growing, and they being combined with dairying, cattle breeding and poultry etc. These are the three stages of combinations of agricultural enterprises on the basis of which general farming may again be classified under three heads.

Closely resembling to the term general farming there are two terms: ***diversified farming*** and ***mixed farming***. Ordinarily the term general farming can be used for any of these two types. But specifically diversified farming means growing of several crops, or including different kinds of livestock in a stock-ranch. There are diversified crop farms as well as diversified livestock farms. The word mixed farming is used for a type on which growing of crops is combined with some kind of stock-raising. A more explanatory substitution for it would be crop and livestock farming.

4. ***According to the business enterprise.*** On the basis of the nature of business farming may be classified into: (a) *Self-sufficing or subsistence or family living farms*, when most of the goods produced on the farm are consumed in the farm family and agriculture is carried on mostly as a mode of living. (b) *Commercial farming*, when the farmer lives on profit, agriculture is mostly carried on as a business, and most of the farm produce is for sale in the market. (c) *Part-time farming*, when agriculture is combined as a secondary occupation with some non-agricultural occupation.

5. ***According to farm organization.*** On the basis of farm

organization it may be classified as : *(a) Individual farming*, when the farm family is the unit of operation and the farmer operates the farm individually, mostly with the help of his family labour and resources. *(b) Joint farming*, when two or more (mostly two and occasionally three) farm families operate their land jointly as one farm, combining their lands, supplying labour and other investment in a particular proportion (mostly equally) and dividing the output in the same ratio. The combination is mostly for one agricultural year and lasts till the harvest. *(c) Cooperative farming*, when cultivators form a cooperative society pooling their own land or taking it on lease or buying it, and cultivate it jointly by means of production owned by the society. Sometimes land is cultivated individually and the society performs some common services such as supplying of credit, marketing of the produce and supplying costly implements. Really speaking at some stage the actual farm operations must be done on a cooperative basis. *(d) Corporate farming*, when the farm is operated by a joint-stock enterprise. The work is done by hired labour under the supervision of paid services. The share-holders are concerned only with the profits or losses. Agriculture is followed generally on large-scale based on capitalistic method. *(e) State farming*, when the farm is owned by the Government and worked by the paid labour under the management of the government services. The workers have no voice in deciding the nature of crops, or in the management, and they have no interest in the improvement of the farm. The operation is generally on large scale and such farms are often equipped with up-to-date machinery. *(f) Collective farming*, when the members surrender their land irrevocably. The rights in land and livestock are joint and the actual farming is done commonly. The income is based on the amount of

work done. Farmers mostly live with individual families in own houses which have small garden allotments attached to them. Sometimes in the extreme form of collectivization members live together, have a common kitchen and own everything commonly, having no separate belongings except trifling things of personal use like the tooth brush.

6. *According to land tenures.* There is a bewildering variety of farms and farmers based on the nature of rights in land. However, on the basis of the duration of the occupancy right farms may be of five types : *(a) Tenancy-at-will*, when no right accrues in land and the farmer simply depends on the sweet will of the owner. Generally, such farms are for one agricultural year. The tenancy is renewed and the farmer may have the same land next year or different land. *(b) Lease holding*, when the land is held for a number of years under a lease. *(c) Life tenancy*, when the right of cultivation lasts till the life of the operator, *(d) Hereditary tenancy*, when the right of cultivation is inherited and passes from generation to generation according to the law of inheritance. *(e) Heritable and transferable tenancy*, when the right of cultivation is both heritable and transferable. Besides, another type of classification based on tenancy may be as : (*a*) *Tenant farming*, when the land is taken on rent from landlords. The rent may be paid in cash or in kind. *Share-cropping* is also a form of tenancy farming in which a part of the produce, generally half, is paid as rent. (*b*) *Peasant proprietorship*, when the land is taken directly from the State by the farmers and there is no intermediary between the farmer and the State. The right is also heritable and transferable. (*c*) *Owner or Landlord farming*, when the land is farmed by the actual owner or the land holder who has the superior right of ownership in it. The actual farming may be done by himself or through hired labour.

7. According to farm labour. On the basis of the actual farm work done, farms may be of two types : (*a*) *Family farms*, when most of the agricultural operations are performed by the farmer with the help of the family labour, and (*d*) *Farming by hired latour*, when most of the farm work is done by wage paid workers.

II. FARMING AS AN OCCUPATION

There is an old Indian proverb that agriculture is the best of all occupations. Such a conception is not peculiar to India alone but it reflects the traditional view of all agricultural societies. As observed earlier man had to be fed and food production was the most fundamental and permanent concern of man. The fundamental importance of agriculture, therefore, dominated the thought of man from the very beginning of settled life, and thinkers made agriculture the only key to economic activities. 'Throughout the age-old struggle of mankind to make a living, perhaps no dream has been more appealing than that of a home on the land—a snug, secure place where one could be reasonably sure of enough to eat, of shelter, of warmth, of those elemental necessaries of life that the average man thinks of first for himself and his family'.*

One thing peculiar about farming is, and it is hardly true of any other vocation, that it is a home enterprise, intimately combining business with home. Farming should, therefore, be considered in two ways : as an occupation and as a living. Technically speaking, they are two different forms of activities, and the principles governing them are likewise different.

The tests of an occupation are economy and efficiency, to be more explicit profitableness, safety, stability, and ultimately the national good. Judged by its profitableness agricul-

*Larson and Teller, What is Farming ? p. 13.

ture cannot be the best occupation. Agricultural communities all over the world are not so advanced asindustrial communities, and are not even equally prosperous*. In agriculture only a few become rich. A small percentage is well-of but the rank and file is poor, and some miserably poor. But farming is said to be more safe and stable, and less susceptible to serious dislocation in the financial world than other businesses are. This is mostly due to self-contained economy. Farm production on the whole is fairly stable but taking the different regions and individuals into account income variability is quite considerable, which is due both to production variability and business fluctuations. Besides, agriculture is subject to natural hazards more than any other form of business. Again, in the Bengal famine of 1943 majority of the starvation deaths were of rural people and farming community. That makes the idea of safety doubtful. However, since agriculture produces primarily food and agricultural economy is mostly of a self-sufficing nature, it is less susceptible to financial disturbances than other occupations. Booms and depressions, inflation and deflation, and unemployment, etc., do not affect farming so seriously as they do in the case of other businesses. Even wars do not dislocate agriculture so much as other industries. Hence, farming on the whole can be treated to be more stable and safe than other occupations.*

But farming cannot be treated as a business only. It is a mode of life as well. And some go to the extent of

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*Really speaking large scale farming and big business cannot be compared. A big farmer can do slightly better only through improving the organization but so far as the methods of production are concerned he has got the same standard as his small neighbours. Farming is not an occupation in which a small revolving fund can be made to do wonders, nor is it one in which few great fortunes are made by a lucky turn of the wheel which grinds thousands of competitors. It is mainly the result of individual effort. The vast majority of farmers are trying to get along doing the best they can under all sorts of handicaps.

saying that it is a mode of life and not a business, and hence, business principles should demand least consideration in it. Really speaking there is a close intermingling of the two lines of activities each exercising a great influence on the other. The farm family is very important to the farm business, and equally important to the family are food, clothing and fuel provided by the farm. Farm and the family become more closely involved because there is a sort of conflict between the desire for cash income and wholesome living, between the use of income on the farm and for family, and between the work on the farm and the time for living, recreation and leisure. Farmers have to make a choice between how much to sell in order to get enough income to meet the various obligations and how much to keep for their family requirements. They have to make a choice in the use of income and other resources for carrying out the farm operations and improving the farm, or for living, comfort, leisure, health, education, and recreation of the family. There is a choice between work on the farm and enjoying life, for children to go to school or to look after the cattle and crops, and for ladies to take care of children and look to household duties, or to attend to milch cattle and to help the male members on farms. The choice has to be made between the care of children and their education or the rush of work at the sowing and harvesting time, between the medical care of the wife or some urgent farm expenses, between reducing the debt or performing some social ceremony, in short between more income or better life, and between farm business or farm life.

*Is security a powerful economic motive ? The psychology of agricultural communities proves it to be so. To the prosperous and specially those who have imbibed the spirit of individualism and competition, and are sure of themselves as competitors in the commercial and the business world, it may not be so. But to the relatively poorer sections the sense of safety provided by the farm, regarding food and living, makes them stick to farming inspite of the fact that it provides relatively poorer standard of living and lower incomes.

The standard of living and the standard of farm work are also closely related. Working conditions are as much a part of life as food, clothing and housing, etc. Any improvement which makes the farm work light also contributes to the welfare of the family and may increase the income. Again most of the satisfactions which make up life and which are termed as 'utilities', are derived not from direct consumption like taking of food or wearing of clothes but from pleasure of work. The usual illustration is the satisfaction derived by an artist by looking at his paintings. The satisfaction which farmers derive from maturing crops and fattening livestock, a grain heap on the threshing ground or a milking cow, and even the care of crops and animals when they grow and develop, is as genuine as that of an artist.*

Farming has got certain advantages. Farmers work for themselves and have a greater independence than labourers working for others. Farm work is varied and out of doors. Farming provides opportunities for making a living possible with comparatively smaller investment. There are opportunities for smaller investments and smaller businesses, hence, there are greater chances for mediocres also to be quite successful. Agriculture is an occupation which though suffers on account of inefficient and unintelligent operation and still returns a living, while other businesses, inspite of inefficient operation may not return a living. Farming provides work

*There is a fine story about farming told by Plutarch, the famous Roman historian. Over 2000 years ago, a certain nation sent emissaries with a large sum of gold to gain the favour of a prominent Roman citizen. They sought out the powerful Roman and found him on his little farm. Though he had been three times accorded a public triumph and though he owned many slaves, they found him in the chimney corner of his cottage. busy dressing turnips for the evening meal. After they had made their offers, the great man said to them, 'The Roman who owns a farm like this wants nothing you can give. What need have I, or any man who can produce and enjoy such a supper as this, of gold'. He sent them away and went on dressing turnips.

for young and old and work which women and children can do with profit and pleasure. Farm life provides a better community life, and life which is more close to natural conditions and nearer to human hopes and desires than life in other occupations, specially in cities, which are dominated by pecuniary motives, selfishness and greed, resulting in dehumanizing of human personality. Farm life is more contented and peaceful; it is more simple and happier.

Farming in our country is a tradition and a mode of life. But the choice between the farm and the family very often resolves in favour of farm work and cash income than actual living. Most of our farmers, almost all, must secure enough return to keep their families, and hence, must consider business principles in so far as they bear on their securing enough money for meeting their various obligations. Both business principles and family considerations, therefore, have to be given their due weight. The business aspect is rarely so successful that farm life may appear to be a long sweet song. Due to a number of handicaps farm business runs so low that farm life is a downtrodden sweated slavery and a permanent struggle against fate. Farm life in rural areas is devoid of some conveniences which are available to workers in other occupations in towns. But the cost of living in rural areas is lower. Even during the depression farmers are not faced with unemployment. During the time of general unemployment agriculture serves as the shock-absorber. And farm life is more contented; and farm communities are most peace loving.*

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*The economic history of the developed countries shows that with economic progress the attachment of people with land has gradually become less numerous and less close. But the results of the urban—cum—commercial civilization which has come into being are not very happy. On the other hand, experience shows that every great war tends to draw increasing attention towards farming, which means that such turmoils which disrupt economic life considerably seem to revive the simple old hope of seeking safety, security and peace on land.

III. SPECIALIZED Vs. DIVERSIFIED FARMING.

The distinction between specialized and diversified farming has briefly been drawn in the discussion of types of farms. In the extreme form specialization means single crop farming, or only one kind of business regarding one kind of livestock. Similarly, diversified farming in the extreme form implies a combination of a very large number of hetrogenous agricultural industries both in respect of growing of crops and raising of livestock, *e. g.*, growing of several kinds of crops: cereals, oil seeds, fibres, pulses, fruits and vegetables, etc., and also having different kinds of livestock. In actual practice such extreme forms are rare. In our country we have examples of the same land growing rice repeatedly for a number of years in the rice zone, or in Rajasthan certain lands growing bajra for a number of years. Again, in the case of tea gardens and rubber plantations, we have examples of single crop farming. There are also dairy farms keeping only cows, selling milk and buying all feeds and fodder. But such cases are uncommon. Really speaking, the difference between specialized and diversified farming, in actual practice, is only that of degree. The former implies two or three crops or relatively less number of crops and the latter five or six or even more, *i. e.*, a relatively larger number of crops. Another way of drawing a distinction is that one implies living on the profit and the other living on the farm. It means specialized farming is drawn more extensively into commercial and business relationships, and is dragged closer to the same principles which underlie other business undertakings. And in diversified farming producers live mostly on the products of their farms; the farms produce almost as many things as needed by family and the farm. Applying this test to the actual conditions it is found that specialized farming is not only for profit and wholly for the market, and

similarly diversification is not absolute self-sufficiency or farming merely for home consumption. Here also, there is a question of degree. One is mainly for the market depending largely on business principles, while the other is generally for home consumption. There can be examples of farms growing several crops and most of them being ment for the market. The real distinction is not the growing for the market or for the family, but the degree of the variety of products, or the number of businesses.

Advantages of Specialized Farming. (1) Specialization leads to community centralization. When the degree of specialization is greater the facilities for marketing are better. It attracts wholesale buying. Thus, products are more easily marketed.

(2) Farm work is less exacting, less confining and liable to a less neglect.

(3) Specialized farms are generally better equipped, since the proportion of fixed charges being less they can afford to have better machinery and other equipment.

(4) A start is usually possible with less capital investment.

(5) Less equipment is required.

(6) Less labour is needed.

(7) Chances of undetectable leakage are minimised.

(8) Farmers have considerable leisure to enjoy life.

(9) Specialization leads to a greater degree of skill and dexterity in the production and care of a particular product.

(10) In some cases lesser land is required. A five-acres poultry farm or twenty-acres fruit or vegetable farm may probably produce almost the same income as 40 or 50 acres of mixed farm. Specialized cereal farming is of course extensive but not fruit and vegetable farming.

Objections to Specialized Farming. (1) Specialized farming is very hazardous. There is a greater dependence

on the market the failure of which brings serious disaster,* *e. g*, bankrupt Europe unable to buy at high prices made American farmers also bankrupt and U. S. A's best land was under most trouble. In the U. S. A. specialization has been the leading cause of farmers' troubles and the worst example is of their cotton belt.

(2) Generally, farmers unconsciously become a part of an international plan because they become producers for world market. And in abnormal times they become more helpless.

(3) When international trade is invloved buying and selling of specialized farms become difficult because bargaining on a safe basis is rendered very difficult in case of variations in international prices. A comparatively small and diversified farm seldom goes bankrupt.

(4) Success of farm depends on the crop conditions of one or two crops, and crop failure spells disaster.

(5) The worst effects are to be seen when the prices fall. The system leads to dependence on public help. And the poorer the country the lesser help it can afford, and farmers suffer more.

(6) The return in cash is mostly once a year and hence, irregular. The investment fails to turn over more than once a year.

(7) It does not provide for the proper maintenance of soil productivity. Continuous use of the land for the same crop not only exhausts soil fertility but also results in losses from diseases. Commercial fertilizers can counter balance

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*Demand for agricultural commodities is generally said to be relatively more inelastic. It is subject to fewer changes than that for other types of goods. But even the most stable parts of diets experience changes, *e.g.*, during the First World War due to emergency there was a 20% cut in bread in the U. S. A. diet. It has never increased since then. Consumers have adopted the new type of diet as normal and producers have adopted to meet the requirements of new type of diet by producing more fruits, vegetables and dairy products.

the reduction in fertility but the soil-borne diseases neccessitate crop rotations which are not properly carried out on specialized farms.

(8) Labour and equipment is not used to the best advantage.

(9) Specialized crop farms do not keep sufficient livestock to consume waste products of farms and to make the waste land productive.

(10) It does not produce the necessary articles of food. And even the producers of food become dependent for their basic requirements on traders, and suffer from trade risks and business hazards even when production is maintained.

Advantages of Diversified Farming. (1) It offers more economical and better use of equipment.

(2) Since different crops mature at different times, the system offers a steady and constant employment to labour, and distributes the farm work more evenly throughout the year. There are more months for productive labour and hence, greater income. The nature of steady employment retains better workers on the farm.

(3) When several crops are grown in succession soil fertility is kept in a better balance, since leguminous crops transfer atmospheric nitrogen to the soil. And soil-borne diseases are also reduced. Sometimes soil texture is also improved.

(4) Farm practices and methods are improved on account of better rotations, green manure crops, clean tillage, storage of moisture and reduction of loss from pests. Sometimes crops not only fill up the gap, or a vacant or idle time and space in rotations, but help other crops. Thus, the opportunities for productivity are increased.

(5) The system results in a better land use. Many farms

have a variety of types of soils. Diversification leads to the adaptation of crops to soil conditions. A combination of deep and shallow rooted crops taps different layers of soil for plant nutrients. Again, deep rooted crops store a part of the plant nutrients in the heavy root growth near the surface. And close growing crops reduce soil erosion and add organic matter in the soil when they are ploughed. Thus to some extent they reduce the need for fallowing.

(6) Combination of crops and livestock leads to better utilization of crops. There are certain industries which prove more economical if they are carried together. Diversification permits a proper utilization of by-products and thus minimises waste.

(7) Returns are more quicker and more regular. Investment has chances of turning over more than once a year.

(8) There are several sources of income and more money producing factors. Thus, there is greater safety of investment and certainty of income every year. Climatic hazards are not so disasterous as in the case of specialization.

(9) Market fluctuations do not hit the diversified farmers so hard as the specialized ones. It is because diversification is not primarily based on producing for the market and hence, market factors are not so important. Secondly there are a number of products for the market and it will be rare that the market may be depressed for all.

(10) It is better for beginners who are not closely familiar with local agricultural practices and conditions. There are chances of some business proving profitable if others fail, and thus of returning some reward.

(11) It is a more complex system of farming, and hence more exacting to the operator or the manager. Their capacities are put to real test in respect of crop planning, organi-

zation of work, utilization of labour and equipment and marketing, etc.

(12) The system is more suitable for maintaining a heavy population.

Objections to Diversification. (1) In case of too much diversification crops compete for the use of labour and equipment at the same time, and in such cases some are liable to be neglected.

(2) There is multiplicity of duty, and year round routine. Less time is left for leisure and living. This sort of objection is more appreciated at an advanced stage of economy. In a country like ours the problem is of providing more work.

(3) Due to the variety and small quantities for sale, there are generally difficulties in marketing farm products.

(4) The work is scattered, more exacting, and, therefore, liable to be neglected sometimes.

(5) Though two or three crops in rotation exhaust the soil fertility more slowly than single crop farming, but they do it very effectively, specially when crops are grown in rows. But this generally happens in a lower degree of diversification and row-cropping.

(6) In case of mechanized farming both general and special purpose machines are used for a lesser duration of time. At times the situation has to be mastered and the work has to be finished quickly, hence farmers are inclined to buy larger and greater amount of machinery than is ordinarily needed. This increases overhead costs.

Adopting a particular system. After examining the advantages and disadvantages of the two systems it should not be difficult to decide whether farmers should specialize or follow diversified farming. But it is worthwhile to note that there is no single answer to this question. First, agriculture

is no where, and perhaps, cannot so highly be specialized as many other occupations. Secondly, whether a farmer should or should not specialize, or to what extent should he diversify, depends largely on conditions under which he lives. Soil and climatic conditions mainly govern the nature of crops grown. Amount of rainfall and the facilities for irrigation determine the extent of intensification. Besides, in poor communities and relatively underdeveloped areas farming is mostly of subsistence type and farmers grow several crops; and in prosperous communities self-supporting farms give way to specialization. It is because when a man has to work hard from morn till evening simply to make a bare living he has no time to think about the scientific aspect of his undertaking or the business principles underlying it. It is only when he receives an adequate return that he has opportunities to think of such things. In prosperous countries specially in the West there has been a tendency towards specialization which is probably the result of surplus economy. Moreover, in densely populated countries like India and China in which agriculture is sufficiently old and established and farm practices have slowly matured and have attained almost an equilibrium, diversified farming has aimed at best land use and the maintenance of a dense population. On the other hand, it has been seen that diversification does not help all farmers. Hence, it is not generally a question of choice between the two systems because most of the things will be governed by circumstances. But a more correct view is that for successful farming diversity of business is an important factor. And a medium degree of diversity so as to give an even distribution of labour, to offer a variety of products to sell so as to bring regular and sure income, and to best utilize the land, is much better than either an extreme form of

diversity or a low degree of it.

Case for Mixed Farming. In view of the peculiar features of our agriculture the case for mixed farming is quite obvious. Our agriculture is overcrowded; the crop yields are low; farm income and standard of living are very poor; and cattle economy is very closely connected with agriculture because animal power is the main source of power in agriculture, farm yard manure is the main source of maintaining soil festility, and animals make good use of subsidiary and by products on farms. Under such circumstances a system of mixed farming will most suit our conditions.

It is capable of maintaining a thicker population. It offers a chance of better labour utilization by providing greateremployment, and further reduces the period of spare time. Thus, it will make a maximum use of the factor of production which is available in plenty, and by enhancing the duration of productive employment will increase the productive capacity. Besides under the conditions of land scarcity it offers better methods and practices of land use. Different types of lands will be used for the purpose for which they are suitable. Thus by establishing a balanced land-use-pattern it will better conserve the soil fertility, subsidiary and by-products of agriculture will be utilized by different kinds of live-stock, which in their turn will provide farm-yard manure. It not only makes our agriculture more economical but also recoups soil exhaustion. It is more significant in our case because the possibilities of the use of chemical festilizers and artificial manures by farmers in general, are limited due to several reasons. Again, it will provide not only a subsidiary source of income but also more frequent and regular income, and thereby will enhance the standard of living.

Really speaking the case for mixed farming can be established only after considering the alternative measures.

The problems of our agriculture as have been pointed out above, e. g., over crowding, spare time, lower yields, and low incomes, etc., can be solved better by a system of mixed farming, which seems to suit best our conditions. A recent study in Mathura district of Uttar Pradesh comparing mixed farming (cereal cultivation being combined with dairying) with purely cereal cultivation, puts the case in a more concrete shape.*

Items	Mixed farming	Cereal cultivation
I. Land Utilization.		
(a) % of the double cropped area to net cultivated area. (%)	26'8	17'3
II. Labour Utilization.		
(b) Employment provided to family labour per average farm. (male-work-units)	480	358
(c) Working days for human labour per agr. year. (days.)	302	245
(d) Working days for cattle labour per agr. year. (days)	223	170
(e) Agricultural-idleness in family labour. (% to available work days)	9 0	24 6
(f) Spare time of work animals. (% to available work days.)	39 0	53 0
(g) Total employment per acre per year. (male-work-units.)	66'4	50'2
III. Farm Income.		
(h) Gross income per acre. (Rs,)	286/8-	209/9-
(i) Net income per acre. (Rs.)	71/7-	58/-

From the study of European agriculture Yates and warriner come to the same conclusion that '.....grain pro-

* Jitpal Sing, Economics of Mixed Farming in Mathura District, 1949, an unpublished thesis, Dept. Agr. Eco,, B.R. College, Agra.

duction by itself will never give a high money output per acre, and is, therefore, utterly inappropriate as a staple farming for crowded regions,' and the evidance supplied by them is quite interesting,* but it reveals its full significance only to one who is familiar with European agricultural conditions.

A. Active workers in agriculture per 100 acres farm land.

Over 15	Italy, Greece, Bulgaria, Rumania, Poland. Albania, Yugoslavia.
12—15	Switzerland, Belgium, Germany, Hungary, Spain, Portugal, Czechoslovakia,
9—12	Netherlands, Norway, Finland. Lithunia.
6—9	Denmark, Sweden, France, Estonia, Latvia,
Under 6	United Kingdom, Eire.

B. Net output in £ per acre. (1937)

12—15	Belgium, Netherlands, Switzerland,
9—12	Denmark,
6—9	Norway, Sweden, Italy, France, Germany, United Kingdom, Estonia,
3—6	Hungary, Bulgaria, Greece, Spain, Portugal, Slovakia, Poland, Finland, Lithunia, Latvia, Eire,
Under 3	Rumania, Yugoslavia, Albania,

*P. L. Yates and D. Warriner. Food and Farming in Post-war Europe, 1943, pp, 39—40,

C. Net output per active worker in £ (1937)

Over 120	U, K , Denmark,
90—120	Belgium, Netherlands, Switzerland.
60—90	Germany, France, Norway, Sweden, Eire,
30—60	Finland, Czechoslovakia, Hungary, Italy, Spain, Estonia, Lateria.
Under 30	Fortugal, Poland, Rumania, Yugoslavia, Greece, Bulgaria, Lithunia, Albania.

IV. PROBLEM OF SELECTION.

Selecting farming as an occupation. It is mostly a personal matter and must be determined by tastes, aspirations and other circumstances of the individuals concerned. There are, however, other factors for general consideration, specially in respect of farming as a business, such as potential profitability of farming, availability of alternate occupations and also the social values attached to it. Therefore, before making a choice of farming as an occupation both the sets of factors have to be taken into account.

(a) Personal considerations. In every locality we find examples of farmers who are most successful due to their special ability or efficiency, others miserably failing, and still others presenting all gradations between success and failure, depending far more upon differences in the human element than on those in physical conditions of land and other opportunities of money and market. Thus, in making farming successful considerable stress has to be placed on the individual. There is, however, no rule to indicate the percentage of success attributed to man. But it must be quite considerable. It is sometimes believed that half of the success depends on man and the other half depends on

the conditions of soil, climate and market, etc. (a detailed discussion of this point is made elsewhere). While considering the personal factor several elements have to be taken into account. They are : personal taste for agriculture as an occupation, experience in farm practices, knowledge of local agricultural conditions, level of efficiency as an operator, energy, enthusiasm, courage, faith and responsibility.

(b) Other considerations. The other set of factors comprises of those which have been considered in previous pages under the heading 'farming as an occupation'. To be brief, it has to be considered both as a business and as a life, and as such, it is quite stable though not a very profitable business. It affords a healthy, peaceful and enjoyable life, and a variety of work. While making a choice the points to be considered are : probable income and its adequacy for the family and the farm, stability and safety as a business, availability of alternate occupations limiting choice, nature of work provided by it, social values attached to it and the type of life it affords.

Selecting Farm Business. After making choice of farming as an occupation the other question is of selecting the type of farming or the farm business. It will largely be determined by circumstances, and the factors to be taken into account can be put under four groups : (*a*) Environmental conditions or the locality limitations, such as the soil and the climatic conditions, quantity and the quality of labour and the location of market and the market conditions, which will greatly determine the kind and quality of the crops grown. (*b*) Availability of capital. (*c*) Financial requirements for operating expenses, or family needs, or for both. Since different farm businesses have variable earning capacities greater family needs may influence the choice of the business. (*d*) Personal tastes and the capacity of the operator.

All these factors have a bearing in making the choice,

and they have to be balanced against each other. The need of larger income may shift the personal factor to a second place. Again, lack of capital may compel to choose a business of lesser income possibility. Sometimes the environmental conditions prove most powerful and overcome all other considerations. Hence, a consideration of all these factors is necessary. But it is to be noted that if there is a greater elasticity of choice, or if one has the whole country to choose from, all the factors enter into choice. But in actual practice the choice is generally simplified by the decision based on either a given locality or a particular business. To be precise, the factors which have to be taken into consideration while deciding the desirability of an enterprise are :—

1. Income possibility or the profitableness as determined by local experience.
2. Physical conditions of soil and climate.
3. Effects of the type of farming on the fertility of the soil.
4. Financial requirements for equipment and other investment.
5. Extent and quality of labour requirements.
6. Nature of work and its seasonal distribution.
7. Location with respect to market.
8. Other conditions existing in the market, specially marketing costs and facilities for sale.
9. The extent of enterprise, and the volume of business determining the quantity and stability in supply.
10. The extent of the market for the product or the demand so as to determine the probable influence of an increase in the supply on market price.
11. Personal inclination of the whole farm family for the particular line of business.

Selecting the Farm. The basic essentials in selecting a

farm are right type of land, good income producing power, congenial community life and reasonable price. These are broad considerations including amongst them a number of elements which, under a detailed analysis must be considered separately. They are as follows :—

1. *Types of farming.* The farm to be selected should fit in the already formulated plan and must be able to produce the kind of crops, or raise animals which the operator intends. To have a place simply because it is a farm and then try to find out the right type of crops or animals after long experiments, is a costly method of gaining experience.

2. *Quality of soil.* It determines yield and is the most valuable asset. Through proper management and artificial manuring some improvement is possible, but the soils of naturally poor physical condition will not pay.

3. *Topography.* General lay-out of the land, slope and its direction, presence of ravines or hills, proper drainage, etc., influence the kind and quality of produce, farm practices and operations.

4. *Shape and arrangement of the farm.* There should be facilities for dividing the farm into fields of proper size, and proper arrangement of fields, buildings, roads, paths and water supply, etc. Irregular shape and a haphazard arrangement of these things increase difficulties in cultivation, add to the cost, and sometimes waste land.

5. *Size of farm* It is one of the most important considerations because it mostly determines the volume of business. The size should be such as to provide full and profitable use to labour, capital and equipment, and ultimately to provide an adequate income and a tolerably good, if not a high, standard of living. It should not be too small to limit the opportunities for profitable employment of labour and capital, and thus, adding to the cost of cultivation, nor

should it be too big resulting in under-cultivation and wasteful use of land.

6. *Climate.* It plays an important part in determining the kind of crops. Temperature, rainfall, forest, hail, thunder storm, etc., determine the succes or otherwise of crops. Pleasant climate leads to healthy life of men and cattle, and permits regular farm work. And unfavourable climate may cause diseases which may deteriorate the health and working capacity of men and cattle, and reduce crop yields.

7. *Water supply.* Normal rainfall is seldom sufficient for crop production. The need for irrigation, therefore, is paramount for successful cultivation. Without it fertility of land and manures cannot be fully utilized. Cultivation cannot be intensified and crop yields are considerably reduced.

8. *Location with reference to market.* The earning capacity of the farm is considerably affected by its location. Proximity to market and good means of transport and commuication are basic for successful commercial farming, specially when the produce is of a perishable nature. Production can be arranged with reference to consumers' preferences and the output can be transported quickly, cheaply and in fresh condition. The locational factor may not be very important in subsistence farming but in commercial farming it is of fundamental importance.

9. *Financial requirements.* The price of land or rent should not be too high and out of proportion to income producing power. The operational requirements and the family needs during the period of production have to be adjusted to the availability of money immediately or in future.

10. *Labour.* Amount, quality, availability and cost of labour (wages) have to be considered specially in case of large-scale farming. Due to scarcity of labour the work may

not be performed in time, and it may affect the yield. If wages are too high the costs may be out of proportion. On the other hand, cheap labour may limit the extent of mechanization. In case of family farming it is not so important.

11. *Safety against damage.* Sometimes considerable damage is caused by wild animals, birds and stray cattle. Safety against them is important for successful farming.

12. *Social conditions.* Good neighbours provide not only a congenial community life but also govern profitableness of farming. When new comers are not liked hinderances are created in work, crops are damaged, petty bickerings and sometimes prolonged litigation take place, and life becomes unwholesome and farming unprofitable. Besides the farm should not be too isolated for good social life.

Agriculture for Town dwellers. In some cases persons residing in cities also adopt farming as an occupation, sometimes in remote villages and more often in places, easily accesible by roads. Such persons are either the big landlords who have temporarily or permanently shifted to cities, or city money-lenders to whom land has passed under a debt, or service-men who during the period of their service want to continue the possession of land or maintain connections with villages, or other rich persons who follow individual or corporate farming mainly for profit, or those having spare cash want to have land property. In most of these cases farming is done on a comparatively larger scale, work is done by wage paid labour, even the management is paid, production is for the market, and profitability is the main aim. But leaving aside big commercial farms most of the farms due to the lack of supervision, prove unprofitable. Land is not maintained in a high state of productivity, and it leads to under utilization. As a subsidiary occupation, and

specially providing the basic necessaries of life, it may be considered good, particularly in abnormal times. During the period of high prices it may prove profitable also. But from the view point of land utilization it should be discouraged as a national policy. Under the present shortage of production optimum utilization of land and maximum production is the aim. So far as the question of property right in land is concerned, it is a different question. If the institution of property in land is maintained tenancy laws can provide an adequate and safe arrangement. Either through lease or sub-letting land must be maintained in a high state of productivity. Even in case of newly reclaimed tracts colonization from thickly populated regions should be preferable to extensive commercial farming by individuals or corporations. On the whole it is a sort of enchroachment by cities on villages reducing the farmer to the status of a wage earner. Even from the view point of business and profitability, in most of the cases it is not desirable. Therefore, farming by town-dwellers in villages must be discouraged. In can, of course, be tolerated in the vicinities of cities if they have farms nearby and practise farming under their close supervision.

Agriculture as a Subsidiary Occupation. Village artisans, menials, workers who migrate to cities in slack season, and others having very small areas of land, follow farming as a part-time job to supplement their incomes derived from their traditional main occupations. In many cases the areas are so small that the operators cannot afford to keep bullocks and other farm equipment. They have the land ploughed and sown by those from whom they take it, and supply other labour. Land is not put to proper use and it is under-cultivated. Lack of experience in the technique of production generally results in low production. It also

reduces the size of farms of regular farmers and increases the pressure on land. This practice has become common because the income of artisans from their occupations has declined and there are no alternative occupations in villages. The real remedy is the development of cottage industries for artisans and the creation of farms of suitable size for farmers. Very often, the development of cottage industries as a subsidiary occupation for farmers is suggested as a remedy for under-sized holdings and as a provision of subsidiary income. This amounts to dual occupation, which has been very successful in Japan. In the transitional period it will have to be done. But in the long run the adjustments will take place and specialization will lead to the choice of a single occupation. Therefore, farming as a subsidiary occupation by those having little agricultural traditions should be discouraged.

A recent study in Meerut District or Uttar Pradesh brings out the following results.*

	Artisan himself Cultivating Land.			Artisan Warking as a Farm Labour.		
	Tradi-tional oc-cupation.	Agr. (as subsidi-ary).	Total.	Tradi tional oc-cupation	Agr. (as subsidi-ary.)	Total
1. Labour employment labour units.)						
Total,	132	231	363	151	150	301
%	66 4	63·6	100	50·2	49·8	100
2. Annual Income (Rs.)						
Total.	554/3/3	142/9/7	696/12/11	675/6/-	247/10/-	923/-
%	84·7	15 3	100	73·2	26 8	100
3. Income per laour unit. (Rs.)	4/3/2	-/9/10	1/14/9	4/7/7	1/9/9	3/1/1

*Jai Niwas Tyagi, Agriculture as a Subsidiary Occupation, 1951. an unpublished theis, Dept. of Agr. & co., B. R. College, Agra.

V. VALUING THE FARM.

Appraisal Process. The term valuation is mostly used as a synonym for appraisal, *i. e.*, the theory and the process of estimating the value of a given property at a specific place and time. In a derived sense it refers to the value placed upon the property as a result of an appraisal. Valuing a farm, therefore, ordinarily means determining a figure in terms of money which one would be justified in paying for a farm or an agricultural enterprise.

The appraisal process consists of two main parts: (i) Physical inventary, *i. e.*, collection of all the physical data affecting the value of a farm, and (ii) Economic appraisal, *i. e.*, converting physical yield into money income, or determining their value in terms of money. The whole process is comprised of six stages, the first three of which are concerned with physical aspects and the other three with economic aspects. They are as follows:—

I Physical Data.

1. ***Appraisal map and soil inventary.*** It includes a complete description of physical resources of the farm, such as location, demarkation of its boundaries, location of buildings, trees, streams, soil texture, depth of surface soil, character of sub-soil; topography; climate; drainage, etc.
2. ***Estimation of yield.*** It includes an estimate of productivity through estimating crop yields and typical cropping systems.
3. ***Building inventary.*** It includes physical inventary and analysis of farm improvements and equipment such as measurements of buildings, capacity, estimate of future life and adaptability, etc.

For this section we have largely drawn on W. G. Murray, Farm Appraisal, 1947.

II Economic Appraisal.

4. *Preparation of Income Statement.* It aims at determining the internal producing and earning capacity of the farm. The net income is found out with the help of farm product prices and expenses of production. It also includes building valuation, and costs and valuation of other things.

5. ***Determination of value by capitalizing the income.*** It means deciding the present worth of a farm with the help of the estimated annual income by capitalizing* the expected future income at the pravailing rate of interest.

6. ***Determination of total value.*** It is the final determination of the total value by adding the intangible values (values attached to the farm on account of favourable location and other amenities or non-economic features being available) to the productivity value, and by making other adjustments after comparing the sale value of the farm in question with those of other farms in the locality.

Methods of Valuation. There is almost unanimity of opinion in respect of the appraisal of farm productivity. But there is considerable difference of opinion on the best method of valuation, *i. e.*, the process to be followed in converting production estimates into value. Two extreme suggestions on the best method of valuation are: (i) The net income capitalization method, and (ii) The sales value comparison method. They are termed briefly as the income

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*Capitalizing means assigning to the farm a value on which the annual net income is the prevailing rate of interest, *e. g.*, if the farm area is 100 acres, the rate of rent (taken as annual net income) is Rs. 8 per acre and the prevailing rate of interest is 5%, the capitalized value of the farm will be Rs. 16,000. The determination of the rate of capitalization is a difficult process because it depends on the expected income and also the expected rate of interest both of which are inconsistant,

approach and the sales approach. These methods have their own merits and demerits which make them suitable under particular circumstances and unsuitable in others. Therefore, in order to avoid the evils of both and to retain their good points a third suggestion is to combine the two on a compromise basis by employing analysis, comparison and capitalization. These methods are as follows:—

1. *The net income capitalization method.* In this method value is determined by capitalizing the net annual income taking into account the returns from land and buildings. It requires, first, an estimate of productivity and net income, second, selection of the rate of capitalization, and third, adjustment of the capitalized value to account for the non-economic features or amenities mostly of intangible nature. The estimates of the income may be based on the returns of landlords or of owner-operators. The difficulties arise in calculating certain items of expenses involved in owner-operation. Therefore, while valuing land the income method usually relies on estimates of rental income which can be substantiated by comparison with actual facts, and owner-operator income is generally estimated while examining the possibility of an owner having sufficient income to pay the interest on a mortgage loan.

The merits of this method are that it is easy to determine the annual rental value specially where tenancy is more common, and where soil and climatic conditions, and not the management, are more important in determining yields. And as T. D. Morse believes, income capitalization is the direct and primary approach to valuation.* It leads to exhaustive mathematical analysis. And since, it can develop to such a

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*T. D. Morse, American Rural Appraisal System, Journal of the American Society of Farm Managers and Rural Appraisers, II No. 2, Nov. 1938, p. 98, Quoted by W. G. Murray, Farm Appraisal, p. 206.

large extent from definite mathematical data and formulae it appears logical to use it as a foundation to build upon.

The limitations of this method are as follows :—

(*a*) The most serious handicap is that in certain localities there may not be rental agreements, and in others rental income may not be uniform. Again, the estimate of income in case of owner-operation is very difficult. And estimation of rental income in areas where tenancy is uncommon becomes untrue to facts.

(*b*) A considerable portion of land value is due to non-economic features, amenities and other intangible elements.

(*c*) It is very difficult to determine the rate of capitalization.

(*d*) The difficulty in determining both income and capitalizing rate is greater in regions where crop yields vary considerably and agricultural prices fluctuate widely.

(*e*) Estimates of net annual income lose much of their significance in areas of marginal farming where average expenses and returns almost balance each other, and farm value is very low.

(*f*) It does not suit where a wide variety of methods of farming are practised, or where farms produce a variety of crops.

(*g*) It is unsatisfactory where buildings, location and management are of special significance and soil conditions play a minor role in determining annual return.

(*h*) It assumes a scientific accuracy which, unfortunately, it does not possess. Hence, it is subject to serious errors, and is not reliable. As F. Aereboe believes,* valuation according to revenue is unscientific, impracticable and indefensible. A

*F. Aereboe, The Value of Landed Property, International Institute of Agriculture, Bulletin of the Bureau of Agricultural Intelligence and of Plant Diseases, Nov. 1912. Quoted by W. G. Murray, Farm Appraisal, p. 206.

slight mistake in yield per acre (under the assumption of the same cost of cultivation) will bring about such a difference in the net returns that the whole value after being capitalized will appear absurd. Again, even if the valuation of net returns were practicable, capitalization will depend on the rate of interest in which a small difference will bring about a considerable difference in the value.

2. *The sale value comparison method.* It uses actual sales as standards. The level of value in the particular region is determined from actual sales. The first step in this method is to estimate the farm productivity or to establish the productivity rating of a given farm. The second step is to consider the non-economic features, and accounting for the intangible features. The final step after rating the farm as a productivity and amenity feature is to fit in the general level of values in the region through comparisons. It is a checking or a corroborative process in which values are first determined on the basis of comparative productivity and other factors, and then the capitalization method is used as a check in determining the correctness of those values. Market price of farms is supposed to be the best index of value since it represents the actual price finally settled between both the buyer who wants to offer the lowest possible price and the seller who wants to get the highest possible price (forced sales being avoided).

Those who emphasize this method think that in farm appraisal the figure arrived at is the probable market price, and not what one thinks that the farm should be worth. And as G. C. Haas believes.* market price is the result of the judgments of the land market, and represents the best esti-

*G. C. Haas, Sale Prices as a Basis for Farm Land Appraisal, Minn. Agr. Exp. Sta., Tech. Bull. 9., Nov. 1922. Quoted by W. G. Murray, Farm Appraisal, p. 208.

mates of buyers and sellers about the future farm income. Secondly, value estimated by any other method will approximate sale value. It is, because sale value and income value remain almost at the same level except during short periods when sale values may be higher on account of excessive optimism during a boom or lower due to undue pessimism during a depression, than they should be. Again, when income value based on normal price level is much less than the sale value it is brought at par with the latter through changes in price of the capitalizing rate. Thirdly, as Karl Brandt thinks, this method is fit for quick application on large scale. It is less costly. Theoretically it operates on a more scientific basis and the results are reliable.

The handicaps of this method are: (a) unreliability of the sale value estimates specially where farms are handed down from generation to generation and sales are scarce; (b) sale value has a lesser significance in making comparisons with other farms. It may be the only basis for comparison, but its limitations cannot be overlooked ; (c) lack of standardization in the land market.

After discussing the two methods one would note that though there are differences between them they use farm product prices as a common base and also use the method of capitalization. Direct capitalization of income as a method of land valuation has serious handicaps, but its usefulness as a guide and a check has to be recognized. Really speaking the two methods should supplement each other. A compromise method is suggested which aims at avoiding the evils of both the methods and at the same time retaining the merits of both. It employs analysis, comparison and then capitalization. Since in some cases a particular approach may be more suitable than the other, greater weight has to be attached to the one better adapted. There are different kinds of

appraisals. The specific use to which the appraisal is put determines the place of emphasis, *e. g.*, while buying land main emphasis is on the productive characteristics of soils, since the main objective is the future earnings ; while selling land the seller should see that both income and non-income or intangible features are included ; in condemnation appraisal (taking land for military purposes, for air fields and for roads, etc.) a reasonable compensation to the individual is the aim of the govt., and main consideration is of the personal sacrifice which the present owner makes ; if it is designed for tax assessment it must reflect the existing conditions and must show the relative position of one region to another ; and if it is made for loan purposes the emphasis is on long range views, such as the probable conditions of the land during the period of loan, natural hazards, price risks and borrower's integrity and security.

Theories of Land Value. Valuation, it is learnt from the above discussion, is a process of establishing a value figure based upon a particular programme through a formula of capitalizing economic return. The value figure is an amount that an entrepreneur would be economically justified in paying for land to be obtained under a specific business decision. And as such, it is a function of all future returns depending upon several economic and non-economic features, as foreseen by prospective entrepreneur. Therefore, 'land value' is not truly the value of land alone although for all practical purposes it may be considered to be so. What one generally has in mind is the 'capitalized land return' which is the result of many compromises in applying the basic land value formula. Opinions differ on the very basis of this land value formula, and they are known as different theories of land value, which are as follows :—

1. *Rent Theory.* It is based on the classical conception

of rent as a surplus, *i. e.*, an excess of annual income that any piece of land yields over and above the cost of investment in the form of labour and capital. It is the worth of its annual use. This is what the tenant would pay for land-use, and it is also what the owner should count if he cultivates the land himself, or if he wishes to sell it, the amount he can get for it will depend upon rent, *i. e.*, the value of its annual use. The competition amongst investors tends to establish a normal ratio between the annual net rent of a piece of land and its value, *e. g.*, if the current rate of interest is 5% price of land will be about 20 times the rent.

2. *Interest Theory.* Land value is residual in character[1] since capital and labour have priority claims against net earning. If after meeting these claims any income is left then land has value and the amount of value which land acquires in this way depends upon the amount of excess productivity. The main point is that value of land is a function of price of capital and labour, for net return of an enterprise cannot be determined without first determining the value of improvements. The residual nature of land income implies that while valuing land we should proceed through estimating labour and capital and the required returns to them. The conclusion is that the price of land is determined only after, and in part, by the price of investment (capital and labour). This argument is also based upon the classical idea that land is fixed and immobile while other factors are not. But the modern view-point is that land is economically mobile[2] and hence, land value is not residual in character. Return to any factor of production can be considered residual.

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1. Land is residual in the sense of permanence of value. It is physically non-deteriorating and unlike improvements rarely becomes valueless.

2. Land is economically mobile to the extent to which it can be put to several uses and to the extent to which a unit of it can be substituted for another or for capital and labour.

3. Demand and Supply Theory. Unlike classical economic analysis distinguishing land, labour and capital as prime factors of production, modern economic theory suggests that pure definition of land as nature has little practical value since in production land and investment in the form of capital and labour are so intricably combined that there is no possibility of separating and measuring the productivity of original and indestructible qualities of land. Productivity of an enterprise is an undifferentiated stream of services or revenues. And in economic behaviour land is similar to other factors of production.* Therefore, land valuation is not fundamentally different from investment analysis in other fields. And land value is determined by the forces of demand and supply.

But in actual practice buyers differ from sellers and in each group one individual from another. Hence there cannot be a single series of earning powers attached to a piece of land. On the other hand, there will be different earning powers for each different seller and buyer. The difficulty is that which one is to be capitalized into present market value. Again, each seller and buyer has his separate discount rate, a separate process through which to arrive at his individual present worth of future income, and maximum bid for it. Thus, in the market process individual capitalizing underlies both the demand and the supply sehemes, and hence value is not the normal equilibruim of free forces of demand and supply but in practice it has to be strictly individualized.

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*In some respects land is similar to other factors, but this similarity does not justify a complete merger of land and capital because for analytical purposes land retains important distinguishing characteristics, *e. g.*, location is of peculiar importance in the case of land. It rests on the physical immobility of land and the relative permanence of location feature. Besides, relative durability of land and the relative inflexibility of supply are differences in degree that are sufficient to have considerable economic significance to distinguish it from capital.

Besides, land values are considerably influenced by local customs, institutions and standards.

Increase in Land Value. In an old agricultural country having a thick population, by far the major portion of which depends on agriculture, land has a special economic significance and a natural attraction. During the last five or six decades and specially during the last decade there has been a considerable rise in the price of land. There are several factors leading to this rise :

(i) decline of cottage industries combined with a rapid increase in population which have resulted in a gradually increased ruralization of the country with an undue emphasis on landed property ;

(ii) inadequate development of alternative sources of investment in the form of industry, trade and commerce which have diverted a considerable portion of rural investment in land ;

(iii) development of transport facilities for exchange and distribution of agricultural commodities which have minimised the isolation factor and have increased locatinal value ;

(iv) scientific and technical developments in agriculture which have regularized or increased outtern or have minimized agricultural hazards ;

(v) general rise in the price level ;

(vi) impact of urban growth ;

(vii) security of life and property and settled political conditions ;

(viii) a threat of Japanese invasion during 1942—43 combined with a slight loss of faith in paper currency which induced many people to invest in landed property ;

(ix) recent tenancy reforms and the abolition of Zamindari and Jagirdari systems in most of the States which have led the land holders to sell or lease land and make money;

(x) and the rise in prices during and after the war which has increased farm incomes and agricultural profits, and have created a sudden land hunger.

CHAPTER V.

Rural Life and Economic Transition.

I. THE VILLAGE COMMUNITIES

Origin of Villages. In order to understand rural life we have to study the village which was the unit of our old economic system. From times immemorial almost throughout the country, people have been living in small isolated and self-contained villages. It is very interesting to enquire as to when and how did they come into existence.

The term 'village' means 'permanent settlement', and is indicative of a stage of settled life as opposed to nomadic life, and of permanent or continuous agriculture as opposed to shifting cultivation. Shifting cultivation marks the first stage in the development from pastoral stage, and permanent agriculture marks the beginning from pastoral to agricultural stage, and begins with permanently settled or permanent community life. Thus, village communities begin with continuous cultivation. It should, however, be noted that even in pastoral stage when life is nomadic there is concentration of population ; there are settlements though of a temporary nature and agriculture is followed which is of a shifting character. At that stage there is community living and some community institutions are developed. But such settlements are temporary and are not technically called village communities. Settled life begins with continuous cultivation and that marks the beginning of village communities.

It is difficult to say exactly as to when did village communities originate. Sometimes it is believed that the word 'Arya' means tiller of soil and from it they conclude that continuous cultivation in India began after the coming of the Aryans, and village communities likewise sprang up after that time. Again, it is also believed that communities were always on a kindred basis, except where family tie seems to have been broken by over-sea migration. These kindreds were usually tribally organized on a patrilineal basis, often under a chief or a headman. This organization has been an Aryan feature. But there is ample evidence to disprove these statements. Leaving aside for the time being the question that whether the Aryans, when they came to India, were accustomed to settled life and continuous cultivation or not,[1] it can easily be established, and there is ample evidance to prove, that the Dravidians whom the Aryans found in India, were living a permanently settled life and had village communities. Even the Kolarians who were the earlier inhabitants, were accustomed to that sort of life, though most of them were in pastoral stage and were mostly nomads. Conditions in the different parts of the country being different, the Kol race (different tribes) lived in different stages of pastoral and agricultural life. Most of them were nomads, some moving after a short time and

1. The Aryans were originally pastoral people. In what stage of development were they when they first moved, and when they came to the plains of India cannot be said with certainty. But it is generally believed that they came in waves The first Aryan tribes in India established themselves along the Himalyan slopes in Kashmir. There agriculture must have been limited to narrow valleys or terraced fields on the mountain side. Perhaps they took to settled agriculture and life afterwards when being pushed by successive waves they left the hill sides and descended to the wider spaces of the alluvial plains of upper India. There they found the Dravidians living in village communities and following continuous cultivation. Though in different parts of the country the Dravidian race must have been living at different stages of pastoral and agricultural development.

some after a long. But some of them lived in villages and followed continuous cultivation. Thus, the existence of villages goes to the times of the Kolarians and Dravidians. And it is certain that before the coming of the Aryans in India village settlements of a permanent nature were there in India. But they were not the general feature of rural life as they became later on after the Aryan settlements.

The idea of living together or aggregation of man in vilage groups seems to have its origin in some purpose of effective cooperation. Basically it is due to natural instict which can be called to be the fundamental cause of village grouping. Regarding the purpose of effective cooperation several hypotheses have been advanced, *e. g.*, the task of clearing the jungle for cultivation, the supply of water and the need for protection from wild beasts and hostile tribes. Again some villages seem to have arisen due to tribal instinct. It is difficult to say exactly as to what was the purpose of earliest groupings. It is also difficult to say that all the earliest groupings were due to one and the same purpose. We are inclined to believe that the earliest aggregation of men was for the purpose of security or protection. But afterwards, at one and the same time, village groupings must have sprung up for different purposes as mentioned above. Besides some thinkers have referred the village system to Hindu Law and believe that the system is peculiar to Hindu races. But sufficient evidance is available to prove that the system was prevalent in India among the races living prior to Hindus, and which, with some of their institutions, still survive in some parts of the country. The history of evolution shows that in the same environment human mind behaves in the same manner. We are inclined to believe that where environment was suitable villages had been formed by all races almost at the same time.

Types of villages. There are two types of villages, and they are distinct in origin: Severalty villages and Joint villages*. (*i*) ***Severalty villages*** are perhaps the oldest form of villages. Landholders are disconnected aggregates of families each claiming its own holding. They are practically owners of their several family holdings which they have inherited or bought or cleared from the original jungle. They have a common headman and also some common officers and artisans who serve them. They are directly connected with the government and there is no landlord (class or individual). Cultivators have no claim as a joint body of the whole estate and then dividing it among themselves, nor are they jointly liable to the government for the revenue. In some places we find the superior lords surviving, who claim to be owners of all the soil, and tenants are recognized only as landholders though hereditary after holding for several generations. They are conquerors or adventurers who gained the superior position in one way or another. In Manu we do not find any such claim of the ownership of the soil being made by the Raja. He had his private lands.

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*Some thinkers like Phillips believe that there is only one type of village, the joint village, which is the earliest and the original type. It is in the process of decay, and in flux of time the joint rights are substituted, and the severalty type arises. This does not seem to be correct. There is evidence of such cases in which in the process of decay one form passes into another. Joint villages as a result of partition get splitted up and are turned into individual properties. But it is easily recognizable and is a different thing It should not be believed that the joint village in the process of decay has been transformed into severalty village which is of a later development. Really speaking severalty villages seem to be of earlier origin, and the two are distinct in origin. A few exceptions may be there which do not prove the general rule.

Campbell has termed them as 'democratic' and 'aristocratic', and Baden Powell as 'Ryotwari' and 'Landlord'. The latter terms have become more popular in use. Sometimes we come across such terms as 'autonomous' and 'feudal'. But they are not expressive of the main distinction and not better terms to be used.

As a ruler of the country his right is represented to the revenue, taxes, cesses and the power of making grants of the waste land but perhaps not an owner of the land. That is why they are called ryotwari or non-landlord villages.

(ii) Joint villages. There is a strong joint-body mostly descending from a single head or a single family having pretentions of being higher castes and having superior title claiming jointly the entire estate. They are descendants of former rulers or colonizing founders or conquerors or grantees or later on of revenue farmers and auction purchasers. The tenants have only the right of cultivation. The whole area of the village, including the site of habitation and the waste land, is claimed by that body, and the tenants use it only by permission. The body of landlords has a superior right of ownership of land and stands between the cultivators and the State. They divide the estate among themselves on their own principles and acknowledge themselves in some degree, jointly liable to the State for the revenue demand. Such villages have arisen in two ways : (*a*) they are a growth among and over the first type of villages, and (*b*) they have arisen from the original conquest and occupation of land previously unoccupied by some tribes and leaders of colonists. A further classification of their growth as given by Baden Powell is as follows :—

(*a*) Landlords rights have grown up over the village of the first type.

1. Out of the dismemberment of the old Raja's or chief's estate, and the division and partition of larger estates.
2. Out of grants made by the Raja to courtiers, favourites and minor members of the royal family, etc.
3. By later growth and userpation of Govt. revenue officials.

4. In quite recent times by the growth of revenue farmers and purchasers when the village has been sold under the first laws for the recovery of the arrears of revenue.

(*b*) Landlord rights were claimed from the first settlement or fcundation.

5. From the original establishment of special clans and families by conquest or occupation and by the settlement of associated bands of village families and colonists in comparatively late times.

Old Village Communities and their Disintegration. The word 'Village Community' should not be interpreted to mean anything like a communistic or socialistic right or interest. There is no evidence to show that villages, even in the remotest past, were owned communally or even cultivated land was owned in common.* In many cases, villages are held in common for some time but that cannot be called community ownership. In such cases they are always so held by joint descendants of a chief or a conqueror who some how acquired the estate. These descendants have equal rights and privileges. Correctly speaking, the term 'com-

*It has been asserted by several thinkers that the institution of lordship is of relatively recent origin and that it was superimposed upon an original lordless community. Originally there was co-ownership and common cultivation by village communities. Maine believed that in India land was originally held in common by groups, of people for the most part, of common descent but including strangers who had been adopted. Laveleye thinks that all peoples utilized this economic form as they passed from pastoral to agricultural stage and that communal ownership was natural at this phase of development. On the other hand, Coulanges has strongly denied the conception of common ownership of land. Baden Powell finding no evidence seriously doubts it. And Ashley, Pollock and Maitland, Lewinski and Sanderson have also seriously questioned it. Property in land is said to pass through three stages : (i) when it is held by tribe or clan and is said to be the common property of the whole body, (ii) when redistribution is abandoned and each family retains its holding permanently, and (iii) when families break up and individual ownership is created. These stages are those of community property, family property and individual property. In

nity' should only be used with reference to a corporate life showing a close connection and interdependence between the families living in each village. This close connection arose due to several facts: they lived together under a system which made them joint owners; in some cases they lived together under similar conditions; in others, they had tribal or caste connections, and in still others they had simply a common system of local government. But the word 'community' being used for such a close connection between families, should not in any way suggest an idea of community or common ownership of land.

The self governing and self-sufficient village communities were the most important feature of economic and social life in the past. They were equally well developed both in North and South, and were the most outstanding features of rural life almost throughout the country. About Bombay province Elphinstone wrote in 1819 that "These communities contain in miniature all the materials of a State within themselves, and are almost sufficient to protect their members if all Governments are withdrawn."* About Madras it was reported in 1812 that 'under this simple form of Municipal Government

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India in case of most of villages, property is in 'family stage'. Opinions differ considerably and it has not been well established that there was an early stage of joint tribal holding. Some curious instances are given by Tupper regarding Jhelem District of Punjab : that in some areas now forming separate villages there was once some units of tribal holdings divided into shares. The cases mentioned show a part of the land being held in common but the produce was always divided according to certain shares. That shows that different family shares were recognized. Moreover, it was due to local circumstances. Besides, the idea of common ownership is referred to the custom of periodical redistribution of land or holdings in particular tribes for which there is sufficient evidence. But this was always followed by distinct allotments of holdings. It indicates a desire to equalize the holding so that some may not get all better land and others all inferior land. Redistribution of land does not indicate so much a communistic idea of property as a desire to equalize land The question, however, remains unsolved and requires further research.

*Elphinstone's "Report on the Territories conquered from the Peshwas," 1819.

the inhabitants of the country have lived from times immemorial..... The inhabitants give themselves no trouble about the breaking up and division of kingdoms, while the villages remain entire, they care not to what power it is transferred, or to what sovereign it devolves, its internal economy remains unchanged."[1] About Northern India Sir Charles Metcalfe wrote in 1830 that "the Village Communities are little republics, having nearly everything they want within themselves. They seem to last where nothing else lasts. Dynasty after dynasty tumbles down, revolution succeeds to revolution, Hindu, Pathan, Moghal, Mahratta, Sikh, English are masters in turn, but the Village Communities remain the same..... ... The Union of Village Communities, each one forming a separate little State in itself, has, I conceive, contributed more than any other cause to the preservation of the people of India through all revolutions and changes which they have suffered, and it is in a high degree conducive to their happiness, and to the enjoyment of a great portion of freedom and independence."[2]

These village Communities as it appears from the above statements managed their own economic and social life. They had very little contact with each other and almost no knowledge of the outside world. They had a peculiar constitution. Most of the population was agricultural. The other occupational groups were those of artisans and village servants and menials. Many of the artisans had small plots of land which they had either rent free or on concessional rents. Many of the menials and village servants were artisans also. But the most peculiar feature of these communities, which distinguishes them from their parallel, in other countries, was the close connection and interdependence of the

1. Fifth Report, 1812, p. 85.
2. Sir Charles Metcalfe's Minute, dated November 7, 1830.

different occupational groups. The artisans and servants were paid a certain quantity of produce by each cultivator and in their turn they rendered certain services to them. The amounts paid to them and their duties were not uniform throughout the country. All the village servants were not artisans nor all the artisans were village servants. But artisans whose services were regularly required by all members of the village community were generally both artisans and village servants. Their units were highly self-contained and self-sufficient. They produced not only their own food and agricultural raw materials but also met almost all the requirements of industrial output, since almost every village had a variety of artisans including carpenter, weaver, potter, oil presser, cobler, ironsmith and sometimes a goldsmith also. Most of the requirements, which were not so numerous as now, were produced within the same unit, and only a few articles such as salt, glass bangles, gold, fine cloth and some luxury goods required for ceremonial occasions were imported from other places. These units generally produced for their own demand and little for the market which in the technical sense of the term did not, as a matter of fact, exist. We hear of a flourishing foreign trade in the past but there were no important exports of agricultural produce. Agriculture was more of a subsistence type. Every farmer grew a variety of crops for his use suiting to the local conditions of soil and climate, and kept a few milch cattle. The revenue demand was fixed as a share of the actual produce varying between 1/3 and 1/6 from time to time. It was accompanied by a number of taxes and cesses. Hence though the revenue demand in the past does not seem to be very high, the total payments were quite considerable.

The size of these village units was different in different parts of the country. In plains, where the environment being

congenial it was easier to earn the livelihood and life was buller and better, the villages were of larger size than those in hilly and barren tracts. The constitution and organization of these communities and the administration of their affairs through village panchayats are said to be responsible for the happiness of the people residing within these units. They maintained peace and order even when there was anarchy in the realm. They settled most of the disputes arising among the members, and managed their own economic and social life. They served as a form of social security and protected their members.

There is a very interesting question about the enduring quality of these communities. It is said that Indian Village communities had their parallels in the English medieval manor, the Russian mir and the German mark. But the Indian Village Communities had a peculiar feature on account of which they could persist in the face of numerous political changes and could withstand numerous shocks. The statement that the village life was entirely unaffected by wars and revolutions can be accepted only with reservation, since during the 18th century and specially after the breaking up of the Moghal Empire the whole country being a theatre of constant wars and brigandage, the village life could not remain entirely undisturbed. Besides, there were innumerable movements of people from place to place. But it is a fact that the village organization remained mostly unchanged for centuries. It is interesting to enquire as to whether the survival of these communities for such a long time was due to some inherent characteristics, or was it due to some outside factors. Opinions differ on this point. One explanation is that the lack of communication and consequent absence of effective centralized system of administration was mostly

responsible for their survival for such a long time. Another version is that the compactness and the solidarity of the communities which was due to their being forced to rely on themselves for defence against aggression was mostly reponsible for their persistence. Both these factors seem to be simply contributory. The real cause is their peculiar form of social structure, specially the caste system which those communities adopted in India. The occupations and the social status were hereditary, and the custom made the different sections of the village community highly interdependent on each other. They were closely interwoven in practically all the economic and social activities. This form of village constitution determined the whole structure of economic and social life; and the solidarity which it imparted to the village community aided by the factor of isolation and the consequent local autonomy and self-sufficiency, mainly contributed to their long survival.

The economic development of the country was affected by these communities in several ways. Isolation and self-sufficiency imparted to Indian agriculture a subsistence character. The absence of market and the difficulty of communications have been responsible for the lack of commercialization. In the case of artisans their offices being hereditary, their productive system likewise became stereotyped. Under such a system of organization price or money economy had little place. The needs of the community were served by barter rather than by exchange. Since the community was considered to be responsible for the protection and maintenance of its members competition had no place in the economic system. Practically, all the spheres of life were regulated by customs. This sort of organization had its definite advantages, but the whole rural life became stereotyped, and the greatest drawback was that the incentive for

efficiency and improvement was weakened, and customs and traditions being dominating forces in the choice of occupations and other matters, conservatism checked the habit of adaptability, due to which a number of forces that were released during the latter half of the 19th century upr ooted the old economic structure of the village communities, and the rural population could not adapt itself to the new environment.

Historians have recorded the lamentable facts about the decay of these self-governing institutions specially during the latter half of the 19th century. They are said to have survived well both in form and reality until the Crown rule in India, and virtually ceased to exist before the first generation of British administrators had closed their labours in the conquered territories. The reasons of their decline are said to be :

(i) the administrative reforms and the abolition of the Panchayat system,

(ii) the fixation of rent and revenue in the form of money,

(iii) the establishment of civil and criminal courts for the administration of justice,

(iv) improvement in the means of communications,

(v) progress in education, and

(vi) the growth of the spirit of individualism.

It should, however, be noted as to what is meant by the phrase 'decline of village communities.' The villages continue to exist ; many of them have been enlarged, and their number has also increased. It is the self-government and local autonomy (administration through village Panchayat) which is gone, and the corporate life (close connection and interdependence of different occupational-cum-social groups) which is disintegrated. Thus, their decline should be

interpreted in the sense that their functions and duties being, due to the loss of self-government and local autonomy, taken over by other newly established courts, they have become lifeless ; due to the modern economic forces being released after the Industrial Revolution, the interdependence of different groups has become less, and the corporate life has greatly disintegrated with the result that the village communities in the old sense of the term have gradually declined.

II. PRESENT ORGANIZATION OF VILLAGES.

Organization of Villages. An ordinary Indian village is described as a group of mud houses which are huddled together in a more or less compact area situated under a cluster of trees in the midst of fields which provide the main source of livelihood to the inhabitants. The Royal Commission on Indian Agriculture observed 'that the main characteristics of village life are still those of centuries anterior to British rule'.* What they wrote about two decades back is true to-day, and isolation and self-sufficiency still remain to be the outstanding features of village life.

Most of the families have been living in the same village for generations, and most of the holdings have been inherited from common ancestors. These holdings have been divided or aggregated as the descendants of a common ancestor have increased or decreased in number. Both according to the Hindu Law, and the customary law, the inheritance of immovable property has been among sons in equal shares. There have been slight variations but it is mostly true that inheritance is by blood in the male line and very seldom by will. The result has been a repeated partition and a gradual

*The Report of the Royal Commission on Indian Agriculture, 1930. P,

tendency towards sub-division of holdings leading to their uneconomic size. The population generally consists of several castes arranged in a social hierarchy in which economic status and social values are usually found to go together. Most of the people are agriculturists, some of them have permanent rights in land either as owners or as tenants having hereditary occupancy rights. Out of these some cultivate all the land they hold, and some having larger areas sublet to others. Lowest in the economic and social scale are agricultural labourers, mostly belonging to low castes. Some of them have acquired small pieces of land either under permanent tenure or on rent and rarely in proprietary right. But most of them are simply casual farm-workers. Between the land holders and the labourers in the economic scale are the artisans, generally, except in the smallest villages, there are some skilled artisans. Some of them follow agriculture as a part-time occupation. Below them in the economic and also in social scale are the village menials or servants who partly follow community services and partly work as farm labourers. All the social and economic stratification is rather rigid, and the choice of occupation, the nature and scope of economic activities, and the social behaviour, etc., are mostly determined by tradition and custom. The original functional groups were gradually converted into social groups and they hardened into an occupational caste system.

Agriculture which is the main stay of by far the major part of the village population is generally said to be a gamble in the monsoon since only a small part of the cultivated land is protected against the vagaries of the rainfall by means of irrigation. Almost all the major agricultural operations are regulated by the monsoon and most of the agricultural activity is confined to only a few months in the year. The small size of farms, the present methods of farming and the

na ture of agricultural seasons combining the farm activities to short durations at specific times, leave a considerable amount of spare time with farmers, and contribute to a low standard of living. The urban population not being even 15% of the total, the demand for farm produce for final consumption in towns is comparatively a small part of the whole volume of farm production. Besides, the inadequate means of communication and transportation have kept the villages in isolation. Producers both agriculturists and artisans have had little incentive beyond that which was furnished by local demand. And local demand has always been very small. Thus, circumstances have combined to maintain a subsistence type of farming, and the village population has maintained a self-contained village economy. The villages which are remote from cities and roads are comparatively more self-sufficient in character.

The lack of incentive which still continues to be an outstanding drawback in rural life has been partly due to self-sufficing character of villages which was due ultimately to the lack of proper means of communications and transportation, and partly due to the fact that in the recorded history of India there were very few periods during which the people in general over large tracts of the country enjoyed peace and prosperity for long.* The sense of insecurity created

*The glories of our past have been recorded in high sounding phrases. But was that wealth and prosperity shared by the common man ? The facts have to be carefully scrutinized. Excepting in the golden age in the Gupta period the masses in general rarely enjoyed peace and prosperity for long Even, during the British administration, when peace was secured over large parts of the country the prosperity was occasionally disturbed by severe famines and the exhorbitant revenue demands of the State. But a question which usually arises in one's mind is : if peace and prosperity was not the lot of the common man how could such fabulous wealth be accumulated, and how could art and culture make so much progress. We are inclined to believe that the ancient wealth of India which historians have magnified was most probably the luxurious life and the pomp and magnificence of the royal aristocracy and the wealth of temples. And the art, culture, religion and poetry, etc., all developed under the court patronage.

by the occasional disturbances of peace was further strengthened by exhorbitant state demands in one form or another. Thus, the lack of incentive is a legacy of the past. During the recent past the incentive has been provided through several means, *e. g.*, security of tenures, fair rents, high prices and security of life and property provided through administrative reforms. But these measures have not been able to overcome the long established phychology. Changes are slowly taking place. Isolation is gradually breaking up. Markets are widening. Villages are being brought in touch with towns and the outside world also. Specialization and commercialization in farm production has been introduced in the form of increased acreage and localization of some cash crops. Social values are also changing. The so-called lower castes are rising in economic status and also in social scale. There is some political consciousness also. The new economic, social and political forces are at work. They are breaking up the existing organization. But since all agricultural communities are highly conservative, these changes can only take place very slowly. Thus, we find a beginning being made in almost all these directions but the general picture remains almost as usual. A fuller account of these changes is given in the following sections on social background and the economic transition.

Characteristics of a Rural Society. The basic features of a rural society are derived from its living nearer to nature and relationship to land from which most of its members eke out their living. The nature of diets, the methods of work, the mode of living the social grouping, the cultural pattern, the thought process and the general behaviour are largely determined by this relationship. Hence, they tend to be regional and largely influenced by natural environment. The vertical social mobility in a rural society is

largely related to the movements up and down the scale from landless labourers to the position of a landlord. The organization of a rural society includes a high proportion of status as against contract relationship. Society is composed chiefly of primary groups. People are bound to a greater extent by organic relationship rather than by cooperation necessitated by economic division of labour. The individual has comparatively fewer contacts, since his field of activity both geographic and social is narrower, but his contacts are lasting. Though the individual lacks the modern sophisticated specialized personality, there is a fair degree of adjustment and life is simple, stable and sure.

A rural society is characterized by isolation and hence, the economic features develop around its regional self-sufficiency. The unit of production is the family which tries to produce much of its own goods and what it does not make is produced by artisans residing in the same or nearby communities. There is a lesser degree of competition for goods, power and status. Agriculture and industry are closely connected and are mainly characterised by local environment. Culture, likewise tends to be regional, and develops out of the local environment. The rural society develops some selective traits, *e. g.*, simplicity of life and social rituals, abbreviated speech patterns, rigid moral standards, customary folkways, adaptation and non-pecuniary philosophy towards work, etc., which are quite distinct from those of an urban society. Rural art is expressed in house construction, domestic articles, religious images and in festivities, such as dances, songs and games. Since there has never been an absolute isolation in rural communities it is very difficult to say as to what extent a specific rural culture is indigenous to the country and how much of it is due to outside factors specially the urban influence.

The main characteristics of a rural society as distinguished from those of an urban society are :—

(i) relative predominance of agricultural as against non-agricultural occupations,

(ii) closeness of the people to natural environment as against an artificial man-made environment,

(iii) an organic relationship in the community members based on cooperation as against economic and commercial combinations based on competition and for profit seeking,

(iv) simple and happy life as against complicated and worried existence,

(v) smallness of its communal aggregates and a relatively sparce population as against huge agglomeration concentrated in a compact area resulting in a dense population,

(vi) primary social grouping leading to a greater social homogeneity and less internal stratification and differentiation as against too much diversified and socially and economically stratified secondary human groups,

(vii) politico-social classes being related to the holding of land as contrasted with a system largely related to personal and movable property,

(viii) comparatively less occupational, territorial and vertical social movements as against vast and frequent geographical, occupational and vertical social movement of population,

(ix) conservatism as against inventiveness,

(x) but a life more close to human hopes and desires as against 'a life of negative energy, suicidal vitality, moral and spiritual failure and dwarf personality'.*

The more isolated a rural society is, the more distinct are these characteristics, and as the isolation breaks and it gets

*L. Mumford. City Development, 1946.

into greater contact with urban society, a cultural interchange takes place, and the distinctive characteristics begin to disappear as a part of the standardization process. As the contacts increase culture and language become more national and less local. Urban fashions, styles and behaviours permeate the rural society. Education and technology increase. Money economy slowly replaces barter, and prices are quoted in terms of currency based upon standard measures. Economic division of labour increases, commercialization and specialization in production begin to emerge, credit begins to play greater role in production rather than remaining confined to only consumption. Property begins to accumulate in the hands of non-agriculturists. But the vitality of the social life of the rural community begins to decrease and the antagonism and conflict between different economic and social classes increase. And life becomes more complicated, more formalized in social relationships, more mechanized in material aspects, more artificial in environmental setting ; and social organizations become more systematic and less spontaneous.

III. SOCIAL ENVIRONMENT AND AGRICULTURE

A Common Impression. Many text-books written on the economic conditions of India and on the economic history of India have traced the impact of social environment on economic progress. They give an impression that our social environment has not only been uncongenial and unfavourable for economic development but has definitely hampered or retarded it. From this hypothesis a conclusion is generally drawn that in order to make economic progress possible the social institutions, customs, traditions, relationships, ideas, ideals and behaviour, etc., in short, the whole social environment has to be fundamentally reformed,

reorganized and modified so as to suit the new circumstances of a progressive or developing economy. This view is shared by some foreign authors like Moreland, Wadia and Anstay. Many Indian writers, some of them being impressed by foreign writers, and some perhaps as their own beliefs, subscribe to the same view. Amongst the students such an impression about the influence of social environment on economic life and activities is quite natural. Some of the statements explaining this influence in the field of agriculture which are intended to be examined here, to the exclusion of other economic fields, are as follows :—

Caste mainly determines the occupations and thus checks both geographical and vocational mobility. The result is that agriculture is overburdened and many other occupations experience the scarcity of labour. Some castes, generally the superior ones, do not perform certain farm operations (ploughing) do not grow certain crops (vegetables), do not keep certain type of livestock (pigs, poultry & donkeys etc.), and do not use certain types of manures like bone-meal and human excreta. Some low castes cannot follow some occupations traditionally belonging to superior castes due to the difficulty of social mixing, and cannot adopt dairy farming because of the difficulty of marketing the products. The joint-family system is mainly responsible for the rapid increase in population which has deteriorated the land-man relationship and is primarily responsible for the present food shortage. It increases recklessness and improvidence among the junior members and by capitalizing the credit of the entire family at the time of debt it accentuates farm indebtedness. The laws of inheritance and succession have mainly governed the existing land systems in which land is said to be very unevenly distributed, and the outstanding problems concerning farms, *i. e.*, the uneconomic size, the sub-division

and the fragmentation are mainly their outcome. The system of purda amongst women of higher castes prevents them from working with their male members on the fields and look after the cattle outside the home. This results in some farm operations being delayed in some castes, under-cultivation due to labour shortage and increased farm costs. Religious beliefs stand in the way of killing the useless and weak animals which remain a burden on land and create fodder, feed and food shortage, in killing stray cattle, birds and monkeys which cause a considerable damage to crops, and on the other hand, they are responsible for supporting a substantial class of unproductive and idle able-bodied mendicants who lead a parasitic living and add to farmer's responsibilities. Social ceremonies concerning marriages, births and deaths, govern considerably the administration of individual resources, determining indirectly the structure of preferences, standard of living, volume of savings and capital formation ; and are responsible for a considerable portion of agricultural indebtedness and for the continuation of agrestic serfdom. To be brief, the philosophy of life, the thought process, the habit pattern and the general behaviour of the rural masses have taken their shape and character from our social environment. They are characterized by pessimism, fatalism, superstition, conservatism and suspicion about new things and new ways of doing things. Talking in a different vein, many of the existing economic problems having a bearing on agriculture, *e. g.*, unequal occupational distribution with a very heavy burden on land, rapid increase in population with a gradual ruralization of the country, unequal land distribution, uneconomic size of farms, sub-division and fragmentation, agricultural indebtedness, agricultural idleness, low yield, high cost of production and a low standard of living of the farming population, etc., are partly the outcome of our

social environment. Not only that agricultural progress in the form of mechanization, commercialization, specialization and intensification, etc., is held in check ; and it has throughout been discouraging push, drive, adventure, mobility, adaptability and inventiveness.

There is also a contrary view that the influence of social environment on economic evolution is merely secondary, and the economic conditions and forces have a greater determining influence on social evolution than vice versa. This is Engellian diagnosis which traces the final causes of all social changes and political revolutions in the modes of production and exchange. This view is not shared by many, and is, therefore, not current in India. The former view is, however, quite common. But this impression and specially the conclusions drawn from it are likely to create a confusion of thought when an analysis is attempted, and further are likely to place emphasis on wrong measures and priorities on less urgent measures when a solution is sought, *e. g.*, while blaming the social ennvironment for creating and intensifying some of the economic problems the opposite side, *i. e.*, the influence of the economic environment on social structure, institutions, behaviour and problems is generally overlooked. A sociologist can trace with an equal degree of certainty, the causes of many social problems in the economic environment. Again, while believing that the social environment is mainly responsible for holding the economic progress in check one feels to suggest that to make progress possible it should be recast. But it is neither possible nor desirable to reorganize the whole social environment at once or even in a shorts time. Besides shall we concentrate the whole attention on reforming it and wait for the progress to begin till it is reorgnized so as to suit the new environment. Is it really the caste system which stands in the way of using better implements,

seeds, manure and more of irrigation facilities? Is the social structure really unfit for improved agriculture?

How far shall the change be one sided? What is to be made the spear-head of the proposed development plans? These are some of the questions which are not properly tackled and answered by the foregoing analysis. It is necessary, therefore, to study the relationship of social and economic environments before the real causes of our problems can be located and the appropriate solutions can be suggested.

Relationship Between Social and Economic Environment.

The history of evolution shows that the growth of culture and civilization depends on biological inheritance, physical environment and cultural endowment. Human nature, values, relationships, life philosophies, thought processes, habit patterns, group forms and personality configuarations, etc., are formed within a particular environment. They are the results of interactive forces which in themselves have causal relationships. Thus, man is shaped and reshaped in a particular environment which in itself is continually modified by man.* This explains the unity or oneness of the total situation of which social, economic, political and cultural environments, etc., are mutually related parts. It further explains that these environments cannot be studied and evaluated individually or in isolation, and the relationship and the influence of one on the other are not one sided but interactive and

*There is a difference of opinion on the relationship between physical environment and human culture and civilization. The geographical determinist believe that the physical environment or the natural factors fairly completely determine human activities. Sociologists, anthropologists and some human geographers, however, believe that man acquires enough force to control nature to supply his needs since he has the capacity to build culture and transform his habitat to suit his social needs. Thus, man himself becomes a great force of nature. We are inclined to believe that in the developed cultures and in the experience of civilized man there is no absolute geographical determinism, and the influence of natural forces is relative to the stage of development of man's civilization. The higher the levels of civilization the lesser the importance of forces of nature.

mutually stimulating. Hence, we cannot hold the social environment to be mainly responsible for our economic muddle, or for holding economic progress in check, nor can we ascribe our social problems mainly to economic conditions and institutions since each one is partly an outcome of the other.

A correct understanding of this relationship provides appropriate explanations for many of our common notions, and can trace the real causes of particular forms of human behaviour. The natural setting affects the structural pattern of society, the nature of output, the type of occupations and the density of population. The structural pattern of society bears directly on the type of institutions, nature of functions, character of relationships and social processes and problems. The density of population also bears on the human values and relationships. Human values in their turn influence the nature of economic behaviour and the forms of economic institutions. The types of occupations and the conditions under which work is done, influence personality pattern, social outlook, psychological traits, scale of values and ratios of preferences. Such a heavy pressure on land and an unbalanced occupational distribution is not so much due to caste system determining the choice of occupation as to the geographical environment and the stage of economic progress. Hence, for transfering some working force from agriculture to other secondary and tertiary occupations the most important thing and the first thing to be done is not the dissolution of the caste system or the joint-family system but to release certain economic forces and to create certain economic climate to make the shift possible. The main problem therefore, is not social but economic.

The rapid increase in population is not only due to the systems of joint-family and child marriage but also due to

biolcgical, natural and economic factors. Hence, the disintegration of joint-family system and an increase in the age at marriage time will not hold the population in check unless conscious family planning is attempted, which will be successful only when the standard of living has been improved to a stage when the individual begins to feel consicious of controlling the size of family. The most effective remedy is, therefore, to better the standard of living.

Agricultural population is said to be much less mobile, and this character is said to be mostly due to our social customs and institutions. Really speaking farmer works with nature and is vitally influenced by the process and conditions which exist throughout the natural world. Farming is so much dependent on soil, topography, climate and other weather conditions that market changes in geographical habitats require considerable changes in the mode of living and manner of working. Migration of farm population must mean marked changes in the technique of production and farm practices, and, therefore, must be less frequent and less distant than in the case of urban occupations. Nature makes its imprint permanently on the personality of agricultural population. A constant care of the living and perishable things affects the philosophy of life of farmers. Harvest being always threatened he develops a sense of insecurity. When crops begin to dry up there is nothing which a farmer can do except pray for rains. There develops an awareness of the eternal presence of nature for which he is generally blamed to be fatalist and pessimist, and these characteristics are popularly said to be due to religious and social background. The slow pace of change and relatively less inventions in agriculture as campared to those in urban people cannot be explained as adequately by the differences in the intensity of competition or the process

of mechanization, as by the fact that farmers have learnt to scale the pace of their activities and to adjust and accommodate their movements to the slow moving process of nature. The habit pattern of farmers has been chiselled up in an environment in which the natural processes of life, growth and death take their slow but sure course. Farmer's habits are built to conform to the requirements of living in such a setting. Agricultural technique is more directly adapted to natural factors than industrial technique. The process of inventions in rural environment is generally in the way of making tools so as to suit to working with natural forces. On the other hand, in an urban-industrial environment inventions take the direction of adapting the technology to meet the demands of artificially created environment. Urban inventions, therefore, must be more numerous and frequent because in an artificial setting changes in human needs and desires are much more rapid than in a natural setting in which the course of events is fairly regular. The preponderance of vegetarian character in diets is due not so much to religious outlook as to the economic reasons, since vegetarian diets are more land economising and can maintain a thicker population. Besides numerous examples can be cited to show that economic considerations overcome social customs and traditions, and it is not always the latter that influence the former. A recent investigation carried out in Meerut district of Uttar Pradesh shows that 86% of the persons migrating to industrial centres from the village during the last decade are Brahmins who are relatively least mobile due to social and religious considerations, and in the case of occupational adjustments social customs and traditions have given way to economic considerations. It is the job-opportunity which will provide the best solution for shifting

the population from land, and social institutions will not hinder the adjustment.*

This explains the nature of relationship between social and economic institutions and the part played by them in economic progress. Really speaking the imposition of a new economic order in the 19th century which is based on freedom and competition, and is motivated by profit—characteristic of industrial and commercial civilization—does not fit in our cultural evolution and social structure which is corporate in character. The modern economic system which is developing on the same lines as in the West after the Industrial Revolution, has not evolved out of our ancient past. The basic philosophy, the scale of values, the human motives and ideals etc., of the two systems are incompatible. The institutions that serve agricultural life at present are adapted to older and relatively static situations. They are not adequate to the requirements of new organisation which is more dynamic. The former represents a rural and agricultural civilization while the latter, an urban and industrial civilization. They require considerable social and economic adjustments, and the adjustment must take sufficient time. And during this period of adjustment there are bound to be many economic problems which seem to be due to social environment and many social problems which seem to be due to economic system. Really speaking they are the problems of adjustments, and the solutions should aim at making these adjustments smooth and quick. It is an inappropriate analysis to blame the social environment for checking economic progress, and it will be equally inappropriate to suggest a dissolution of the entire social structure to make economic progress

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*Jaipal Singh, Distribution of Labour and Earnings in Agriculture, 1951, an unpublished thesis, Department of Agricultural Economics, B. R, College, Agra.

possible. But it should, however, be noted that it does not lead to a non-recognition of the influence of social environment on economic system and problems. Economic relations, and institutions as a matter of fact, cannot exist apart from their cultural and social context, since they do not exist in a vacuum but in a particular setting which must stamp it with its character.

The Future Policy. The foregoing analysis of the relationship between social and economic environment shows that for agricultural progress the dissolution of the entire social structure is not indispensable. Creation of an economic climate will automatically loosen the rigidities and overcome many customs which at present seem unsurmountable. Our agricultural population is living at a very low level, and has a narrow intellectual outlook. At this level power of adaptation and change must be very low, and hence change is bound to be slow. Ordinarily, we imagine a social disaster or considerable social friction as a result of a changed economic system. This is not so. At higher levels the power of adaptation is more. But the change should be brought about gradually. The story of the decline of cottage industries is a lesson. Beside, what we call modern economic progress is commercial, industrial and urban civilization. It aims at power, profit, greed, and glorification of the individual rather than at social stability and solidarity. Even in the West the social consequences of it have been very unhappy, and life is becoming more artificial, complicated and unhappy. To the extent our social structure has offered resistance to the development of such an environment it has rendered some definite service. Again, in the modern economic civilization of the West, religion has played a rather insignificant role. From this sometimes a conclusion is drawn that for economic progress religion can be ignored. Somehow we

have begun to believe that industrial-cum-commercial civiliza-
tion of the western type is the ideal which we want to achieve
when we talk of economic progress or agricultural develop-
ment; and since our social structure does not fit in the exigen-
cies of it we have begun to ascribe all blame to that. Really
speaking this economic ideal itself has to be changed. It
does not mean that social structure is not to be touched.
That too must be reconstructed to suit the new atmosphere.
But some of its basic ideals and relationships have to be
maintained because there is something beautiful, healthier,
moral and nearer to human hopes and desires. The concrete
answer will, of course, depend on what type of atmosphere
we want to create, *i. e.*, the shape of things we want. That
will determine the human values, and all the systems and
organizations will slowly be adjusted to its requirements.

Lastly, regarding the adaptation of the old social and cultural pattern which was adjusted to a relatively more static situation, to the new setting which is more dynamic, we have to remember that in the process of evolution change must take place. With the advancement of civilization forces of change gather momentum, and inspite of institutional and emotional resistance social and cultural pattern must change. But the pace of automatic adjustment is slow and hence the slow rate of adaptation of our institutional life and social structure to the new economic system is quite natural. And this lack of accommodation and adaptation must continue. It is because no institution can be perfect and can fully meet the requirements for which it is created. Even the most thoughtful and most intelligently directed institution cannot fully and correctly anticipate the future conditions and deeds. In a relatively more static society in which mobility is less and cultural changes are slow institutions continue to serve for comparatively longer the

recognized social needs. But in a more dynamic society in which changes are quick they become inadequate very soon. That inadequacy is called the lack of adaptation. This is exactly our situation. Therefore, blaming the social environment for the backwardness of agriculture serves no useful purpose. Nor do we find the original causes of many of the economic problems that have a direct or indirect bearing on agriculture to be located in social system. For the development of agriculture the most important things are : technology, education of farmers and cheap and efficient rendering of certain services like the provision of water, finance and sale of farm produce. There are many other requirements also. But what is meant is that the greatest problem is not social ; agricultural progress is not checked mostly by social structure ; and for agricultural improvement we shall have to look more to other fields than religion and social surroundings.

IV. ECONOMIC TRANSITION AND AGRICULTURE

Meaning of Economic Transition. The phrase economic transition ordinarily implies change from one economic stage to another. The process of evolution is a ceaseless journey, and economic history is a continuous march. Change being a permanent characteristic—any period of time can be considered transitional. Again normally the change is smooth, the form is non-violent, the consequences are unspectacular and one stage merges into another imperceptably. Hence the characteristic differences between the two stages become undistinguished. But over longer periods even the slow changes accummulate to an extent that economic conditions, organization and institutions become fundamentally different, and the two periods appear to be very much, if not absolutely, different from each other so as to be appropriately termed as different economic stages. Sometimes the forces of change

gather so much strength that change becomes drastic, it takes violent form and the consequences are striking. The economic structure changes fundamentally within a relatively shorter time. It implies a sudden or revolutionary change from one stage to another.

In its economic evolution the world is said to have passed through five stages : hunting, pastoral, agricultural, handicraft and industrial.* But in the nomenclature of the science of economics the term 'Econ mic Transition' is generally used in a specific sense, *i.e.*, for the change from the old rather medieval

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*Economic progress is measured in terms of man's control over nature for the satisfaction of his material wants, and usually five stages are mentioned : (i) the stage of direct appropriation from nature, which is termed as *hunting and fishing* stage ; (ii) the stage of domesticating and herding animals, which is termed as *pastoral* ; (iii) the stage of settled life depending on growing of crops, which is called *agricultural* stage ; (iv) the stage of specialized *handicrafts ;* and (v) the stage characterized by the use of modern power-driven machinery, popularly termed as the *industrial* stage.

A second classification measuring human advancement in terms of the progress in the use of tools, mentions different stages as : *paleolithic* or old rough stone age ; *neolithic* or recent or polished stone age ; *bronze* age and *iron* age, etc. Each of these ages marks the use of new and improved type of tools.

Another classification measuring human progress in terms of man's adaptation to his geographical milieu, shows three stages : (i) *Etiological*, when man is merely a creature of the environment, and in adapting to its possibilities submits to his situation ; (ii) *Ecological*, when man and region are not separate but mutually interdependent entities, and man's mastery over environment is not a one sided transaction but a value for value bargain ; and (iii) *Epharmological*, when man as an active agent of his environment dictates rather than surrenders, and develops in the desired direction.

Patrick Geddes, describing the development of modern technics, has used entirely different terms to indicate different stages : (i) *Eotechnic*, it refers to the dawn age of modern technic. The economy is based upon the use of wind, water. and wood as power, with wood as the principal material for construction. It was dominant in Western Europe from the 10th to the 18th century. (ii) *Paleotechnic*, it refers to the coal and iron economy, which existed as a mutation in the eotechnic period, but began in the 18th century to displace the eotechnic complex, and became dominant between 1850 and 1890. (iii) *Neotechnic*, it refers to the new economy which began to emerge in the eighties, based on the use of electricity, the lighter metals, like aluminium and copper, and rare metals and earths, like tungsten, platinum and thorium etc , utilization of by-products and growing perfection and automatism in all machinery. At

economic system to the new or modern economic system which came into existence after the Industrial Revolution. The Industrial Revolution began in England in the middle of the eighteenth century, and then spreading to other countries; it has transformed the whole economic organization, the systems of production, exchange and distribution, the measure of values, the scale of preferences, the ideas and ideals, the mode of life and all economic relationships.*

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present, the eotechnic complex is a survival, the paleotechnic is recessive, and the neotechnic is a dominant. (iv) *Biotechnic*, it refers to an emergent economy, already separating more clearly from the neotechnic (purelyl mechanic) complex, and pointing to a civilization in which the biologica sciences will be freely applied to technology, and in which technology itself will be oriented towards the culture of life. Application of bacterio- logy to medicine, of physiology to nutrition and of psychology for the discipline of human behaviour is common. Biological and social arts become dominant, improvements instead of depending solely upon mechanical manipulation of matter and energy rest upon organic utilization of the entire environment, and groups are considered in their multifold relations : physical, biological, social, economic, esthetic and psychological.

*About 1770 a series of inventions were made in England, which brought in the factory system and revolutionized the economic life, but the course was completed by about 1815. Toynbee and Mantoux put it as 1760 to 1820, and Cunningham from 1770 to 1840. In France it was felt after the French Revolution and the Napoleonic Wars, 1789-1815 Germany entered her industrial age of power driven machinery after 1870. Japan abolished her feudal system and began her industrial career about 1870, specially since the Sino-Japanese War of 1894 U. S. A. became an industrial country since 1880. And in Russia the change took place after 1890, but specially after the Revolution, hardly 25 years back. It should, however, be noted that it was not a sudden change which occurred and then ceased. It is a process which after being commenced still continues. Secondly, Industrial Revolution is a theoretical conception and not a mere historical denotation designating a period of English economic history.

Chang while commenting upon the line of thought explaining the nature and characteristics of *Industrial Revolution* mentions four schools or groups : (i) Blanqui in France and Gaskell in England, who considered inventions as the prime cause of the great changes, identified more or less completely the inventions with the Industrial Revolution. (ii) Toynbee and some of his followers who have placed greater emphasis upon changes in economic thought and commercial policy than on changes in industrial organization. Invention and the growth of factory system, which undoubted- ly characterize the system, are considered only incidental to the new outlook in theory and commercial policy. (iii) Marx and his followers. Marx distinguished the revolution in 'modern industry' from that in 'manufacture,' by saying that 'in manufacture the revolution in the mode

The old economic system is characterised by*:

(i) Isolation of small self-sufficient groups and this state being mostly due to inadequate transport and communication system.

(ii) Uneven occupational distribution of population with predominance of agriculture over other occupations, and of rural over urban population.

(iii) Small-scale production with simple and imperfect division of labour.

(iv) Industries in handicraft stage, smaller capital, and absence of employer and employee or capital and labour relationship.

(v) Limited market and hence production being mostly for local consumption.

(vi) Exchange being conducted through barter system due to the absence of money economy.

(vii) Undeveloped state of credit and banking, and

(viii) Customs and status mostly regulate values and predominate competition and contract.

The modern economic system is fundamentally different from it. The main characteristics are :

(i) Highly developed and efficient system of transport and communications, after breaking up the isolation of small groups, have increased the interdependence of different groups,

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of production begins with labour-power, in modern industry it begins with instruments of labour'. He emphasized both changes in productive force (technical changes) and changes in productive relations (organizational change), which he took as interacting, both generating and destroying, through the history of economic evolution. Industrial Revolution is explained by the interaction of these two changes, and mostly by their inter action (iv) Modern writers among whom Shadwell and Usher may be named. They hold that Industrial Revolution is only one phase in a vast and complex process that is still going on. The various transformations in that phase are gradual ; and its natural characteristics can be fully understood only by a research into the fundamental causes or factors that are underlying the long process of economic evolution (Pei-kang Chang. Agriculture and Industrialization, 1949, pp. 73-77.)

and has brought the different countries very close to each other.

(ii) A more balanced occupational distribution with agriculture occupying less important role and secondary and tertiary occupations more important place, and predominance of urban over rural population.

(iii) Large-scale production with complex and perfect division of labour.

(iv) Specialization in production, increased use of machinery, concentration of industry, accumulation of huge capital directed by entrepreneur, creation of a labour class, its concentration in manufacturing centres, and the disappearance of the personal relationship between employer and the employees.

(v) Very wider market, and commercialization of production.

(vi) Money economy in place of barter and hence price entering the calculation of values.

(vii) Highly developed system of banking and credit, and

(viii) Freedom of contract and competition.

In some countries this change has been so rapid that within a period of 50 to 75 years the old economic system has been completely substituted by the modern economic system ; and these countries at present are highly developed industrialized countries like England, Germany, U.S.A., France and Belgium, etc. In India the beginning was late and the pace of change has been rather slow with the result that though the impact of modern economic forces has brought about noticeable changes in the economic system, and is gradually transforming the old organization, the old system and organizations still continue, and they have only partially been changed. The new system has not come into being with

full consequences, but the change has already set in, and hence we say that India is in a state of economic transition.

Beginning of Transition. It is difficult to determine the exact period when the forces working towards this change began to operate in our country. Really speaking in the history of no country can the two periods be clearly separated by a definite line of demarcation. India had commercial relations and cultural contacts with the West for several centuries but that did not affect her economic structure till the 19th century. In the beginning of the 19th century India began to feel the impact of some of these forces, and changes began to operate slowly. But their total influence was by no means so large as to make a noticeable structural change. It was since the middle of the 19th century that these forces introduced fundamental changes in our economic life and system. The transition which began in England in the middle of the 18th century and ran its full course by the first quarter of the 19th century, began in our country about a century later, and is still going on since it has not yet been able to complete its course.

There were several factors which worked towards this transition:

(i) The most important factor in transition has been the linking up of India with foreign countries by means of new ship routes, and the opening up of her interior by means of roads and railways. Opening of the Suez canal in 1869 made Indian market and supplies of raw material quite close to the West by reducing the former distance through Cape of Good Hope by about 3000 miles. Beginning of the railway enterprise in India in fiftees, an almost simultaneous beginning of road construction, and their rapid increase during the days of Lord Dalhousie, opened the interior of India to the full blast of foreign competition.

(ii) Beginning of the competition of British manufactures

produced under large-scale operation and with the application of mechanical power, with Indian industry which was carried on by artisans on a small scale, with the result that the Indian artisan was ousted by the British industrialist both in the home and outside markets.

(iii) The establishment of British rule in India synchronized with the beginning of the competition of British manufactures with Indian exports. The foreign rule introduced a new revenue system and also a new system of judicial administration.

(iv) Rise in prices which began near about 1860: Introduction of payments to government in cash increased the demand for money, but metals being scarce in India prices had a falling tendency during the first half of the 19th century after which a reverse tendency is seen. It was almost at this very time that the Indian exports increased very much and the world supply of precious metals was also increased considerably due to the discovery of gold in Australia and California and silver in Mexico. It led to a considerable flow of precious metals in India and raised the price level. Besides, the construction of large scale public works in India raised the wage level also.

(v) The failure of American cotton crop in 1846 made England conscious of seeking an alternative market in India. After that the American Civil War in 1861-65 and the subsequent cotton famine in Lancashire is said to be the first important event to bring to the notice of Indian farmers the existence of western markets for their products. It likewise showed for the first time how close India was brought to the Western market.

(vi) Establishment of a strong, stable and centralized administration leading to the establishment of law and order and security of life and property which in its turn provided

opportunity and incentive for work.

(vii) Introduction of money economy as a result of cash assessments, and increased credit due to rise in prices, and

(viii) The influences of British culture, civilization and education which gave rise to the spirit of individualism.

The most noteworthy feature about the causes and forces of economic transition is the coincidence of many events. These events mutually stimulated the force and pace of each other, and thus brought about a sudden and violent change popularly termed as revolution. But in India we do not use the term 'revolution' but only 'transition', which is a milder term indicating a lesser intensity of change. It is because the pace of change has been rather slow here, and the transformation has not been complete, as will be seen from the following study.

Changes in Agriculture and Rural Life, The most outstanding influences of these forces were the decline of village handicrafts, the disintegration of the village communities and the breaking down of the village isolation and self-sufficiency. The consequences were many-fold ; and both agriculture and farm-life were influenced immensely.

The immediate effects were : the pressure on agriculture began to swell and this brought about an unbalanced occupational distribution. The Indian farmer came in contact with the world market and began to produce for exports in the form of raw materials. The most remarkable was the case of cotton cultivation. Though cotton was cultivated in India from very early times the export of raw cotton upto 1860 was very small.* Dr. Royle wrote in 1851 that 'It forms but a

*Before the 19th century India used to export elegant fabrics and not raw cotton. After the Industrial Revolution in the West the machine-made goods pushed the Indian exports away from foreign markets. This changed the nature of Indian exports, and India became a supplier of cotton. In about 1830 English industry drew its cotton principally from America and at that time India exported a very small quantity of cotton, It was after 1860 that cotton exports increased much,

small part of the imports into this country (England), but a more conspicuous factor in those of China ; the two quantities together, however, make but an insignificant portion of what is produced in the country.' The following statistics about cotton significantly indicate the fresh trend.*

Years.	Price. (as. per lb.)	Exports to U K. (Bales.)	Extension of Cotton Cultivation in. C. P. & Berar.	
			Yrs.	Acres.
1859	2—7	509,695	1861—62	375,623
1860	3—7	562,738	1862—63	427,111
1861	4—2	986,280	1863—64	488,436
1862	6—4	1,071,768	1864—65	691,198
1863	10—5	1,229,984	1865—66	568,398
1864	11—5	1,399,514	1866—67	598,801
			1867—68	735,633
			1868—69	750,875

After 1864 the value of cotton exports formed more than half of our total exports for several years. Similarly, though jute was cultivated for long its extensive cultivation in Bengal for the purpose of export began near about 1830. Agricultural prices began to increase, *e. g.*, in 1861 rice was sold in Bengal at 27 seers a rupee and in 1870 the rate became 22 seers a rupee, in the same period the rate of wheat in Punjab changed from 18 seers a rupee to 15 seers a rupee, the rate of Bajra in Bombay changed from 21 seers to 13 seers a rupee and the price of cotton in C. P. and Berar changed from ·/2/7 per lb. in 1859 to ·/11/5 per lb. in 1864. Local and provincial price variations were immense. Major-

*G. Watt—Article on Cotton in Dictionary of Economic Products in India; The Annual Report of the Cotton Commissioner for C. P. and Behar 1867-68, p. 132; and Dr. Royle' Culture & Commerce of Cotton in India, 1851, p. 18, quoted by Gadgil. The Industrial Evolution of India in Recent Times, pp, 16-18.

General Briggs in his evidence before the Parliamentary Select Committee pointed out that in 1823 grain was 8s. a quarter in Khandesh, 34s. a quarter in Aurangabad and 64s.–70s. a quarter in Poona, and in 1833 a famine year in North-West Province, wheat was sold at Agra at the rate of 13⅓ seers a rupee and in Khandesh 61 seers a rupee. Such variations began to be minimised, and the price trends in one part began to affect the movements in other parts. And a considerable volume of agricultural labour class came into being. Though agricultural labour existed since very long it was never a distinct and considerable class. After the decline of village handicrafts it swelled suddenly. After the formation of the Public Works Department by Lord Dalhousie in 1859 and the construction of huge public works, labour class came into being; and after these works were over it depended on agriculture.

Slowly and slowly the transition began to manifest itself in many directions. The growing pressure on land led to a gradual shrinkage in the size of farms, *e. g.*, the average size of farms in village Suraya in Mainpuri District of Uttar Pradesh was reduced to 7·1 acres in 1940 from 11·7 acres in 1870, in village Pimla Soudgar in Poona the average size was reduced to 7·0 acres in 1915 from 40 acres in 1771.* Foreign markets began to influence Indian agriculture which began to be slowly commercialized. Cotton, oil seeds, jute, hides and skins began to be exported, and the area under industrial crops likewise registered an increase.† Internal trade in agricultural commodities increased considerably.

*Village surveys conducted by Dr. D. S. Chauhan and Dr. H. Mann.

†The extent of commercialization in agriculture is not to be judged only by the extent of industrial crops grown but by the actual amount of agricultural produce put on the market or the volume of trade. Though farmers grow mostly for home consumption, because rent and interest falling due after the harvest time they have to put on the market considerably more than the actual marketable surplus, and then buy again in the off season.

Localization and specialization of crops according to soil and climatic conditions began to take place, *e. g.*, jute in Bengal, wheat in Punjab, oil-seeds in C. P., cotton in Bombay and later on sugar cane in U. P. and Bihar. Agricultural prices got an upward trend, land values increased, cultivators' rights in land became more safe and tenure more fixed. This enhanced the credit position of farmers considerably. This is also said to be a cause of the considerable amount of agricultural indebtedness and likewise a factor in the passing away of land from agricultural to non-agricultural classes. Prices in principal *mandis* began to correspond, and further the inland prices began to follow the world market, *e. g.*,

Monthly wholesale prices of wheat, April 1934 to March 1936.*

	Hapur	Karachi
Average price per md. (Rs.)	2·463	2·797
Standard Deviation.	0·326	0·207
Co-efficient of Variation.	13·236%	7·401%
Co-efficient of correlation (r)		+ 0·774
Probable Error of (r)		± 0·055

Taking the weekly wholesale prices of wheat at the same places and for the same period we find the Co-efficient of correlation + ·819 and probable error ·028.

Monthly wholesale prices of wheat, at London, and Karachi, 1929 to 1931, (before the import duty).

	London	Karachi
Average price per md. (Rs.)	4·296	3·824
Standard Deviation.	1·344	1·038
Co-efficient of Variation.	24·301%	27·144%
Co-efficient of Correlation (r)		+ 3·104
Probable error of (r)		± 0·028

*J. K. Pande—Prices of cereals in the United Provinces, 1938.

High co-efficient of correlation and low probable error in the first case show that prices at ports and at *mandis* in the far interior are very much correlated, and in the second case show that fluctuations in foreign prices affect our prices. Isolation of the village is broken and its self-sufficient character is considerably changed. The media of contact and communication are increasing and they are constantly minimising the spatial separation. Money has entered exchange and all payments of services. Rent, wages, taxes and prices are regulated and determined more by competition than by custom and status. Mobility of labour both occupational and geographical, has increased considerably. The old village organization is transformed, the old relationships of farmers are changed, the influences of social institutions and processes are considerably modified, and the fundamental values are more closely identified with economic factors. The more fundamental and far reaching changes are : breakdown of farmers' isolation, abolition of the feudal system, re-italization of the cooperative spirit, removal of untouchability and establishment of rural democracy through village panchayats. The more visual changes are : replacement of barter by money economy, payments in cash instead of in kind, development of transport and communications, increased mobility of labour, commercialization, specialization, and mechanization of production and the rise in wages and prices.

The process of transition is not uniform* in all classes of people and in different parts of the country. In isolated and

*The economic history of the world records five distinct stages in its development. But this process of evolution has not been simultaneous throughout the world ; and any particular stage has been shorter in some countries and longer in others, depending upon the quality, character and relationship of the basic and emergent factors. Moreover, it is not necessary that all countries should pass through all the stages. Some countries or some sections of population in any particular country can skip over one stage or another, or can reduce the duration by accelerating the rate of progress.

remote parts old cultures persist and old methods and customs continue ; and in parts where outside contacts are frequent and modern forces have a greater impact, the process of transition has gone a long way. There are examples of a few completely mechanized large-scale farms in almost all States, of completely commercialized and specialized farming like potato cultivation in Farrukhabad District and rose cultivation in Aligarh District of Uttar Pradesh, and on the other hand of primitive type of cultivation amongst the aboriginal tribes in Orissa and Vidhya Pradesh, Bhils in Rajasthan, and even of shifting cultivation in Assam hills. But these are extreme cases which do not represent the general picture of the country. The vast majority of farmers, however, is passing through uneven stages, exhibiting characteristics some of which pertain to the older system and some to the modern system. This is peculiar to transitional stages, and is quite natural. There is dislocation and lack of adjustment. Some sections, and older generation in all sections, are more conservative and cling religiously to old customs and methods, yet things are changing fast.

But how far has the essential character of agriculture changed ? The organization of agriculture, the technique of production, the farm practices, the pattern of farm life and the standards of farming and living, on the whole, appear to be as they were long back. The percentage of population depending on agriculture was 68·5% at the time of first census in 1872, and it is found to be the same 68·2% in 1951. More than 80% of the total cultivated area being devoted to food crops, shows the preponderance of cereal cultivation, and the fact that hardly 30% of the total agricultural production enters the market, shows the subsistence character of our agriculture. Besides, considerable amount of agricultural indebtedness

and a very low standard of living and farming show a back-ward or an underdeveloped stage. Low output, low income, low rate of saving and investment, and on the other hand, high propensity to consume which in its turn aggravates scarcities, apparently exhibit a state of stable equilibrium at a low level of economic behaviour. The ebb and flow of agricult-ural life and activities appear to be grooving deeply into channels of custom. There are evidences of emotional clinging to established attitudes, traditional pattern of life, accustomed behaviours and ancient cultural traits. In fact, it is not a stationary state but that of stagnation* which Toynbee terms as 'the blind alleys of civilization.' To be specific, inspite of subsistence farming specialization in production is taking place, and crops have localized according to the soil and climatic conditions. Enlargement in the size of the unit of production in the form of joint-cultivation, cooperative cultivation, capital-istic farming, etc., have already started. Fair rents and fixity of tenure have been attempted for the last few decades through-out the country. The feudal system is being abolished. The capitalist farmer seems in the offing. Legislative measures have already been passed for the fixation of wages in agriculture. The use of farm machinery and the challenging influence of modern technology are on the increase. The area under improved varieties of seeds is increasing specially in the case of sugarcane, wheat, cotton and rice. The production of fer-tilizers and their use is expanding. Irrigation and power are considered most important parts of the Five Year Plan. Agricultural prices, farm incomes, cooperative credit, animal

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*The state of stable equilibrium at a low level as seen in many under-developed countries is not stationary and cannot be interpreted as a lack of transition or change. "There is stagnation which appears as a symptom in its aetiology but is not endogenously determine d function of the system. Like any other system it experiences a change and an interaction of the Accelerator and the Multiplier, and in their peculiaritie s lies its uniqueness." Dr. Baljit Singh : Federal Finance and Underdeveloped Economy, p. 2, 1951.

breeding, and agricultural education and research are being given increasing attention. Though farmers are geographically isolated as compared to town dwellers, few are now so completely isolated as to be beyond the reach of the modern means of transport and communications. The fluctuations in the international agricultural prices affect even remote cultivators. Besides, though farmers grow a number of crops and largely for home, they approach the market more readily and frequently for buying their requirements and for selling their surplus produce, and thus do not attempt to grow all they need.

Farm life has likewise undergone and is at present undergoing a change. Economic values are entering activities of farmers in all walks of life.* Social status, recreation, group contacts, personal freedom and many other basic values have begun to play increasing part in functional relations and social order. Cash, competitive, and market economy is entering the agricultural life since farmers seek financial reward for their work. Virtues of simple life are losing their significance and are giving place to artificially created needs expressed in the form of increasing emphasis on consumption, ostentations in ornaments and clothing. Pecuniary considerations are being placed above subjective

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*It is important to consider the role of economic factors in the scale of values of a people. Success should not be taken in absolute terms but as defined by a particular culture. In oriental civilizations coveted values are religious, philosophical, speculative and subjective ; and they are placed above economic goods. On the contrary in occidental culture the competitive society ranks status, achievement and emulation as first ; and since they are achieved through the accumulation of economic goods pecuniary values are most fundamental, and economic factors are pivotal in the attainment of the objective of life. The more important thing is one that determines the maximum amount of total satisfaction. If it is attained through economic factors they should be considered more important, if not, less important. But the total satisfaction in any social group will be governed by the systems of values or the objectives of life. Though they also change, they are more fundamental, and determine the relative importance of economic factors,

and other philosophical values. Adjustments in social movements have gone far beyond traditional social forms. Changes are visible in the whole pattern. Social institutions, social process, social behaviour and the nature of problems are all changing. Contacts are wider, and movements are faster and distant. Activities seem to do more with business. Relationships are more interconnected. Domination of locality in habits and consumption is decreasing due to the breakdown of isolation, widening of markets and the extension of contacts. Farmers expect adequate reward for their work ; its failure is not considered simply a stroke of bad luck or attributed to anger of some mythical god. On the other hand, they feel frustrated. Their attitude is resentful and bitter towards the economic order. The very fact that old system is failing to meet life's new needs proves that a transition is taking place.*

Nature of Problems during Transition. When an economy passes from one stage to another the movement is not direct and through straight line path. It is a change from one set of circumstances to another. The movement from one

*There is, however, a feeling that economic transition should have normally brought about a period of prosperity and growing standards of production and living. This has not been possible due to several factors : a quick succession of famines after 1865 covering almost the whole country with the result that during 1870—80 farmers throughout the country lost all the progress made so far, economic drain under colonial rule which gradually impoverished the country, rack-renting and exorbitant rate of interest charged by money lender dispossessing farmers of most of his gains, rapid increase in population eating into all production increase, and the great economic Depression which considerably reduced farm incomes. The effects of these factors are generally prolonged and recovery takes very long. This prolonged nature should well be appreciated.

For further study the following books are recommended : Pei-kang Chang, Agriculture and Industrialization, 1947 ; T. W. Schultz, Agriculture in an Unstable Economy, 1945 ; M Sweezy, The Theory of Capitalistic Development, 1942 ; J. D. Black, Factors Conditioning Innovations in Agriculture, 1945 ; and schumpeter. The Theory of Economic Development and Business objects, 1934.

point of equilibrium to another is through a cobweb and from one step to another the movement is through a concave path Thus, the transition implies a movement through a network of interlocking circles. This explains the interdependence and interconnection of different problems. Thus transition in agriculture, therefore, is the result and in its turn a cause of transition in other economic sectors. Transition implies increasing or intensifying complexities. It creates fresh problems and renders the existing ones more complicated.

Ordinarily speaking this transition is the process of industrialization which should be defined as 'a process in which changes of a series of strategical production functions* are taking place'. In this sense it includes industrializing both manufactures and farms. It involves different stages, and the nature of problems at different stages is also different. However, ordinarily speaking the problems which arise are those refering to : changes in cost structure ; changes in the internal organization of farms and a new combination of factors of production ; changes in the quantity of demand, depending upon the elasticity of demand and cost structure of particular goods ; changes in the nature and extent of mechanization of agriculture, depending upon the price of farm products and the scarcity and cost of labour ; changes in the size of farms ; changes in the quantity, and efficiency of both human and animal labour ; changes in the types of farming ; changes in the marketing structure of agricultural commodities ; and ultimately the change in the place of agriculture in the total national economy. In actual practice

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*Strategical production functions are those the changes of which are generating and determining the changes of other production functions, while the latter may be termed as 'induced.'

Production function is usually written as P=f (a, b, c,.....), where P is product and a, b, c,..... are productive services or factors used in production. In Cobb-Douglas formula it is written as p=bLkCj for two dimensions or P=b+kL+jC for three dimensions.

there is considerable shifting of labour and capital both geographical and vocational, and farmers have to make several adjustments with reference to variations in prices, costs, quantity and kind of demand, volume of employment, volume of consumption and savings, extent of capital formation and the nature of technology.

V. RURAL-URBAN RELATIONSHIP

Rural Exploitation. There has been a gradual depletion of wealth and power from our villages. There are two major factors responsible for it. After the disintegration of village communities the social protection afforded by them ceased and their functions in social, economic and political matters were taken up by other institutions. Secondly, the decline of village handicrafts narrowed down the field of economic activities, and by increasing the pressure on agriculture rendered it more and more uneconomic. In addition to these two major factors there has continuously been an urban ward drift of money and intelligent and healthy men from rural areas, motivated by economic and social status and the attractions of city life. The result is that to-day, inspite of the fact that villages contribute a major part of the national income, they wear a deserted appearance. Village life is rendered less vivacious and less varied, unwholesome and unhealthy, cramped and circumscribed and narrow and incomplete. On the other hand, cities are becoming the nuclei of power and privilege, of wealth and glory, of art and culture and of modern advancement. There is a significant gulf between the two ; and it has gradually been widening for some time past. An undesirable feature of this is that the cities are thriving at the cost of villages

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For further study readers may look to our two articles : Rural-urban Relationship, Rural India. July 1949 ; and the Role of Village in Progressive Economy, Rural India, April 1951.

which appear to have remained where they were centuries back without making any noticeable progress.

The economic consequences are unhappy for both cities and villages. In villages we find that the size and capacity have limited the opportunity for progress. The chances for multiplication of occupations, extension of employment, and accumulation of wealth are minimised. There is no material and social environment in which culture can be enriched, civilization can make a progress and life can be fuller. Really speaking rural life is reduced to an existence on a sub-human level.

City development in our country is not an organic growth of the society. Even in its physical form it has mostly been a casual egglomeration of men and buildings rather than a natural economic process. Urbanization, though very limited in India, has taken such an ugly shape that water, light, air, soil, the basic environments of life are becoming more and more difficult to procure. The environment is gradually becoming unfit for a happy life. There are said to be quick and easy methods of earning and spending. These pecuniary processes may be considered satisfactory on economic grounds, but humanly speaking they are low forms of activity. The mechanical ingenuities, the pecuniary pride and the splendid devices in providing the material bases of life are simply the symptoms of spiritual failure. Many of the universal forms of dishonour are not considered undignified. The honest workers shave wood, beat iron bars, handle earth ; scholars incubate ideas and artists and poets brood in some unwholesome quarters in neglected corners. Physically, our cities have failed to provide the basic conditions of life, socially there is no civic and community life and culturally the human personality is dwarfed.

Urbanization, in other words, 'is dehumanization, depersonalization, desocialization and devitalization.'*

The gradual impoverishment of villages and a huge population living at a very low scale of living, and carrying on under deficit economy, are very grave features. The villages produce less, they eat less, they sell less and they buy less. It forms a vicious circle dragging the nation down. The gulf between the villages and the cities is already quite significant and it is gradually widening. The worst feature is that under the present economic set-up it cannot be minimised. On the other hand, the present process of rural exploitation which is inherent in the modern industrial system, and the existing system of distribution of economic activity, will continue. The growing diversity of human culture shows that advanced communities change rapidly and backward only slowly and slightly. The existing system will increase the difference between cities and villages in future. The present differences between the developed and the under-developed countries of the world are increasing. It establishes the same fact.

Interdependence of Rural and Urban Areas. The linking factors between the two are food, raw materials, labour, and farmers as buyers of goods and services.

It should be appreciated that villages are the bed-rock of our national structure. They are the ultimate source of the diffused rays of life which fall into focus in cities. The signs and the symbols, the designs and patterns and the systems and the orders of urban life, which are considered to be the durable elements of human heritage, are simply the 'etherealized' forms of life in the countryside. All phazes of village life contribute towards the existence of cities.

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*L. Mumford, City Development, 1946. For further study of urbanization one can look to Mumford's Culture of Cities, 1940.

Thus, there is a limit to the progress of the former fixed by the nature and character of the latter. And any attempt for progress and planning cannot afford to neglect the countryside. Not only that the extent to which progress can be made by the country as a whole cannot be far ahead of that of villages.

On the other hand cities (taken both as economic base and social emergent), through culture and technology, provide motive force for economic progress by widening the scope for economic activities, diversification of occupations, multiplicity of opportunities, specialization of functions, deepening of experience, enriching modes and methods of expression and ultimately leading agriculture, industry and government into new channels of experiment, and thus transforming passive agricultural rural environment.

A case for Regional Distribution of Economic Power and Activity. The parasitic existence of cities cannot be tolerated in future. It depends on how permanent are the forces and methods which drain our villages. Under our present constitution and with the rising surge of political, economic and social consciousness, rural exploitation cannot be tolerated permanently. And longer it continues, the greater are the chances of serious dislocations, violent changes and unhappy consequences. Hence, it is necessary to seek a remedy as early as possible.

The remedy lies in providing the necessary opportunities and incentives for progress in the countryside. Before analyzing the factors leading to it let us be definite about the meaning of the word progress at which we aim. In short it implies the development of a balanced human personality*.

*When machine was considered supreme human ideas and ideals were too much influenced by quantitative measures of power and progress. Now organism being considered uppermost the line of thought has changed to qualitative measures like growth, norm, inter-relationship and association. The aim is not to make man more powerful but to make him capable of developing the attributes of culture.

Progressive economy assumes an economic frame work in which at least the basic requirements of life may be provided to all, and further the equipment for the realization of the creative needs of the community life may be provided in adequate quantity, and the growing standards of civilized life may be realized. Really speaking it is a preliminary condition for the realization of the final objective. To be accomplished it requires a suitable environment. In brief the remedy lies in the creation of a new environment in which not only the forces and methods depleting the villages may be counter balanced but a new economic, social and political life may be emerged in the countryside. The methods are : to check the causes of accelerated drift to cities through legislative measures and social reforms, to increase the capacity of villages to hold the population at a higher standard, and to replace the existing economic framework which is incapable of bettering the lot of poor farmers by new units of organization, administration having new ideals of life, new scales of values and new system of income distribution. It requires a balanced occupational distribution, security of employment and output, opportunities for enhanced production, equitable distribution and adequate savings, stimulating an urge for improvement, social engineering and the development of the art of life. Objectively speaking it require rural industrialization on a decentralized basis, and thus creating diversification of employment and a source of income, intensification of agriculture and improvement of farm technology, reorganization of rural credit and marketing so as to avoid the exploitation of the rural population by middlemen, development of means of transport and communications, electrificatoin of rural areas, scattering the higher educational institutions in rural surroundings, overhauling the constitutions, powers and functions of the existing local bodies,

provision of security of life and property in the countryside which has recently been endangered, and the provision of the emenities of life at cheaper rates.

The fresh organization must be attempted on a regional basis harmonising the rural and the urban elements with a biologically adequate environment of the former and the cultural resources of the latter. The knowledge of organic life shows that there cannot be a compartmentation of population into separate rural and urban zones. The autonomy of organism which is a characteristic feature of its growth does not lead to isolation. Environment is a cooperative factor. Therefore, the existing distinctive features of rural and urban areas[1] and institutions have to be avoided giving place to a fresh regional organization. Correctly analyzed it is neither municipalizing villages nor ruralizing cities.[2] It is not simply transferring the population or decentralizing the authority. It is reorganizing the whole economic structure with new economic institutions, ideals, scale of values and relationships. It will mean a balanced distribution of economic power and activities on a regional basis, and community giving place to society.

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1. The degree of urbanization in India is very limited and such a big country cannot be urbanized to the extent to which some western countries have. But the concentration of economic power in cities and rural exploitation are obvious. The system has got some inherent characteristics which hamper progress. The danger is that the country may go the way of China if things are not improved. It can lead to a collapse of the whole modern urban and commercial civilization which implies greed, domination, and conquest.

2. The idea is different from that of 'urbanization' of the countryside which aims at a richer life of social contact, and is also distinct from that of the 'extension of city development' which intends to increase the influence of natural surroundings on metropolitan civilization.

For further study one can look to : Dr. T. R. Sharma, Location of Industries, 1948, and A. P. Usher, A Dynamic Analysis of the Location of Economic Activity, 1943.

VI. VILLAGE PANCHAYATS IN U. P.

The government of Uttar Pradesh has passed The U. P. Panchayat Raj Act, 1947, in order to establish and develop Local Self-Government in rural areas[1] and to make better provision for village administration and development. The village is the unit, and in every unit there are three bodies: the Gaon Sabha, the Gaon Panchayat and the Panchayati Adalat. Their organization is as follows :—

The Gaon Sabha. For every village or a group of villages within three miles, ordinarily having a population of 1000 to 2000 persons, there is a Gaon Sabha, which is a body corporate[2] having perpetual succession and a common seal. It consists of all adults (males and females above 21 yrs.) permanently residing in the area. A member will be disqualified if he or she is of unsound mind, is suffering from leprosy, is an undischarged insolvent, is a servant of a local body or is a convict. Normally, the membership is life long and one ceases to be a member only when one incurs any one of the above disqualifications, or when the area in which one resides is excluded from the jurisdiction of the Gaon Sabha, or when one leaves the village. On the establishment of Gaon Sabha a register is prepared in Hindi in the prescribed form, of all adult persons permanently residing within the jurisdiction of such Gaon Sabha, and it is revised at least once a year.

The Gaon Sabha elects according to joint electorate system, from amongst its members, a President (Pradhan) and a

1. Rural areas include all areas except municipal areas, cantonments, town areas and notified areas.

2. A body corporate is the same thing as a Corporation, an artificial person established for prescribing in perpetual succession certain rights, which if conferred on natural persons would fail in process of time. It is an artificial being, invisible, intangible and existing only in contemplation of law.

Vice-President (Up-Pradhan) for a term of 3 years, and an Executive (Gaon Panchayat). Ordinarily the Gaon Sabha holds two general meetings in each year after the two main harvests. The Kharif meeting considers and passes budget for the following year and the Rabi meeting considers the accounts of the preceding year. Besides, each meeting considers the biennial reports of business submitted by the President. An extraordinary general meeting can be called by the President, or can be requisitioned by 1/5 members within 30 days of giving a written request. For any meeting 1/5 of the total members shall form the quorum while no quorum is necessary for a meeting adjourned for want of quorum. Vested in each Gaon Sabha is a Goan Fund, which is managed, realized and utilized by the Gaon Panchayat. It consists of taxes imposed under this Act, sums handed over to Gaon Sabha by State Government, sums ordered by a court to be placed to the credit of the Gaon Fund, contributions by District Board or other local authority, amount assigned to Gaon Fund by any special or general order of the State Government, amount received by way of loans and gifts, portion of rent or proceeds of *nazul* property placed by State Government to the credit of Gaon Fund, sale proceeds of dust, dirt, dung or refuge etc., collection charges for taxes and dues collected on behalf of the State Government, and the payment received on compounding an offence under Section 104. The Gaon Sabha has a power to acquire land, first by private negotiation, and failing that through the Collector. All public property situated within the jurisdiction of a Goan Sabha vests in and belongs to it, and is under its direct management and control. It can borrow money from State Government to carry out any of the purposes. It can impose the following taxes: a tax on rent not exceeding one anna in a rupee payable by cultivators, a tax on rent received

by proprietors and under-proprietors not exceeding 6 pies in the rupee of such rents, a tax on the rental value of Sir and Khudkast not exceeding one anna in the rupee, payable by proprietors and under-proprietors, a tax on trade, callings and professions, and a tax on buildings owned by persons who do not pay any of the aforesaid taxes.

The Gaon Panchayat. It is the executive committee of the Gaon Sabha. The President and the Vice-president of Gaon Sabha are also its President and Vice-President respectively. Beside these two there are 30 to 51 other members elected by the Gaon Sabha on joint electorate system, for a term of 3 years. One-third of the members retire annually. Seats are assigned to minority communities in proportion of population. Gaon Panchayat arranges for the realization of taxes and dues, custody of its funds, and maintenance of its accounts which are audited every year.

It is the duty of every Gaon Panchayat, so far as its funds may allow, to make reasonable provision within its jurisdiction for : Construction, repair, maintenance, cleaning and lighting of public streets ; medical relief ; sanitation and taking curative and preventive measures to remove and to stop the spread of an epidemic ; upkeep, protection and supervision of any building or other property belonging to Gaon Sabha or transferred to it for management ; registering births, deaths and marriages, and maintenance of the register of all the members of the Gaon Sabha ; removal of encroachment on public streets, public places, and property vested in Gaon Sabha ; regulating places for the disposal of the dead bodies of human beings and animals, and of other offensive matter ; regulation of fairs, markets and hats within its area except those managed by State Government ; establishing and maintaining primary schools for boys and girls, establish-

ment, management and care of common grazing grounds and land for the common benefit of the persons residing within its jurisdiction ; construction, repair and maintenance of public wells, tanks and ponds for the supply of water for drinking, washing and bathing purposes, and regulation of sources of water supply for drinking purposes ; regulating the construction of new buildings or the extension or alterations of existing buildings ; assisting the development of agriculture, industry and commerce ; rendering assistance in extinguishing fire and protecting life and property when fire occurs ; maternity and child welfare ; allotment of places for storing manure ; maintenance of such records relating to population census and cattle census as may be prescribed ; administration of civil and criminal justice and the election of Panches on the panel of the Panchayati Adalat ; and fulfilling any other obligation imposed by any other law on Gaon Sabha. Besides, there are some discretionary functions of Gaon Panchayats, and they may make provision for : planting and maintaining trees at public streets and other public places ; improvement of cattle ; improvement of sanitation ; organizing a village volunteer force for watch and ward and assisting the different bodies in discharging their functions ; improvement of agriculture and the development of cooperation ; assisting cultivators in obtaining Government loans, in repayment thereof, in liquidation of old debt and establishing a sound credit system ; relief against famine and other calamities ; extension of abadi ; establishing and maintaining library, reading rooms, clubs for recreation and games and organizations for promoting goodwill and social harmony between different communities ; and other measures of public utility calculated to promote the moral and material well-being or convenience of villagers.

The Gaon Panchayat has power to enquire and report about the misconduct of amin, process server, vaccinator, constable, patwari, patrol or peons of Government Departments, and forward the complaint to proper authority with its own report. It has power to enter into contract with the State Government to collect any taxes and dues for proprietors within its jurisdiction. As prescribed it appoints a secretary and other staff subject to the approval of the prescribed authority, but in time of emergency can appoint a servant for a period not exceeding three months without such sanction. Subject to the prescribed conditions it may establish a committee to assist it in the discharge of any specified duty, and may delegate to such committee such of its powers as may be necessary for the purpose of rendering such assistance. Two or more Gaon Sabhas can combine by means of a written instrument to appoint a joint committee consisting of their representatives for the purpose of transacting any business in which they are jointly interested, and may delegate to such committee power to frame any scheme and modify rules which will be binding on each Gaon Sabha Every member of a Gaon Panchayat has a right, at any meeting, to move any resolution and to put questions to the President or Vice-President on matters connected with the administration of the Panchayat. And every member of the Gaon Panchayat, any joint committee or any other committee constituted under this Act, is liable for loss, waste or misapplication of any money or property belonging to the Panchayat, and a suit for compensation may be instituted against him by the Panchayat with the previous sanction of the prescribed authority.

The Panchayati Adalat. The State Government has divided each district in circles, each circle usually including contiguous

area of 3 to 5 Gaon Sabhas, for the purpose of establishing Panchayati Adalat for each such circle. Every Gaon Sabha in a circle elects 5 adults of prescribed qualifications, permanently residing within its jurisdiction to act as Panches for 3 years, in the Panchayati Adalat of that circle. The Panches so elected by the Gaon Sabhas in a circle form a panel, and elect from amongst themselves a person who is able to record proceedings and to act as Sarpanch of the Panchayati Adalat.

Any person who wishes to institute a suit, case or proceeding under this Act before a Panchayati Adalat can make an application orally or in writing to the Sarpanch, or in the case of his absence from the circle, to such other Panch as may have been appointed in this behalf, and shall pay the prescribed fee. The Court Fee Act, 1870 does not apply to Panchayati Adalats except as may be prescribed. Any party can appear before the Adalat in person or by such representative as the Adalat may admit as a fit person to represent him. But no legal practitioner shall appear, plead or act on behalf of any party before a Panchayati Adalat. For the trial of every case, suit or proceeding, the Sarpanch forms a bench of 5 Panches from the panel, including one Panch residing in the area of the Gaon Sabha in which the plaintiff of a suit or proceeding or the complainant of a case resides, one Panch residing in the area of the Gaon Sabha in which the defendant or the accused resides, and three Panches residing in the area of the Gaon Sabha in which neither party resides. But no Panch or Sarpanch can take part in any case to which he or any near relation, employer, employee or partner is a party, or in which any of them may be personally interested. In the event of any disagreement between Panches the opinion of the majority prevails.

Almost all the minor cases—criminal cases, civil cases, land revenue cases and cases of gambling, cattle trespassing and any other offence under any other enactment declared by State Government to be cognizable by a Panchayati Adalat—are brought before Panchayati Adalats. Criminal cases are instituted before the Sarpanch of the Adalat of the circle in which offence is committed, civil cases are instituted before the Sarpanch of the Adalat of the circle in which the defendant or any defendants ordinarily reside or carry out business at that time, and cases under Sec. 70 of the Land Revenue Act are transferred by Tahsildar of the Adalat within the local area of which the land concerned is situated. A criminal case pending before a magistrate can be transferred by him to the Adalat if he feels that it can be tried by it. Besides, the Adalat has special jurisdiction in compromised matters, since it has power to decide all civil, revenue and compoundable civil cases not pending in any court in accordance with any settlement, compromise or oath agreed upon by the parties. But if the Adalat feels that it has no jurisdiction to try a case, or the offence is such in which it cannot award adequate punishment, or is so complicated that it should be tried by a regular court, it returns the complaint to the complainant directing him to file it before the Sub-Divisional Magistrate having jurisdiction to try such case.

A Panchayati Adalat cannot inflict a substantive sentence of imprisonment but can fine upto Rs. 100 (the fine varies according to the nature of offence), but no imprisonment can be awarded in default of payment. It cannot try a person if he has been previously convicted of an offence with imprisonment of 3 years or more, or is fined for theft by Adalat, or is a registered member of a criminal tribe or is convicted for gambling. It has no power to cancel,

revise or alter any decree or order passed by it, except to correct a clerical mistake, but can for sufficient reason recorded, on application made within one month of the date of decree or order or knowledge, restore any case which has been dismissed or in which decree or order has been passed ex parte. A revision from any order or decree passed by an Adalat lies to the Sub-Divisional Magistrate and the Munsif. If there is miscarriage of justice by an Adalat the Sub-Divisional Magistrate or Munsif can at any time in a pending suit, or within 60 days from the date of a decree or order, call for the record of the case from Adalat, can cancel the jurisdiction, or can quash any decree or order. A decree or an order passed by a Panchayati Adalat is executed by it in a prescribed manner. And if the dependants' property is situated outside its jurisdiction it transfers the decree to the other Adalat where the property is situated, or to the court of the Munsif if there is no Panchayati Adalat. The fine imposed by an Adalat is recoverable in the manner provided in Sec. 386 of the Code of Criminal Procedure, 1898. And if the Adalat finds it difficult to recover, it requests the Sub-Divisional Magistrate to recover it.

The Present working. According to this Act Panchayats have been formed throughout the State on 15th August 1949. At present there are 35,919 Gaon Sabhas and 8,414 Panchayati Adalats in the State. On and from the date on which a Gaon Sabha is established in any area under this Act the U. P. Village Panchayat Act, 1920, the U. P. Village Courts Act, 1892 and the U. P. Village Sanitation Act, 1892 are deemed to be repealed. The Panchayats have assumed their duties and are working since then. Every member or servant of Gaon Panchayat or Panchayati Adalat or committee is deemed to be a public servant within the meaning of Sec. 21 of the Indian Penal Code. This raises considerably his

personal status in discharging his duties. The State Govt. has, subject to the condition of previous publication by notification in the official Gazette, power to make rules consistant with this Act to carry out the purposes of this Act, *i. e.*, organization, working, powers and duties of the Gaon Sabha, Gaon Panchayat and the Panchayati Adalat. It means that in the light of the experience the Act is subject to modifications and amendments subsequently.

In actual practice and the provisions of the Act there is a considerable difference. Really speaking the success and failure of Panchayats depends upon the type of people. Where educated and sincere men are available really good work has been done specially in regard to the improvement of roads and paths in abadi areas, education, village sanitation and disposal of refuge outside the abadi areas, lighting of public streets, distribution of cloth in villages and the disposal of petty disputes. During 1950 the total number of different types of cases brought before the Panchayati Adalats was 467,340, out of which about 25% were settled by mutual agreement. As fines and fees they received Rs. 7·9 lakhs out of which they saved Rs. 4·2 lakhs and used them for constructive purposes. The Gaon Panchayats have constructed 218 miles Pacca and 1290 miles Kachha roads, and repaired 3619 miles old roads. They turned 14,134 Kachha wells into Pacca and repaired 35826. They have planted more than 10 million fruit trees and 45 million other types of trees ; and prepared 3·7 lakhs compost pits. On the other hand many Panchayats have proved to be the breeding grounds for party friction and further litigation. The Panches are easily bribed. There is considerable litigation in the courts against judgments of Adalats, and revisions and appeals. There are a few difficulties due to which Panchayats are not able to work properly. A certain standard of

individual character is required for a successful democracy which in the ignorant, illiterate and poor communities in villages is badly lacking. Under the existing political atmosphere respect for law in villages has considerably declined, and the offender is not much afraid of the hand of law, much less of the Gaon Panchayat or the Panchayati Adalat. The congress propaganda against the so far economically and socially superior communities has practically finished the leadership in villages. In the absence of such leaders the Gaon Panchayats and Panchayati Adalats lack capacity to administer matters, and do not command respect and obedience. Due to abject poverty of the masses the finances remain meagre, and most of the funds being utilized in paying the salary of the secretary, very small amounts are left for further improvements. And the party friction spoils the atmosphere of good-will and cooperation which is fundamental for rural progress and smooth working of such local bodies. Really speaking the experience is so short that any judgment should not be passed. The initial difficulties are so outstanding that spectacular results cannot be expected. There can, however, be no doubt about the utility and usefulness of these Panchayats. The Act provides protection of life and property, and the maintenance of civil liberties of all persons residing in the jurisdiction of Panchayats. It aims not only at the development of local self-government but also at reducing litigation and making it economically cheap, establishing rural democracy and training of the voter. It is a step in the right direction and will try to revive the spirit of old village communities. Even during this short period of working these signs are visible.

CHAPTER VI

Famines and Famine Relief.

I. FAMINES.

Famine Conditions. Famine is 'the state of extreme hunger suffered by the population of a region as a result of the failure of the accustomed food supply.'* Famine conditions are said to prevail when large groups of people fail to procure enough food for their normal or accustomed needs. Hence, to be specific, it has to be distinguished from the state of constant under-nourishment of chronically poverty stricken areas. The normal under-nourishment is not called a famine. In such cases, as our own, famine is the state of an extraordinary aggravation of the normal misery.

Causes of Famines. Famine conditions may be created by several causes, which are generally grouped under two catagories: direct or apparent causes, and indirect or remote causes.

(i) Direct causes. Food supply may fail due to natural causes, such as drought, flood, hail storm, frost, prolonged winter, too dry summer, or some other unusual meteorological phenomenon, plague of locusts or rodents, and plant diseases. Failure of crops may further be due to man-made or artificial causes, such as devastation of rural areas by war, breakdown of the system of distribution affecting the region depending upon the imported supply, and speculation in the grain market resulting in prohibitive prices.

(ii) Indirect causes. Deforestation increases the danger of floods, and over-population reduces the size of farms to

*F. A. Southard, Encyclopedia of Social Science, Vol. V-VI, p. 85.

such an extent that it is hardly sufficient to afford a miserable subsistence in good years, precluding the shortage of surplus in bad years. These two factors indirectly lead to famine conditions.

Regarding the causes of famines a few things are to be noted. First, it is rare for a famine to be directly traceable to one single cause. Usually, several factors combine to cause a severe famine. In our country the primary cause and likewise the most common cause of famines, has been a widespread drought due to the failure of the accustomed monsoon. But very often other factors like heavy exactions of rulers sometimes resulting in huge migrations of rural population leaving the land uncultivated,[1] invasions, and internal wars devastating the rural areas, have also combined with it.[2]

Secondly, though the failure of the monsoon involves some degree of crop failure and thereby reduces the physical volume of food and the demand for agricultural labour, every failure of rain does not result in a famine. Varying degrees

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1. 'Muhammad's (Tughlak) exactions, which extinguished cultivation in large tracts of the Doab, and his severity which destroyed those who might have cultivated, contributed in no small measure to the calamity (famine of 1335), which is always mentioned in connection with, though not directly attributed to his ill treatment of his subjects in the Doab.' (Cambridge History of India Vol. III, p. 152).

'No misapprehension can be greater than to suppose that the settlement of public demand on the land is only lightly, or as may be, not at all connected with the occurrence of famines.' (Col. Baird Smith, Report of Aug. 14, 1861, para 36). Besides, during the Muslim and the British Period there are many other similar instances.

2. Some authors have stated that the real and the fundamental cause of famines in our country is the economic backwardness of the people, because farmers have no reserves and no power of resistance when famine occurs. This is not an appropriate expression because aggrarian poverty does not cause the crops to fail. Poverty aggravates the famine and paves the way for it no doubt, when the failure of the accustomed food supply occurs due to other causes. Poverty and backwardness are our normal miseries, and famine is said to occur only when they are exceptionally aggravated by something else.

of the failure of rain involve varying degrees of crop failures, with varying effects on the demand for farm work. A widespread or a continuous failure of rain will, of course, result in a distress, but whether the distress amounts to a famine or not will depend on many situations, such as condition of previous harvest, degree of farm work affected, chance and capacity for imports, and the general resistance of the people, etc.

Thirdly, there has been a common impression that with economic progress and the advancement of civilization there has been a change in the causes of famines. War, rapine and misrule, which were formerly direct causes, no longer cause famines. But some new causes specially depressions and purely monetary factors have arisen. Further the ease with which food can be transported has minimised the danger for natural causes, and the revolution in agriculture has removed even food production from the list of factors causing famines. But in view of the devastating nature of modern wars, and the fact that 2/3 of the world population resides in underdeveloped areas which are mainly agricultural, and agriculture in all such areas is far from secure, the statements can be accepted only with considerable reservations.

Fourthly, population has already, and is further accumulating such a huge burden on food resources that it has assumed the nature of a continuous famine problem.

II. HISTORY OF FAMINES.

Throughout the world, excepting in the tropical regions, the danger of famine has always been great, specially in olden times. All early civilizations were subject to frequent famines. From 108 B. C. to 1911 A. D. there have been 1828 famines in China ; from the beginning of the Christian era

till 1855 there have been 600 recorded famines in Europe ; for 1000 to 1855 there have been nearly 450 famines confined to small regions likes Wales, Lorraine and Alsace ; Egypt was afflicted with drought and locust plague, and in Greece and Rome considerable urbanization magnified the difficulties of securing adequate food supply in bad years. The chronicler of Novgorod refers to a number of famines in medieval times specially in eastern Europe. Some of these famines have been very severe. The great famines in world history are as follows :[1]

Years.	Country.	Years.	Country.	Years.	Country.
B. C. 436	Rome.	1396—1407	India.	1876—1878	India.
A. D. 42	Egypt.	1586	England.	1877—1878	China.
650	India	1661	India.	1887	China.
879	Universal	1769—1770	India.	1891—1892	Russia.
941	India.	1783	India.	1897—1898	India.
1005	England.	1790—1792	India.	1898—1900	India.
1016	whole Europe	1838	India.	1905	Russia.
1022	India.	1846—1847	Ireland,	1916	China.
1033	India.	1860—1861	India.	1921	Russia.
1064—72	Egypt	1865—1866	India.	1932—1933	Russia.
1162	Universal.	1869—1870	India		
1344—45	India.	1873—1874	India.		

Early Famines. Our history is said to be punctuated at frequent intervals by disastrous famines. Details of ancient famines are not known, but their earliest references are traced in some traditions, embodied in the sacred books of Brahamans and the Jain and Buddhist literature.[2] The

1. Encyclopedia Britannica, Vol. 9, p. 64.

2. This contradicts Megasthenes who mentioned that 'famine has never visited India.' (M'crindle, Ancient India as described by Megasthenes, p. 32) His words perhaps mean either during the days he stayed here, or in the living memory of those whom he interviewed, or a severe country-wide protracted calamity. Buddhist records-Vinaya, Jatak, and other books of Sutta Pitak—make definite mention of brief periods of local scarcities. Megasthenes was perhaps overwhelmed by the conditions of living of the peasantry in the parts he visited, specially in comparision to those of the contemporary peasantry in other countries he knew of.

earliest record of famine in historical times is of 460 B. C. in Magadh during the time of Nandivardhan. From 377 to 362 B. C. there was again an almost continuous famine in Magadh. In 650 A. D. famine raged throughout the country. After that series of famines are said to have occurred in 941, 1022 and 1033 when some of the provinces are said to have been depopulated ; and traditions show that men were driven to cannibalism. For a decade from 1148 to 1159, there was almost a continuous famine in different parts of the country. For seven years from 1335 famine was rampant throughout Northern India, when Muhammad Tughlak ordered the evacuation of Delhi to Deogiri in the Deccan. It is said that even for the Emperor's household necessaries of life could not be obtained. Ibn Batuta mentions that towns and districts were depopulated and people were reduced to eat unnatural food such as cooked hides, human flesh and drinking of blood of slaughtered cattle. Again, from 1396 to 1407 the Deccan was devastated by almost continuous famine, popularly known as the Durga Devi famine, affecting one part after another, and it reduced the population to such an extent that a considerable portion of the cultivated area remained uncultivated for years.

During the reign of Akbar famine occurred three times : once in 1556 in the area surrounding Delhi, and then in 1575 in Gujrat, and the third, which was very disastrous and continued for four years 1595-99 in Northern India. The next severe calamity occurred in the days of Shah Jehan in 1630 in Gujrat and Deccan. This is said to be one of the greatest famines recorded in history, and the first about which precise details, specially by Dutch merchant named Twist, have survived. It is said that in Swally only 11 out of 260 families survived; in Surat a populous city at that time nearly 30 thousand perished and hardly any life survived ;

and on the road between Surat and Swally there was a very large number of bodies decaying. Hunter described it as the garden of the world being turned into wilderness.[1] Cattle perished in huge numbers, and people in large numbers abandoned villages and towns. It is said that men deserted wives, mothers sold their children, women sold themselves as slaves, families took poison together or drowned hand-in-hand, and people took human flesh. The other severe famine occurred in the days of Aurangzeb in 1686 in Deccan stretching upto Gujrat. In the same area another famine visited in 1747. Between 1660 and 1750 there were 14 major famines about which precise details are not known. Of all the famines that have occurred during the Muslim period five have been most severe : two in Northern India : in 1335–43 in the days of Muhammad Tughlak and in 1595–99 in the days of Akbar ; and three in the Deccan : in 1396–1407 in the days of Feroz Shah, in 1630 in the days of Shah Jehan and in 1686 in the days of Aurangzeb.

Famines during the British Period. About a dozen famines occurred during the time of the East India Company : in 1769–70 in Bengal, in 1783 in North India, in 1790–92 in the Deccan specially Bombay and Hydrabad, in 1800 in Mysore, in 1803 in Bombay, in 1804 in North India, in 1807 in Madras, in 1813 in Bombay, in 1823 and 1833 in Madras and in 1837 in North India. Out of these four (first three and the last one) were very severe. In 1769–70 in Bengal 1/3 inhabitants or about 10 millions died. There was a tremendous decrease in cultivation and about 1/3 of the cultivated land returned to waste. In 1783 came the Chalisa[2] famine in Northern India, extending from eastern end of Benares Province to

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1. Hunter, W. W., History of British India, Vol. II, p. 59.
2. The word 'Chalisa' indicates 'that which occurred in the year forty', a figure in the Sambat year 1840, and called 'chalis' in local language.

Lahore and Jammu. It continued the next year also, and in 1784 famine conditions prevailed in Madras also. The horrors of this famine have been symbolized in local songs. In place of grain, it is said that people took roots and bark of trees. Hastings wrote to the Council Board in April 1784 that 'from Buxar to the opposite boundary (of Benares Province) I have seen nothing but complete devastation in every village', and Edwards in 1783 found Oudh which was quite populous at that time 'forlorn and desolate'. In 1790-92 came the Doji Bara or the Skull* famine of the Deccan. It extended over the whole of Bombay and Hydrabad and affected northern districts of Madras. This famine is said to be the severest famine ever known in which people died in such large numbers that they could not be burried. Another severe famine occurred in 1837-38 in Northern India, specially in the upper reaches of the Ganges and the Jamuna. It was most severe in the North-West Province. There was an utter desolation in the parganas of Hodal and Palwal. Deaths were numerous. It is said that about 8 lakhs people perished, and in Kanpur, Fatehpur and Agra special establishments patrolled the streets to remove corpses. Dead bodies were lying on the roadside unburried and unburnt till they were devoured by wild animals.

During the rule of the Crown there have been eight major disasters, and about these sufficiently precise and reliable details are available. In 1860-61 there was a famine in Northern India specially in parts of North-Western Province around Agra, Punjab and touched Rajputana and Cutch. The total area affected was 53,500 sq. miles with a population of 2 crores. More severely affected parts were

*It was so called because deaths were so numerous that cropses could not be burried and skulls, the hardest part of the body, were the usual sight here and there.

Delhi, Agra, Allahabad and Alwar State, roughly the tract between Agra and Delhi, comprising an area of about 25 thousand sq. miles with a population of nearly 13 millions. It is said that nearly 1/2 million people deserted the distressed tract. From 1865 to 67 another severe famine affected the whole east coast from Calcutta to Madras penetrating far inland. It began in Orissa in 1865 and then extended to Bihar and Bengal. It is generally known as the Orissa famine of 1866, since it assumed most terrible form in Orissa in 1866. The total area affected was 180,000 sq. miles with a population of 47½ millions. In Orissa alone at least 1 million or about 1/3 of the total population died, and in some of the divisions of Bengal about 1/4 of the population died. It assumed the worst form in Orissa due to isolation, and specially in the rainy season the grain being available it could not be distributed, and in Bengal the lack of data and thus lack of information was mostly responsible for the tragedy.

This famine in the eastern part was soon (almost on its heels) followed by one in the western part in 1868 to 1870. It extended over Rajputana, parts of North-West Province,

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Accounts of all the early famines are said to be vitiated by guesses which are still fruitful sources of controversy. The danger of drawing conclusions on them is illustrated by the fact that inspite of the great mortality in Orissa famine of 1866, the population of the affected district, as estimated by the 1871-72 census, was considerably larger than the estimate made of it by the best authorities prior to the famine. Besides information regarding States (termed by foreign writers as native territory) where famines are said to be more frequent, is sadly lacking, perhaps not thoroughly collected. Even if collected it must be lacking in precise details since enquiries and investigations by Commissions or similar bodies were not made as we find later on in British rule. Accounts of the early famines are available in the chronicles of courts, and from them only a few general descriptions come down, such as vast-scale desolation and depopulation of tracts, man feeding on man and killing him for food, violation of natural human relationships, loss of revenue and conspicuous acts of charity. But even from this mass speculation some general facts regarding the causes and effects stand out clearly and help considerably in studying the nature of the problem and in suggesting methods of control.

Punjab and Bundelkhand. This is commonly known as the Rajputana famine of 1868-69, because of being most intense and widespread in Rajputana in that year. It affected 296,000 sq. miles and about 44½ million people, but the tragedy is said to have been centralized in the states of Rajputana and Ajmer. The extra mortality mainly due to cholera, small-pox and fever which broke out after the famine. It is said that all the characteristics of old famines in India were brought out in this famine, and it was the last famine in which the scarcity of food was felt severely. There were two conspicuous features: one, an exceptionally large cattle mortality; and another, aimless wandering of a huge population. The Report of the Indian Famine Commission of 1880 mentions that majority of cattle in Rajputana perished, and vast masses of people moved out of Rajputana at random, with their large herds, in search of food and fodder, and in the aimless wandering many lives were lost. Officers were so much moved by the terrible loss of life in Rajputana that Lord Lawrence laid down a principle at that time that the government officials will be held personally responsible for taking every possible means to avert death by starvation.

Another famine quickly followed in 1873-74 covering Bihar and adjacent parts of Bengal and U. P. It is known as the Bihar famine because of being most severe there. It affected an area of 54,000 sq. miles with a population of 215 lakhs, but the distressed area was 40,000 sq. miles with a population of 170 lakhs. The terrible mortality of Orissa famine of 1866 and of Rajputana famine of 1868-69 was still fresh in the minds of the people and the government officers. It is said that Lord Northbrook was determined not to allow the same fatal results and lamentable history to be repeated in 1874. As a result of this determination and extravagant relief the Indian Famine Commission, 1880 gives credit to

the Government for no death due to starvation. But this view of the Commission seems to be exaggerated, and the view expressed by the Cambridge History of India seems to be more reasonable that 'for the first time in Indian history a serious failure of crops had not produced heavy mortality.'[1] In the dacade 1870–80 a series of famines occurred covering almost the whole of the country. Almost immediately after this famine in North India there was a famine in the Deccan for two years, 1876–78. It affected major portions of the presidencies of Madras, Bombay, Mysore and Hydrabad. It occurred first in the Deccan, and in 1878 was extended to North-West Province and Oudh. It affected an area of 257,000 sq. miles and 585 lakhs people, and was most severe in Madras and Bombay in 1877. The Cambridge History of India considers it 'most widespread and fatal in the 19th century'[2] and the Imperial Gazetteer of India regards it to be 'more widespread than any calamity then on record.'[3] Perhaps the implication is better expressed by the Famine Commission of 1880 which described it as the worst experienced since the beginning of the British rule upto that time, since the latter famines were more severe and widespread than this. In excess of the normal $5\frac{1}{4}$ million deaths occurred, vast tracts of agricultural land were left uncultivated and there were continuous streams of people migrating from different parts of South India to the Western Ghats. This movement was different from that in Rajputana, since it was in search of fodder in the forests of Western Ghats and not for food of which there was no lack.

For about a decade and a half, roughly from 1880 to 1895, there was no severe famine but there had been several local

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1. Cambridge History of India, Vol. VI, p. 300.
2. Cambridge History of India, Vol. II.
3. The Imperial Gazetteer of India, Vol. II p. 518,

scarcities such as in 1884-85 in Bengal, in 1886 in Chhatisgarh, in 1889 in Orissa and from 1890 to 95 in parts of Madras and C. P. In the closing years of the 19th century two severe famines occurred in quick succession. In 1896-97 famine conditions prevailed in North-Western Province, Oudh, Bihar, Bengal, C. P., Punjab, Madras and Bombay. It is said to have occurred almost all over India except the Southern parts of Burma and the extreme South of the Deccan Peninsula. It was most intense in U. P., C. P., Bihar, Hisar district of Punjab, Madras and Bombay. About 3 lakhs sq. miles of land and 695 lakhs people were affected in British India alone, and out of these $1\frac{1}{4}$ lakh sq. miles of area and 340 lakhs people were severely affected. In 1896 plague broke out in Bombay. Total deaths are said to be about 1 million of which $7\frac{1}{2}$ lakhs were in British territory. The Famine Commission of 1880 considered the famine of 1877-78 to be severest, but this time a famine occurred over still wider tract and was as severe. More intensely affected area was greater in 1896-97 than in any previous famine, and another peculiar feature of this famine was that it affected even those parts which were considered almost immune from famine. Vast tracts of cultivated lands were turned into jungles specially in C. P., and whole districts were devastated.

In 1899-1900 another famine occurred which is said to be not so widespread, *i. e.*, not covering as wide an area as the two earlier famines of 1876-78 and 1896-97, but was certainly quite severe. The area affected simultaneously was largest in 1900 ($4\frac{3}{4}$ lakhs sq. miles) but the number of people affected was largest in 1896-97 (695 lakhs). On the whole in 1899-1900 a small area and a smaller population was affected than in 1896-97. Some parts specially in Bombay suffered continuously for three years. The total area affected was $4\frac{3}{4}$

lakhs sq. miles with a population of 60 millions, of which 1·8 lakhs sq. miles and 20 millions people were in British territory. Famine was not acute in North-West Province, Oudh, Rajputana, Madras, and Punjab, but was more severe in parts of Bombay, C. P. and Berar, Hydrabad, Kathiwar, Baroda and Central India. The famine was more acute in those parts of South where the earlier famine of 1896—97 was also severe. Starvation deaths during famine were not many, but it was followed by Cholera and Malaria in which about 1 million persons died in British India alone. Large tracts of cultivated land became waste, and jungle grew over wheat and rice lands. Remarkable features of this famine were high cattle mortality in Gujrat and migration from States into British territory.

For four decades since 1901 there was no serious calamity though localized famine conditions had occurred frequently, such as in 1902–3 in C. P., in 1905–6 in U. P. and Punjab, in 1907–8 in U. P., Bengal, C. P. and Bombay, and in 1918 in Punjab, U. P., Bombay, C. P., Bihar and Orissa. The experience in 1907–8 was a quick recovery and in 1918 was that the effects of the severe failure of rain were little felt.

Bengal Famine of 1943. The most recent severe famine occurred in Bengal in 1943. Several factors precipitated this crisis. At that time Bengal was producing slightly more than 80% of her food supply, and most of the imports being made from Burma which being occupied by Japan in 1942, rice supply from there to Bengal was cut. Midnapur hurricane in late 1942 by destroying about 1·5 millions tons of rice further intensified the shortage. Public nervousness over the fall of Burma and the denial policy by which boats and large rice stocks were removed from East Bengal due to the fear of being used by the enemy made the shortage

widespread and apparent. On being apparent shortage was considerably intensified by speculation, as a result of which rice supply was hoarded mostly in trade channels, and prices rose beyond the reach of the people, and famine conditions prevailed even in those districts where crops were not destroyed by natural calamities. Supplies from outside were made difficult for two reasons : due to general dislocation of the grain market large supplies were not readily available elsewhere, and due to transport bottle-neck, specially the congestion of railways, movement of supplies to Bengal was rendered difficult. Further floods in Damodar river during the monsoon of 1943 held up supplies from U. P. and Punjab. But inspite of all these difficulties a steady stream of grain was flowing in Calcutta from July onwards, but the government machinery failed to distribute it properly, and to keep the situation under control.

The official version is that the basic cause of this famine was the failure of winter rice crop of 1942. The Bengal Famine Enquiry Commission consider high prices to be as responsible as crop failures in causing starvation. The most outstanding causes were the lack of information and failure of both the Central and the Provincial governments to take timely measures. Hence, even after considering the strange sequence of events, coincidence of so many circumstances, and appreciating the wartime difficulties of the government, this famine is to be taken as a man-made affair.*

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*In the beginning the Government being self-complacent and ill-informed could not foresee the magnitude of the crisis, and when it came they miserably failed to control the situation and to take timely measures. Failure of winter crop of 1942 cannot be accepted as the main cause of starvation since distress and starvation deaths occurred in those districts also in which there was no crop failure. Shortage of supply cannot be believed since huge quantities of grain were stored in Bengal which after being decomposed and rendered unfit for human consumption were destroyed. This cannot be taken to be purely an act of caution during war emergency. Further, it was simply an inefficient control and failure of

The Woodhead Commission estimated that about 6 lakhs or 1/10 of the total population of Bengal was affected, and about 1·5 million people died as a result of famine and the accompanying epidemics of cholera, malaria, small-pox and dysentery which caused as many deaths as starvation itself. The immediate crisis was overcome by the relief and the record rice crop in Jan.–Feb., 1944. After the Bengal famine scarcity conditions prevailed in 1948 in Gujrat and in 1949–50 and 1950–51 in eastern U. P., Bihar, Bengal and Madras, and in 1951·52 in Madras, Punjab, Saurasthra and Madhya Pradesh. But none of them was permitted to develop into a major tragedy. The Bengal famine has brought out some very interesting and important facts:

1. High prices were as important a cause of starvation deaths as crop failure. It means that crop security and production stability cannot fully guard against starvation which may prevail as a result of price movements arising out of speculation or trade cycles.

2. Practically all the population which suffered most

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administration that hoarding on such a vast scale could take place, and a greater failure that available supplies could not be distributed, for it is said that trains loaded with grain remained standing in railway yards for weeks and grain could not be distributed. The report of the Woodhead Commission clearly exposed the failure of both the Central and the Provincial Governments to take timely measures and to keep the food situation of Bengal under control. Beside the defective control. procurement and distribution of food, even medical relief, which could have mitigated the epidemics considerably was far inadequate. The same year famine broke out in Bijapur district of Bombay, ceded districts of Madras, Travancore, Cochin and Orissa. But no where conditions were allowed to approach the severity of Bengal, and it was mainly due to the capacity and efficiency of local authorities in organizing relief and controlling food supplies and prices. The fact, which was admitted by the Woodhead Commission also, that starvation was equally due to high prices, shows that failure of administration in handling the situation mainly caused and intensified the tragedy. The failure of administration is further proved by the fact that many famine areas in the province were without relief until the army assisted the civil authorities in organizing food distribution and medical relief in November 1943. A foreign government could easily afford to play with the lives of the people like this

belonged to poorer classes in rural areas. That the grower of food dies of hunger even after producing adequate for his annual consumption, is a serious challenge to the prevailing economic system.

3. A strange coincidence of so many unfavourable events precipitated and intensified the crisis. Such a combination of fresh events can take place again. Hence the belief that the country, after the development of railways and canals, was rendered safe against any widespread starvation, is shattered.

4. Our famine codes were supposed to have developed so well as to be capable of dealing with all eventualities. But they could not meet the situation. It means that under fresh situations the accustomed procedure and measures fail, and our famine codes have to be adapted to fresh problems.

5. How fatal the lack of information proves, and how serious the situation becomes if timely measures are not taken.

6. It has exposed the seriousness of the food situation in the country, and has focussed the attention of the Union and State governments on the nature and the magnitude of the food problem.

Some Remarkable Features. This brief history of famines in India, apparently a chronological statement of dry, uninteresting and unpleasant facts, brings out some very remarkable features.

1. There have been during the last 300 years 26 major famines, and during the last 700 years 17 very severe disasters. It shows that famines are frequent and cyclical. Their periodical recurrence is said to be dependent on sunspot period. In every 5 years there is an annual scarcity, in every 10 years a wider scarcity resulting in a recognized

famine condition, and in every 50-100 years scarcity extending over wide tracts covering fully or partly several provinces. A closer study of famines shows that after about a century (though the period is not very exact) there is a countrywide abnormality in the monsoon. This is not simultaneous all over the country but continues for a number of years in different tracts with the result that starting from one place the scarcity moves from one part to another and thus covering the country within a number of years. It is very interesting and revealing to study the course of this movement and to analyse the factors which determine the direction and speed.[1]

2. For some time a feeling has been gaining ground that due to so much development in the means of transport and irrigation and some improvement in the resistance of cultivators against famines, the chance of a severe famine was almost completely overcome. But the Bengal famine of 1943 has shattered that facile optimism and has further proved that the danger is not over. Really speaking famine is a danger in all agricultural countries, and so long as India is mainly agricultural and depends mostly on the Monsoon, famine due to the failure of rain and consequent destruction of crops must occur, since uncertainty and irregularity are inherent in the nature of the Indian Monsoon.[2]

3. The list of great famines in the recorded history of

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1. We have deliberately avoided the detailed discussion of it here because full discussion would have taken undue space, and probably would not have fitted in the plan of the present work. But we believe that a close study of meteorological phenomena will reveal definite routes and a relationship with certain definite factors.

2. The Imperial Gazetteer of India, Vol. II, p 527, mentions that 'After 1901 the cycle of bad harvests came to an end and the country slowly and gradually recovered.' This remark does not seem to be accurate, since the chances of bad harvests or drought are not over. It can at the most be taken in the sense that for about four decades since 1900 there was no major tragedy, and after the development of transport capacity to meet the famine was greater.

the world shows that out of a total number of 34 famines 18 have occurred in India. The list may not be very accurate but it is indicative of a peculiar susceptibility of the country to famine. This peculiar susceptibility is imparted by two-fold factors : (i) the uncertainty and irregularity of the monsoon, and (ii) small-scale farming, poverty, endemic unemployment and hence lack of resistance when any crop failure occurs.

4. Upto the end of the 19th century famines have exercised a considerable check on the growth of population.

5. At the time of a severe calamity which is usually the result of a strange coincidence of several factors there is generally some extraordinary difficulty. The situation presents a two-fold problem : either it creates new circumstances of which the relief administration had no experience, or the extraordinary difficulty gives the familiar problem an unmanagable shape and size. In Orissa famine of 1865 isolation due to transport difficulties presented an extraordinary difficulty. In Rajputana famine of 1868–70 there was an utter dearth of fodder, and huge wanderings of men and cattle took place. In the famine of 1896-98 in C. P. the reluctance of wild tribes to accept relief on ordinary terms presented a great difficulty. In the famine of 1899-1900 the failure of water supply and fodder enormously increased the difficulties of administration. In addition to these extraordinary difficulties it is seen that in every famine many persons refuse relief until it becomes too late to save them. Besides, this situation explains the repetition of the same mistakes by the government in matters of relief administration, e. g., the wrong estimate of the situation in 1865 in Orissa, in 1873-74 in Bihar and in 1943 in Bengal ; mistake in the relief of the aboriginal tribes in 1897 in C. P. and in 1900 in Gujrat and Khandesh ; hampering of administration

by unexpected immigration in 1868-70 in Rajputana and in 1900 in many British Provinces; and excessive relief distribution in 1873-74 in Bihar and in 1900 in several provinces.

III. FAMINES IN MODERN TIMES.

Modern Concept of Famine. The conception of a modern famine is a state of emergency in which the government recognizes the existence of unemployment on a scale, which in the absence of general poor law, requires special measures of relief. Historical study of this situation shows that with the change of times there have been changes in its nature, causes, intensity and frequency.

Change in the Nature of Famines. It is said that early famines (mostly upto the Muslim period) were food famines, in which actual food shortage was the chief characteristic, and the main problem was of getting food at all. The later famines were simply money or work famines, in which the main characteristic was poverty and the main problem was of obtaining work and wage thereby getting the means to pay for food.* It does not mean that crop failures do not result in food shortage, and food production is removed from the list of famine factors. The implications are that since usually there is no countrywide failure of crops, the development in the means of transport can meet the scarcity at particular place by drawing the surplus from other places; the administrative organization dealing with famines and the system of administrative relief have progressively reduced the distress caused by crop failures; and the government have taken the responsibility of providing work and

*It is difficult to say as to when does this change take place. It is said that the Rajputana famine of 1868—70 was the last famine in which the scarcity of food was severely felt. Really speaking it is not from the beginning of the British Rule, but specially after the construction of railways and the improvement in the administration of famine relief in the latter half of the 19th century that the change came into being.

wage during emergency. Hence, though the country is constantly faced with local food shortage, there is no fear of deaths due to starvation if people have adequate purchasing power to buy food. The earlier famines were characterized by widespread deaths caused by starvation due to non-availability of food, and the later ones are characterized by a temporary dislocation of employment caused by crop failures. At present the idea of food famine is supposed to have banished except from a few tracts which are still inaccesible to trade.

Changes in the Causes of Famines. As mentioned in the opening section of this chapter famine conditions are now created not so much by direct and natural causes as by indirect and monetary causes. It does not mean that natural factors no more cause famines. Really speaking in India they continue to be so. And fresh causes have also been added. The development of transport and irrigation have minimised the power of natural factors in causing famines, and now price variations, caused by monetary and fiscal factors resulting in trade depressions, can also create famine conditions by creating widespread unemployment and lack of purchasing power.

Changes in the Intensity of Famines. In the past famines used to be mostly localized, but now the effects of local shortages are spread over larger areas, and thus the intensity is thereby reduced. The rigour of famine in the form of deaths and suffering is also minimised because relief can now be administered more quickly and widely, and the measures and methods of relief are more scientific and numerous.

Changes in the Frequency of Famines. The change in the conception of famines makes it difficult to compare the

frequency of famines at different periods; and it is difficult to say whether the food famines in former times were more frequent or the work or money famines are more numerous in modern times. There is, however, an impression that famines were more frequent during the Company Rule and during the early period of the Crown Rule than under the native rule. This impression is probably due to the fact that there has been a systematic record of famines during the later times and the accounts of previous famines are comparatively more incomplete.

Regarding the frequency of famines in future there are two contrary views. Some say that the danger of famine is increasing, while others hold that it is gradually minimised. It was commonly believed that during the 19th century revolution in agriculture, development in the means of transport and the methods of food preservation and storage vanished famine from the Western World, and famine was very unusual in the civilized world. But there have occurred several famines since then : Irish famine of 1846–51, Russian famines of 1892, 1905 and 1921–22, China famines of 1878, 1887 and 1916, U.S. A. famine of 1930–31, and Indian famines towards the end of the 19th century and in 1943. Besides there are several things which indicate a growing danger :

(i) There are several chronic famine areas in the thickly populated underdeveloped regions of the world. *(ii)* At present population is causing a famine problem, and population experts predict an increasing pressure on the margin of subsistence which unchecked would breed increasing famines in future. *(iii)* In future there is a possibility of famine in natural resources of the world. *(iv)* The danger of food shortage is entertained not so much on account of paucity of resources as on account of the declining percentage of popu-

lation on agriculture, and *(v)* Widespread unemployment and famine conditions can be caused by trade cycles.

On the other hand the methods of fighting famines are progressively increasing and thus minimising the chances of widespread disasters. The prophecies of population experts are perhaps based on present net increase of population and the existing methods and technique in agriculture, and they do not fully account for the likely modifications in population behaviour and the technological development in food production. In India though population is increasing at a growing rate and the food supply is lagging behind presenting a Malthusian spectacle, there is neither a danger of growing severity nor of increasing frequency because the methods of fighting them, both preventive and protective are becoming more elaborate, scientific and efficient. But this should by no means be taken as immunity from famines, but only in the sense that their frequency is gradually minimised. Famines will come from time to time, not so quickly, and not resulting from single crop failure but work famines on a scale to call for state relief.

Changes in Resistance and Recouperative Power. In the long struggle against nature considerable ground has been gained in the form of both protection and prevention. Among the former by far the best methods have been the development of railways and irrigation works. Other efforts to increase farm prosperity in the form of general administration, land revenue administration, cooperative credit, agricultural improvements, marketing, prices, and animal husbandry, etc., have gradually increased the resistance of farmers. Besides, other improvements, not confined to agricultural classes, such as industries, trade, commerce, banking, ethnological and linguistic surveys, and vital statistics, etc., have

increased the power to fight against famines.* The power of prevention has also increased gradually with the result that the recovery from famines is now much quicker and mortality is less. Though the tales of suffering and mortality in Indian famines are still heart-rendering to the civilized world, they are much less than during past famines. But one class which is still left behind is that of agricultural labourers.

Areas Immune from and Specially Subject to Famines. The areas which receive heavy rainfall (annual average of at least 70 inches or 7,000 or more tons of rain water per acre) and in which the chances of a serious departure in any year are remote, such as coastal strip between the Western Ghats and the Arabian Sea from the extreme south of the Peninsula to the southern boundary of Surat District, Assam and lower Bengal, are said to be safe against widespread drought. The hazard of famine is not very great in areas which are rendered safe by irrigation, such as areas served by large canals and tube-wells in Northern India and the deltas in Madras. Besides in such areas also in which cultivation without irrigation is exceedingly precarious (where rainfall is less than 10 or 12 inches and which are scrub lands fit for grazing), the danger of famine is not great. Beside these areas which are either protected or receive heavy rainfall (approximately 10 lakhs qr. miles), or where agriculture is always precarious, the remaining areas are not safe against the vagaries of the Monsoon and the uncertainties of seasons, and hence they are exposed to a risk of famine.

The parts exposed to occasional drought are the plateau of Peninsular India receiving an average rainfall of 30 inches or less, and in the tract of higher average rainfall Gujrat, Malwa and part of C. P. In these areas scarcity is

*For detailed studies one can look to the Reports of the Famine Commissions of 1880 and 1898,

periodic and it often intensifies into severe famines. Roughly speaking the areas lying between the line of 20" and 30" average rainfall are more exposed to famines. Out of this whole area some portions are recognized famine zones. They are Bijapur, Dharwar, Sholapur, Satara districts and the Deccan States now merged in Bombay; millet growing districts of Anantpur, Bellary, Cudappa, Kurnool, and the paddy growing districts of Vizgapattam and Ramanad in Madras; Rohtak, Gurgaon and Hissar districts of the East Punjab; Kutch State; and some western parts of Rajasthan.

Since famine is related not only to drought but also to many other things scarcity or uncertainty of the Monsoon is not the only determining factor in the liability of any area to famine. In modern times no area can be considered absolutely safe against famine. It can occur anywhere. But in an agricultural country the danger is greater in areas of uncertain rainfall. Famines usually occur where normally rainfall is sufficient for a good crop but a severe departure from the normal brings about an unexpected food shortage.

IV. EFFECTS OF FAMINES.

Famines in India are mostly caused by widespread drought resulting in crop failure. The characteristic features are food shortage, fodder shortage, unemployment on a vast scale, aimless wanderings of men and cattle resulting in a heavy loss of life of both, and epidemics. The extent and intensity of famines vary considerably in different cases, but the basic features being the same the effects are similar innature though they differ in degree. Generally the effects of famines are as follows:—

(*i*) ***Increase in death rate.*** Unless relief is very efficient and rendered in time, there is a temporary increase in

death rate[1] either on account of starvation or due to accompanying diseases resulting from weakened resistance. Largest number of deaths due to famine have taken place in India, China and Russia. During the last 100 years about 20 million people have died in major famines in India. Some epidemiologists say that diseases are the invariable consequence of famines[2] because of debility resulting from food deficiency or from vile food substitutes, e. g., plague in 1348 in Florence, malaria in 1848 in Upper Siberia, typhus in Finland in 1867-68, plague in Bombay in 1896, cholera and small-pox after the Rajputana famine, cholera and malaria after the famine of 1899-1900, and cholera, malaria and small-pox after the Bengal famine of 1943.

(*ii*) *Wanderings and Migrations.* Famine stricken population takes to aimless wandering in search of food. It happened, in most conspicuous manner, in the case of Chalisa famine, the Rajputana famine and the famine in 1876-78. Besides there are permanent movements also to more favoured places.[3] Delafosse mentions such movements from Wadai in 1830. Petrie mentions pastoral people of arid

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1. Mallory from his study of famines in China concludes that food scarcity was the main check on population. In semi-arid Iran also periodic famines kept the population within limits set by the environment. Similarly in India upto the last century famines annihilated huge population periodically. But inspite of a huge number of deaths during famines they cannot be considered as a permanent check on over-population.

2. Ordinarily famines do not produce new or special diseases, but the typical diseases of the locality break out after them. But sometimes a new disease somehow (perhaps imported) breaks out as plague in Bombay in 1896.

3. Permanent movements as a result of series of droughts and frequent famines take place generally in case of nomadic or pastoral people. But famine as a significant factor in inducing the population of a settled economy, seems doubtful. Some agricultural regions of China, Pueblo culture in America, and Gujrat, Malwa and some portions of Rajputana in India have faced countless famines. But there have not been permanent migrations, and on the other hand they have tried to develop a famine proof economy.

regions migrating to richer lands. The Arab Migrations after 600 are said to have started after a great famine, and series of drought between 816 and 1072 kept them in motion. The movements in the northern plain of Hungary from the Steppes are also said to be caused by prolonged droughts.

(*iii*) *Disruption in economic life.* Failure of crops causes unemployment on a large scale. Being accompanied by a fodder famine it causes destruction of cattle on a large scale which means loss of working capital, the main source of power in farming and a major part of the stored wealth of farmers. Vast areas go out of cultivation, at least temporarily. Normal trade is upset. Industries face a lack of demand arising out of the decline in the purchasing power, and state finances are strained.

(*iv*) *Set-back in agricultural progress.* Famine is said to put back the clock of agricultural progress. Stricken villages are deserted. It reduces labour efficiency by lowering vitality. It increases indebtedness and thus reduces the chance of investment in agriculture. Sometimes industrial crops are to some extent replaced by food crops. There is a decline in the level of skill and knowledge due to death of expert farmers, and loss of power due to death of cattle.* Periodical famines not only eat into temporary agricultural prosperities but by developing a fear complex or a sense of insecurity and uncertainty, also check the incentive and the scope for agricultural development. On the other hand they stereotype the agricultural systems and practices.

(*v*) *Effects on social life and customs.* Wanderings break up the settled life. Sometimes the family life is also

*Food and fodder famines need not necessarily go together, as in 1896 Kharif crops grew large quantities of fodder. But generally fodder famine accompanies food famine And Moreland aptly remarks that 'fodder famine is the worst calamity that can befall the people.' (Moreland, Agriculture of the United Provinces, 1921, p. 122).

broken. Famines are reflected in religious beliefs, ceremonies and rituals in all agricultural commities. They condition some social customs. Sumner belives abortion and infanticide to be protective devices against famines*. And some writers have connected famines with religious exaltation and maina, group movements and social turbulence in Europe in the Middle Ages. In India the worship of rain god, the elaborate ceremonies before and after the harvests, the typical worship when the monsoon gets delayed, charitable disposition of Indian rural masses and social responsibility of destitutes, etc., seem to have originated in crop failures and agricultural insecurity.

(vi) Prolonged difficulties of rural communities. During famines the rural communities suffer most. Though unpleasant, it is a fact that the producers of food die of starvation during famines. And it is a greater pity to find widespread starvation not due to the lack of food but due to man-made economic factors. In a country where famines occur rarely the effects are likely to be ephemeral, but where it is a recurring phenomenon the effects are lasting. Besides in economically advanced countries, the power of resistance being greater, the effects are relatively more temporary, and the recovery is quicker. But in a poor country like India, the effects are lasting, and the recovery is very slow.

(vii) Constructive institutions and measures. Sometimes famine conditions give rise to constructive institutions and measures, which are intended to reduce the chances of famines and to increase the capacity of people to withstand them. The Raiffeisen Cooperative Movement in Germany

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*Cannibalism is seen to have often occurred during famines, but it does not seem to have originated as a regular practice under absolute lack of food. (Southard, Encyclopedia of Social Sciences, Vol. v-vi, p.)

is said to have been organized to meet the needs of famine of 1848. In India the reforms of Chanakya came after the 12 yrs. famines. More recently the Cooperative Movement, the development of railways, the irrigation system and the land revenue policy, are said to be mainly the outcomes of this perpetual and periodic menace.

V. MEASURES AGAINST FAMINES.

Measures against famines have been of two types: (i) preventive, and (ii) protective. The former imply all those policies and measures which aim at checking the recurrence of famines, such as development of irrigation and other agricultural improvements leading to agricultural security, limiting population and other social and economic changes minimising the danger of famines. The latter imply those measures which are adopted to relieve the distress when famine actually occurs, such as distribution of food, provision of employment, remission and suspension of rent and revenue and provision of medical facilities, in short the measures commonly called the relief measures.

Measures taken by Ancient Civilizations. Wherever famines have been frequent attempts of both the preventive and the protective type have usually been made to fight against them. The usual measures were to store food and water. The storing of food as an insurance against scarcity is proved by the stone storage rooms and under-ground granaries found in Harappa and Mohinjodaro in the Indus Valley Civilization, in Lower Egypt in Badarian Culture and in the prehistoric remains of the Swiss Lakeland, and also amongst the savage societies, such as the Maori in New Zealand, the Hopi and Moqui in America.

Examples of famine prevention schemes are the canal irrigation system of Sumer (3000 B. C.), the canals heading

in the Euphrates and draining into the Tigris during Babylonian supremacy, the flood prevention dikes on the Hwang Ho (2000 B. C.), the irrigation works of the Incas, irrigated terraces of Phoenicia, from which the Greeks are said to have acquired the knowledge of irrigation, presence of tanks in South India, the remains of irrigated terraces around Carmel and Gilboa in Palestine, and the irrigation systems of some primitive cultures, such as those of Arizona Pueblos.

Measures under the Native Rule. Some accounts of the development of famine policy and relief seem give an impression that under native rule no adequate and proper measures were ever taken to fight against famines; and hence very often a wrong impression prevails that no effort was made towards famine control and relief by the native rulers, and it is only after the country passed under the Crown Rule that a systematic famine policy and relief grew up. Sleeman complains of the ignorance which prevailed in India in regard to the economic aspect of famine. This can easily be disproved by historical facts about the days of Chandragupta. Canals and wells were constructed as a safety against failure of rain. And during famines poor houses were started and maintained. There were famine relief funds and associations.* Besides history provides innumerable examples of both preventive and protective type of measures being taken during the Hindu and the Muslim periods specially during the days of Muhammad Tughulak, Akbar, and Shah Jahan. The two quite common examples are Jumna Canal inherited from the Mughal times and the canal system of the Cavery Delta coming down from remote antiquity.

It is said that 'under Native rule there was little thought

*The Imperial Gazetteer of India, Vol. III, p. 478.

for, and no effective means of remedial action. Occasionally a large relief work was started and spasmodic attempts were made to send food to famine-stricken areas. But primitive transport could not enter fodderless and roadless country and so broke down where most required. The people wandered and died in thousands, the country was desolate and the revenue was not collected. Conditions scarcely changed in the early days of the East India Company, but by degrees a scheme of systematic relief grew up. The modern view of the responsibility of the State was not reached, however, until India had passed under the Crown.'[1] In a similar vein the Cambridge History of India mentions about famines in the Muslim period that 'as long as districts were land-locked and populations were isolated famine relief was largely regarded as hopeless. Alms giving, storage of food grains in central towns, remission of revenue, digging of wells, were palliatives occasionally resorted. But no attempt was made to stem the full tide of starvation and ruin.'[2] But in view of the circumstances of these days and the difficulties of overcoming a severe distress, any blame of the then administration, not to have fully stemmed the tide of starvation and ruin, or not to have developed some effective remedial means, or not to have formulated a systematic scheme of famine relief, in the modern sense of the term, is wholly unjustified. The nature of contemporary measures in Europe lends support to our contention that anything better, though theoretically possible, was hardly practicable. Under those conditions to counteract a famine or even to mitigate it materially was beyond the power of man. This does not mean that nothing better was at all possible, and the native rulers presented supreme examples of famine policy and

1. History of Ancient India,
2. Cambridge History of India, Vol. VI, p. 296.

relief. But at the same time the impression that the famine policy and relief began by the East India Company and was systematized only after the country passed under the Crown, is not correct. The facts, that the effects of the measures taken by the native rulers were trifling, and the actual deficiency of food was the most conspicuous factor in famine situation, cannot be denied. But that does not prove that little effort was made by the native rulers towards famine control and relief. Moreland's view is more balanced when he says that '.....though their inadequacy may be obvious, it is not easy to suggest what more could have been done.....and it appears at least doubtful whether the best and most humane administration in the world could have organized imports by sea sufficient to meet the situation.....It would be unjust, therefore, to blame the Moghul administration for failure to avert the calamity which in the circumstances of the time, must be regarded as inevitable'.*

Measures during the British Period. During the days of the East India Company matters did not improve at all, and famines were dealt with such measures as the local governments and the district officers thought proper. No attempt seems to have been made to formulate a general system of famine prevention and relief, though there are instances of storing of grain by government, penalizing hoarding, giving bounties on imports, prohibiting exports, opening poor houses, advancing money for sinking wells, and opening relief works to provide employment during famine days. Relief works were first opened in Madras in 1792 ; and from 1812 onwards the principle of non-interference with trade was adopted. In 1837 local government laid down the principle that while the State found work for the able bodied,

*Moreland, From Akbar to Aurangzeb, pp. 213—14.

the whole community must, as in ordinary times, look after the helpless and the infirm. The foreign government for the first time realized the obligation in Agra famine of 1838. But all these measures were very inadequate; scarcity of food continued to characterize the situation; and famine resulted in heavy mortality. During Company's administration frequent wars devastated large tracts, and information in the form of agricultural statistics, vital statistics and other economic conditions was not known. The foreign power was trying to establish its rule, and the directors were more particular about company's profits and were least interested in country's welfare.*

After the country passed under the Crown Rule conscious efforts were made to deal with famines. The present policy seems so have matured after long experience. In order to understand as to how has it evolved it is necessary to go into the details of famine relief during all the famines.

During the famine of 1860 it was declared that the government would provide employment to the able bodied, and the helpless and the infirm should receive charitable relief by voluntary agencies. Gratuitous relief was provided by charitable public and the government opened ten large relief works. Able bodied men and women who could work were organized in gangs, were housed in temporary sheds and were engaged on earth works on canals and roads. Poor houses were also opened in which some light work was imposed on capable inmates, and the helpless persons were relieved in homes. In all 330 lakhs units were relieved in British territory at the cost of Rs. 27 lakhs of which Rs. 9

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*The remarks of the Famine Commission of 1880 that upto the end of the 18th century 'the position of the British India was not such as either to create any sense of general obligation to give relief, or to supply sufficient means of affording it,' is just typical of the attitude of colonial administration.

lakhs were subscribed by the public. The mortality is said to be less than that in 1837-38. For the first time a special enquiry was made after this famine by Colonel Baird Smith into the causes, area and intensity of the famine. He submitted three reports in 1861, and emphasized two things : (i) famine was due not to want of food in the country but to difficulty of starving people in obtaining food, and (ii) the staying power of the people depended greatly on the land system under which they lived. Some of the modern principles, specially in regard to gratuitous relief, were anticipated by him, but his report did not lead to any formulation of general principles of relief. However, a new spirit about famine policy came into being.

The experience during Orissa famine was that defective estimates prove fatal, and that special difficulties crop up in different cases. The maintenance of land records and agricultural statistics in Bengal, and the development of communications in Orissa was considered essential. In two years 350 lakh units were relieved at a cost of Rs. 95 lakhs, 2/3 of which were spent on import of grain. If the total loss of revenue is added to it, the total cost of Orissa famine comes to Rs. $1\frac{1}{2}$ crore to the government. In Madras in 1866, 210 units were relieved at a cost of Rs. 12 lakhs, and the remission of revenue was to the extent of Rs. 15 lakhs. In Bombay the government spent more than one lakh on relief. Mortality during this famine stirred public conscience. The government, instead of throwing most of the burden on the voluntary agencies, itself undertook the responsibility, and borrowed considerable amount to finance additional canals and railways. Now onwards the old doctrine that the helpless and the infirm were to be relieved by the public, was completety abandoned, but really speaking it was not till 1874 that the responsibility of the State for gratuitous relief

was fully recognized. This time is said to be the turning point in the history of famine relief because the report of the committee presided over by Sir Goerge Campbell laid the foundation of a definite famine plicy. The report is believed to have changed the outlook about famines, and the government began to assume greater responsibility in dealing with famines. Campbell remarked that 'the idea rather prevailed that the Orissa failure was a personal failure which need not occur again'. And John Lawrence, who was Governor-General blamed himself for having accepted the facile assurance of the Bengal government.

In 1868 Lawrence declared in the council that his object was 'to save every life'. He created a Department of Irrigation under Richard Strachey, and an enquiry was conducted into the status of the peasantry of Oudh and subsequently with a view to securing them customary rights an Act was passed. In the case of Rajputana famine it was declared that 'the district officers would be held personally responsible that no preventible deaths occurred' but inspite of it the mortality was great. Able bodied persons were employed on relief works. In British territory Rs. 49 lakhs were spent on relief and Rs. 7 lakhs on gratuitous relief. Revenue was remitted to the extent of Rs. 5 lakhs. In the Province of Agra alone 290 lakh units were relieved at a cost of Rs. 30 lakhs. But imigration from native states swarmed the relief works, broke down all relief system and severely strained public charity. However, a new departure in relif was made in advancing about Rs. 21 lakh to cultivators for agricultural improvements.

In the case of Bihar famine, the terrible mortality of Orissa and Rajputana being still fresh in the minds of the people, Lord North Brook was determined not to allow the same fatal results to be repeated. Hence relief measures were

planned on an unknown scale. About 40,000 sq. miles with 170 lakhs of people were considered distressed for which relief works were started. It is said that 26% of the total population of the famine affected area was relieved, and in some districts percentage increased to 50 or even 70. About 30 crore units were relieved at a cost of Rs. 6¼ crores. Gratuitous relief was given on a very liberal scale. Export of grain from some areas (specially rice from Bengal) was prohibited, and when the private trade was failing it imported grain on its own account (4·8 lakh tons of rice from Burma). The relief was ample, timely, quite successful, but is said to be extravagant. There was no financial consideration but life was to be saved at all costs. An enormous expenditure was incurred on 'a famine of unusual brevity and of no exceptional security'. But a definite improvement was made in famine administration, and for the first time a serious crop failure did not result in any conspicuous mortality. For the first time village inspection (for administering relief) was made which still serves as the basis of modern organization.

In the case of the South India famine of 1876-78 the Government insisted upon imposing proper tests, since they acquired an experience from huge expenditure in Bihar famine. For the able bodied relief works were promptly opened, and gratuitous relief was also well organized. But on the whole relief was strict this time. Prices were high and private trade was not equal to the demand. The cost of relief in Madras was Rs. 10 mil. and in Bombay 4 mil., though human lives were saved in Bombay to a larger extent than in Madras, where the charitable contribution from British Colonies was £ 78,000. In Hydrabad and Mysore 7·2 crore units were relieved at a cost of Rs. 72 lakh, and revenue remission was Rs. 60 lakhs. In all 70 crore units were relieved at a cost of Rs. 8⅓ crores. A Commission was appointed under

the chairmanship of Sir Richard Strachey which reported in 1880. They fully recognized the duty of the State to offer relief but held that relief should be so administered as not to check the growth of thrift and self-reliance amongst the people, or to impair the structure of the society, which resting as it does in India upon the moral obligation of mutual assistance, is admirably adopted for common effort against a common misfortune. The object of saving life would be far better secured if proper care is taken to prevent the abuse and demoralization which resulted from ill-directed and excessive distribution of charitable relief. In this spirit provisional famine code was formed and promulgated in 1883. It formed a guide and a basis for various provincial famine codes subsequently prepared, which were tested and revised between 1880 and 1896. The Commission insisted upon the need of proper statistical collection of facts relating to the conditions of agricultural community, and in circulating the code the Government laid down that fundamental principle of famine wage : 'the lowest amount sufficient to maintain health under given circumstances.' The main principles of famine relief laid down by the Commission were :

(i) Employment should be provided on the relief works of permanent utility to the able bodied persons, before physical efficiency is impaired by privation, on a wage sufficient to support, on the conditions of performing a suitable task.

(ii) Gratuitous relief should be given either in their villages in the form of grain or money, or in poor houses in the form of cooked food, to those who are unable to work. It required very careful and organized control.

(iii) Food supply should be managed by private agencies ; but if the latter were unequal to the task it should be done

by the state; and if necessary, export of grain should be prohibited.

(iv) Land owners should be given loans for seeds, grain and bullocks, and to open works for providing employment to labourers and tenants, and land revenue payment and rents should be suspended in proportion to the crop failure.

(v) During excessive drought facilities should be provided for the migration of cattle to forest areas.

(vi) Cost of relief should be so localized as to bring home to its administrators a sense of personal responsibility for expenditure.

In the case of 1896-97 the government took advantage of the recommendations of the Famine Commission of 1880, and hence though the number supported on relief was very large, the actual conduct of relief was much better and at a reduced cost. Administration of relief was not on the same basis everywhere, and in C. P. difficulties were rather great because of reluctance of wild tribes to accept relief on ordinary terms. At one time relief was given to 4 mil. people, and the total cost was Rs. $7\frac{1}{3}$ crores. Loans were given to the extent of Rs. $1\frac{3}{4}$ crores, and revenue was remitted to the extent of Rs. $1\frac{1}{4}$ crores. Charitable relief fund amounted to Rs. $1\frac{3}{4}$ crores of which $1\frac{1}{4}$ crores came from U. K. alone.

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*In 1818 the system of Famine Relief and Insurance fund was introduced with the object of providing, through a special tax, as far as possible annual surplus of Rs. 1 crore for famine relief. The original policy was to spent it first on relief and the remaining amount on reduction and avoidance of debt. In the next budget the policy was changed by accepting the view that a large part of it might better be applied to 'famine protective' as distinguished from 'productive public work', and later on railways and irrigation works began to be constructed out of it. Under the Government of India Act, 1919 a provision was made for setting up Famine Relief and Insurance funds by Provincial Governments by earmarking revenue annually for it, and it was invested with the Central Government.

The experiences of this famine were examined by Sir James Lyall Commission, which reported in 1899. They observed that owing to high prices there was a rise in income, in value of land, and in credit, and thus the resistance against famine was increased. In broad principles of relief administration they adopted the recommendations of the Commission of 1880, but in details they suggested some changes including more liberal wage and greater gratuitous relief during rains, and further recommended relief for special cases like weavers, relief for aboriginals and hill tribes, management of the charitable relief fund and gradual extension of decentralized relief work. The general effect of their recommendation was to avoid all risk and to make relief more attractive.

During 1899-1900 the number of persons resorting to famine works was largest than at any previous time. Lord Curzon estimated that 1/4 of the entire population had come to a greater or lesser degree of relief operations, which were very liberal. There was laxity in tests and revenue was freely suspended. In July 1900, 18% in famine stricken areas in British India were on releif, and at one time 6⅓ mil. were on relief. In all 114 crore units were relieved at a cost of Rs. 10 crores, and the total cost was Rs. 15 crores. In order to improve the administration in States as in British India the Government gave them 3⅓ crores. Charitable relief amounted to Rs. 140 lakhs of which 88½ came from U. K. alone. When the famine was over people did not leave relief works due to high wages there, and secondly because after two successive famines they were not sure that the good season has really set in. The conditions were examined by Sir Antony MacDonnell Commission, which reported in 1901. They thought that taking the famine period as a whole relief was excessive, and hence suggested some

modifications. The cardinal feature of their recommendations was 'moral strategy' or 'putting heart into people.' Believing that if people were assisted in the beginning they would help themselves and if their condition was allowed to deteriorate it would proceed on, they emphasized a policy of 'prudent boldness' starting with early suspension of rent and revenue, prompt and liberal distribution of takavi loans for the purchase of seeds, cattle and sinking of temporary wells. They further recommended: enlisting of non-official assistance on a lage scale; appointment of a famine commissioner in a province where relief was extensive; strict regulations of relief in certain respects; preference to village works in particular circumstances in comparison to large public works which had hitherto been the backbone of relief schemes; dealing with fodder problem to save cattle; considerable increase in rolling stock on railways; agricultural banks of 'Raiffeisen' type to be established; state irrigation work to be pushed on; and methods of agriculture to be improved.

In 1907-8 the policy of moral strategy was followed, prompt assistance by extremely liberal advances for preparation, sowing, and irrigation was given; there was large remission and suspension of revenue; and relief was distributed in areas other than where relief works were started. Out of 13 districts declared as famine stricken, test works were started in 11, and gratuitous relief was given in 26 districts to persons at their homes. About 3 lakh persons

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In 1900 The Indian Peoples Famine Trust was created with the initial donation of Rs. 16 lakhs by Maharaja of Jaipur. The fund was invested in government securities to be held in trust. It increased to 30 lakhs by private donations, and further increased in 1934 by transfering a fund of the U. P. Government. Income from this investment was to be spent on relief due to famines and floods. In the Act of 1935, no provision was made for a separate relief fund, but the provincial governments instituted new famine relief funds which remained invested in securities of the Central Government.

received different kinds of relief, and $1\frac{1}{2}$ lakh workers were employed on relief works. The total cost of relief was about Rs. $2\frac{3}{4}$ crores. The character of relief was changed because of changed circumstances which were mainly : expansion in canals and railways ; high prices ; rise in wages; increased employment on public works, industrial and building operations ; emigration to colonies ; and lesser dependence of labouring classes on agriculture.

In 1918 relief measures were taken under the Famine codes but at any time the maximum number on relief was 6 lakhs. The manner in which the crisis was surmounted showed an increased resistance amongst masses, though high prices caused much silent suffering.

The system of famine relief is gradually settling down, its basic principles are no more questioned, and the diversity in actual practice is being minimized in each successive famine. But the difficulty of government relief is inherent. The reluctance of those who are unaccustomed to relief, and the eagerness of those accustomed to famine to seek relief, are said to remain perplexing to officers as they have been in the past. But the system of relief is becoming more efficient, elastic and adaptable. The most common horror of famine (absolute dearth of food) is now unknown because railways have revolutionized relief, and private trade pours food where required. Since the administration is freed from the basic necessity of finding food, and is supported by agricultural intelligence and other social conditions, it has been able to solve other difficulties more successfully. The elasticity of the system is increased because the test works[1]

1. Test work is an ordinary work employing unskilled labour usually earth-work The conditions are strict but not unduly repellent The object being to ascertain whether the people really need relief,

and relief works[1] are organized with due regard to the feelings of the people. People unable to work are relieved in their villages and special treatment is made with the respectable poor. Habitual beggars are sheltered, clothed and fed in poor houses,[2] weak persons are specially treated, children are being fed in kitchens, infants whose mothers cannot nurse them are given milk, and deserted children are separately cared for. An elaborate scheme for forest and hill tribes is worked out, and artisans, who formerly suffered on ordinary relief works, are now helped in their own trades. Non-official aid and advice are enlisted ; and every effort is made to prevent the loosening of moral and social ties. The strictness of government relief, being confined to the provision of necessaries, is softened and supplemented by private relief funds to which the whole world subscribes. 'We may surely think that the day of isolated experiments and costly blunders have for ever passed. Out of failures and disappointments has come a broad, deliberate and well-tested policy, a mature and effective plan of compaign. Nonetheless will it always be essential that such compaigns should be conducted by devoted and efficient public services, by men equal not only to the ordinary task of administration but to those extra tasks which are imposed by grave emergencies.'[3]

VI. PLAN OF MODERN FAMINE COMPAIGN.

The plan of modern famine compaign is an elaborate scheme, and a complete machinery for relief exists. It is

1. Relief work is a public work on which during emergency employment is provided to a large number for comparatively longer time on a wage sufficient to maintain health under normal circumstances.

2. A poor house is a temporary structure run up in a few day, where paupers are sheltered and given cooked food under conditions of decency and discipline.

3. The Cambridge History of India. Vol VI. p. 313.

rightly said that 'inspite of inevitable defects a modern Indian famine compaign is one of the most remarkable achievements in history of scientific administration.'* The various steps in the plan are as follows :—

(i) *Standing preparations.* In ordinary times standing preparations are made on a large scale, and programmes of suitable relief works are revised annually in every district. Country is mapped into relief circles, and plans are kept ready. The Government is kept informed of the meteorological conditions, crop conditions, prices and birth and death rates, etc.

(ii) *Danger Signals.* A regular watch is kept on the danger signals of approaching distress, and a forecast of the probable failure of rain is made. When rain actually fails preliminary enquiries are started.

(iii) *Preliminary action.* As the uneasiness intensifies the Government declares its general policy and makes the necessary financial arrangements. Great importance is attached at this stage to 'moral strategy'. Meetings are held, policy is explained ; non-official help is enlisted and encouraged to undertake local improvements to employ labour; committees are appointed to organize private charity, villages are inspected and preliminary lists of helpless persons who may require gratuitous relief are made. This gives confidence to people, who are further given liberal advances of money for agricultural purposes and sinking wells. Detailed enquiries about crop failures are also made at this stage with a view to suspend rent and revenue. If the number of paupers is found to be great poor houses are opened where infirm are given gratuitous relief.

(iv) *Period of test.* Test works are started for providing employment. This is an anxious stage, since if the tests are

* Imperial Gazetteer of India, Vol. III, p. 479

lenient the Government is put to unnecessary expenditure, and if they are too strict the situation may not be grasped. The condition of those who seek employment on test works is closely watched, and the condition of those who stay in villages is also inspected. The death-rate is also scrutinized.

(v) *Period of general relief.* When the test works or village inspection disclose real distress, relief works are opened according to the principles given in the code, and village inspection staff is increased. Lists of persons entitled to gratuitous relief are revised, and the distribution of gratuitous relief begins. By about the end of December in the famine year the number on relief is generally large and continues to increase till March. The reaping of rabi harvest and the ripening of mango crop draw workers from relief works, but they return mostly by the end of April. In May the distress is said to reach its maximum and cholera generally breaks out. But the medical help is kept ready all the time.

(vi) *Rains policy (the beginning of the end).* With the beginning of rains the policy changes. In the interest of the country and the people it is considered important that the agricultural conditions should be restored as early as possible, and as large area should be sown as possible. Hence relief works are generally closed and people are moved from large works to small works near their villages at the end of May. Local gratuitous relief is extended, and liberal advances are made to agriculturists for buying agricultural equipment. As soon as rains break out relief workers return to their fields, those who stay on are encouraged to return to villages when the demand for labour springs. A few relief works are kept open in case of need, and those who cannot work and require relief are given it gratuitously. The able bodied are to support themselves and the weak are supported by the State.

(vii) *Closure of relief.* When the earliest of the principal kharif crops ripens, the few remaining relief works are closed gradually, gratuitous relief is discontinued, and the recipients are given a valedictory dole. And during September and October quinine is distributed in large quantities.

CHAPTER VII

Resource Utilization (Land Resources)

I. RESOURCE ASSESSMENT.

Resource Concept. Natural Resources are popularly defined as the environmental aspects or the materials and forces bestowed by nature upon a region, and utilized by man in the satisfaction of wants*. To be objective they include all those things which are originally conserved by nature in the form of a fund or a perennial flow in all the spheres of the physical environment, viz., atmosphere (gas), hydrosphere (water), lithosphere (upper crust of earth and rock), centrosphere (inner strata of the earth which is accessible) and biosphere (organic objects). They imply, in short, all natural things which lie within the reach of man and can be manipulated for his welfare. When interpreted in a wider sense they signify all the free gifts of nature which spontaneously serve some human purpose. As such they mean all the original elements and untransformed objects of nature, like sun-shine, air, water, soil, plant and animal life etc., including all substances, forces, conditions, spheres, relationships and other aspects constituting or emanating from the environment. In a narrow sense they include only those materials

*Those aspects of the environment which are resistant to human effort and are harmful to it, and even those which affect man's efforts neither favourably nor unfavourably, are not included in natural resources. The frozen summits of the Himalayas, the schorching depressions of the Sahara, the impregnable forests of the Congo Basin, the unconquerable stretches of the Antarctica and the arid uplands of Pamir are mostly inaccessible to modern man, because the environment is resistant to sustained effort. The ocean currents, river floods and storms, in the absence of full utilization prove harmful, and instead of supplementing resources deplete them and hamper their utilization.

and forces which have been actually transformed by man or which are the effects of human effort, *i. e.*, which are made available and useful for satisfying some basic and specific wants. In the former case they coincide more or less with the environment, while in the latter they represent only those forms which are interpreted as wealth by economists*. But neither of these interpretations seems to be appropriate because both of them fail to explain the true implications of the concept of natural resources.

In order to understand the nature and scope of natural resources one thing has to be taken for granted that the earth is the home of man. The underlying idea is 'that the earth is a grand stage upon which mankind is playing the drama of its social history.' In a man-less universe there are no resources though it may be full of a multitudinous variety of materials and forces. The idea of natural resources in its true perspective develops with the emergence of man on the earth. The resource concept, therefore, is relative to man and can be understood only when we take into account the relationship of both the environmental aspect on the one hand and the man and his ability to manipulate on the other.

The original concept of natural resources is embodied in the physical environment or the geographical milieu. The physico-environmental factors which determine the volume and quality of natural resources are: locational (situation,

*There is a distinction between natural resources and economic resources. The former is a wider concept than the latter. The points of distinctions are: (a) Natural resources are original elements of nature while the economic resources are mere derivations, (b) The former present the basic materials and forces which can be put to multiple uses according to intention, while the latter are used for specific purposes for which they are produced, (c) Natural resources are the initial potential indicating the capacity of a people to act or to produce effect, while the economic resources are the effect of potency, indicating mobilized resources for satisfying specific wants, and (d) The former have an esteem-value, while the latter have both esteem and exchange value. (This contrast is really one of degree, because natural things which are scarce and esteemed will be considered as economic goods even if they do not come to the market.)

shape, size, distance, isolation and proximity, etc.), physiographical (structure, relief, soil, minerals, and water forms, etc.), climatic (composition of atmosphere, pressure, temperature, rainfall, humidity, winds, variability and other aspects), biological (plants and animals) and social[1] (man and his works). A combination or a combined influence of these factors determines the resource pattern and the mode of life of the people in a given area. On the other hand, when considered from the view point of, and in relation to man, natural resources imply the appraisal of environment as useful to man, the availability of environment in relation to human wants and the ability to manipulate it, and the functioning of the environment in the satisfaction of wants. The former analysis represents the natural resources in their objective form while the latter consideration imparts them a purely subjective character. But one thing has to be noted. Many aspects of the environment which are lying dormant and are of little use today may be used later on after the advancement of civilization and the improvement in manipulation find fresh uses for them. Therefore, in resource assessment at present only those resources are to be included which are useful to man in view of the human wants and the degree of utilization. Besides, resources vary with the changes in human wants and in the ability to utilize them.[2] Their values are also different for different social groups. Resource appraisal, therefore, is meaningful only in relation to specific time, region and people: and resource concept has to be limited to a given time, a well-

1. Man is treated as a geographical factor, and the social factor being included here should not be treated as a confusion of thought. Man constitutes a part and parcel of natural resources and is an active agent of his environment. In the study of the relationship of the geographical environment and man their mutually determining character and unity should not be overlooked.

2. The traditional view in Economics is to treat land (broadly defined as natural recources) as a limited factor, and that characteristic (relatively greater degree of being limited) distinguishes it from other

defined area and a specific social group.

In the final analysis it is the concept of Resource Relativity, or the functional interpretation of natural resources in relation to volume and quality and also space and time, that gives a clue to the growth of civilization and economic progress. This functional interpretation of natural resources becomes clear when the mutability of natural phenomena is considered. Nature is said to be in a process of 'self-movement,' hence everything is in a state of constant flux, though apparently there seem to be at one moment a process of stabilization and in the next of passing away. This explains the constantly changing character of natural resources which weave themselves into fresh and diverse patterns.* They should, therefore, be considered as living and active embodiment of natural phenomena. There is, however, one thing to note. The environmental change and consequently the change in

factors of production. The resource concept as defined above is of constant flux. The cultural apparatus by finding fresh uses, by giving new meanings to nature and by multiplying contacts between man and his environment, enlarges the significance of nature both in space and time. Multiplicity of human wants, advancement in the cooperative social life, inventions and innovations increasing the technique of resource manipulation, in short, every thing which leads to a greater control over nature, revises the criteria of resource assessment and utilization, and thus enlarges the aggregate of resources.

Secondly, the functional interpretation of natural resources which emphasises man's active participation in the detrmination of resources, does not overlook man's dependence on nature. The significance of nature in human life and social progress is as important in the modern society when man has accumulated a multitudinous variety of tools and apparatus for manipulating his environment, as it was in a primitive society when man faced the nature empty handed and without any artificial aid. Fundamentally even today human life is dependent on natural resources as it was in the beginning of history. The ability of man to free himself from nature is limited. and the modern interpretation of control or mastery over nature is obeying nature.

*Changes in natural resources as a result of the 'self-movement of nature, involve both quantitative and qualitative re-arrangement of substances and forces. As a result of it the old resource patterns disappear, and new ones emerge. In this succession which takes place

resource potential is a progressive flow and not a cyclical movement. It means what is gone before does not come again, but the natural phenomena reappear in new categories and emerge in fresh pattern, more adaptable and useful in relation to time and space. This implies that the movement of natural resources is a dynamic system, and any specific functional position—refering to any time and place—is a dynamic equilibrium, establishing a cumulative process of balancing patterns in the same resource system as between two slices of time. The gradual development of resources begins at one equilibrium, which serves as the starting point, and being destroyed in the next time, gives place to a fresh equilibrium in the next time. What is worth while to remember is that this equilibrium is not a static condition but a progressive element. With the help of this progressive view of natural resources it is possible to measure not only the 'fixed resource situations', *i. e.*, the resource assessment in the satisfaction of given demands at a given time, but also the resource potential, *i. e.*, the degree of resource expansion in successive times.

In these characteristics of change and development of natural resources another fundamental characteristic is inherent, and that is the interconnection and mutual dependence of different resource patterns. Since each pattern is conditioned by surrounding phenomena, there is an inseparable connection, and no resource pattern can be treated in isolation. The mutual or reciprocal conditioning of different resource patterns maintains a balance, and in the utilization of different resource patterns (power, vegetable, animal and

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in a wave-process there is a gradual transition in which not only one quantity changes into another but also a quantity into quality and the vice versa. Secondly, the environmental change is not a cyclical movement (i e., what is gone shall come again). but a progressive flow (reappearance of natural phenomena in new categories never twice in the same pattern).

mineral resources, etc.) the whole resource system of a region must be considered as an entity and a unity. This gives a clue to the basic policy of resource utilization in a manner which maintains a balance between one resource pattern and another on the one hand, and between one resource pattern and the rest of the resource system on the other.

Each resource pattern is related to other patterns comprising its environment. Resource patterns and the environment act mutually, and likewise react to other forces of nature. The root of the resource development lies in these actions and reactions. Though the life-spring of the change in any particular resource lies in that resource itself, the direction of the change is determined by the predominant characters of the environing resource patterns, and the speed is determined by the degree of impact of the surrounding natural phenomena. Correctly understood natural resources represent merely an ecological complex, i. e , a harmonious blending and reciprocal adjustment of the organic to the inorganic resources, and of the whole resource system to its constituent resource patterns on the one hand, and the surrounding phenomena on the other. To be precise they are progressive phenomena, representing a functional character, which may be termed as a dynamic equilibrium establishing a cumulative process of balancing patterns in the same resource system as between different periods of time. The concept is limited to a specific time, area and social group, but there is a constant change in relation to the ability of man to manipulate them. It is upon this concept that economic development should be planned.*

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*For a detailed study reference may be made to : Blache : Principles of Human Geography, 1926 ; Charles Adams : Revolution in Land, 1939 ; Hise and Havemeyer : The Conservation of Our Natural Resources, 1930 ; Zimmermann : World Resources and Industries. 1933 ; G. P. March : Man and Nature, Physical Geography as Modified by Human Action,

Myth of the Bounty of our Resources. Our resource potentiality is often described in exaggerated terms. A view has been prevalent that India is richly endowed with natural resources, and the cause of poverty, lies in the fact that they are untapped. This situation is often expressed in the phrase that 'India is a rich country inhabited by the poor.' This brings out an exaggerated view of our future possibilities, and also affects the policies of land-use and social engineering. The myth of this false philosophy of plenty or inexhaustibility of resources will be clear when we consider the following :—

(*a*) The natural resources are not mere material fixtures of the physical environment (both in quantum and kind, and also in relation to space and time), but they are also measured in terms of the degree of applied effort in resource utilization depending upon the ability of the people to manipulate the resources. Resource strength is, therefore, determined by natural resource potential and the human effort ; and in the resource assessment the latter is more important. Productivity is synomymous with ability, and ability with cultural progress. In view of our social factors—quality and the ability of the people to mobilize resources, and the possibilities of their expansion in the near future, there is no ground for any bright hope. People, in general, have relatively limited technical traditions, and their accumulated experience in art, science and cultural apparatus as exhibited by their productive activities (being confined mostly to the primary

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1864 ; Parkins and Whitaker : Our Natural Resources and their conservation, 1936 ; N. R. C., Regional Factors in National Planning and Development, 1935 ; Bowman : Geography in Relation to Social Sciences, 1934 ; Barrows : Geography as Human Ecology, 1923 ; Huntington : The Human Habitat, 1927, Climate and Civilization, 1944 ; R. K. Mukerjee : The Regional Balance of Man, 1938, Regional Sociology, 1943. Man and His Habitation, 1940 ; Gorkey : Culture and the People, 1945 ; Encyclopedia of Social Sciences ; Pezler : Population and Land Civilization, 1941 ; Ely and Wehrwein : Land Economics, 1949 ; L. A. Salter : Land Economics, 1947. A. M. Lorenzo : Natural Resources and Human Adaptations, 1947.

industries) shows no signs of rapid expansion. The expansion of technical and administrative cadres requires a huge investment in money, material and time. The report of the Scientific Man-Power Committee, 1949 clearly explains the inability to provide the necessary technical personnel even after utilizing our training capacity to the full. The importing of technical know-how has its own limitations.

(*b*) Natural resources per head showing our relative position in comparison to other countries are given in the following table : (estimates refer to the last few years before 1939).*

Countries.	Coal and Lignite Reserves: Coal equivalent. (tons/head)	Potential water power, at ordinary minimum flow. (H.P /head)	Iron ore, Metal Content. (tons/ head)	Arable & other cultivated land. (Arces/head)	Pasture (Acres/ head)
United Kingdom.	3,700	0·015	38·1	0·28	0·40
West Continental Europe.	1,510	0·200	31·4	1·09	0·47
East Continental Europe.	980	0·100	4·1	1·34	0·51
U. S. S. R.	6,300	0·460	94·0	2·35	5·70
U. S. A. and Cuba.	17,000	0·250	48·1	2·66	4·40
Canada and Newfoundland.	37,300	2·270	217·1	5·04	6·78
South Africa.	20,600	0·230	300·1	1·31	10·00
Australia and New-Zealand.	3,580	0·640	20·7	3·74	17·00
Argentina, Uraguay, and Chile.	107	0·480	12·7	4·64	18·70
India.	66	0·100	5·9	1·29	0·52
China.	546	0·050	1·4	0·55	1·78
Japan.	227	0·100	·4	0·23	0·11
All countries listed.	3,000	0·160	24·6	1·30	2·10

*A. J. Brown : Industrialization and Trade, quoted by Baljit Singh, Federal Finance and Underdeveloped Economy, p. 32, 1952.

(*a*) In view of the range and variety of human needs resources carry different scales of value. Volume of production is determined by the magnitude of demand. By far the major part of our population depending on primary production, the level of demand is low. At lower stages of economic growth wants are simpler and less varied. Secondly, in comparison to the people of temperate lands, people in all tropical countries require comparatively less clothing, smaller quantities of lighter foods, and cheaper and simpler shelters. This keeps the demand at a lower level permanently. Besides a temperament of contentment which is characteristic of tropical climate (region of bounty) weakens the will to produce in comparison to the desire of successfully meeting the wider range of wants characteristic of temperate climate (which is termed as a region of effort).

Besides, in view of the relationship between climate and working capacity, a comparative idea of the index of health and vigour may further indicate our relative resource strength, which is as follows* :—

Index of Health and Vigour.

Countries.	Index.	Countries.	Index.	Countries.	Index.
New Zealand	100	Germany	91	Italy	81
Netherlands	98	Canada	90	Czechoslovakia	77
Australia	98	Ireland	87	Greece	75
Norway	97	Belgium	87	Hungary	70
Sweden	96	France	87	U. S. S. R.	70
Switzerland	93	Scotland	86	Japan	69
U.S.A. (White)	93	Latavia	86	Poland	69
Denmark	92	Finland	86	Bulgaria	68
England	92	Estonia	83	Egypt	52
S.Africa (White)	91	Austria	83	India	45

*Huntington : Main Springs of Civilization, p. 254, 1945.

(*d*) As a matter of fact all the known categories of minerals are utilized for some purpose or the other, but what is more important is their occurence in certain workable combinations in close proximity (*e. g.*, coal and iron, lime-stone, gypsium and clays, etc.). This determines the possibility of industrial growth.

These are weighty considerations specially in matters of land policy and population policy. An exaggerated view of resource potentialities should not lull us in any sense of security and optimism regarding the future, but it should remind us of our limitations. And instead of allowing the blind biological forces to determine the number in the hope that full utilization of the dormant resources will result into plenty, there is an urgent need of proportioning the population to resource utilization.

Resource Classification. Several criteria can be adopted for resource classification. From a historical point of view, while tracing the successive resource patterns as used by man in the process of evolution, there are three categories :

(*i*) Vegetable materials, which the primitive man used first,

(*ii*) Animals, which he made use of after using the first, and

(*iii*) Minerals, which man used later on.

From a sociological point of view, *i. e.*, evaluating the physical forces from human focus, and keeping in view the basic products, the following classes are made :

I.	Food stuffs.	Primary foods. Supplementary foods.
II.	Raw materials.	Organic. Metallic. Non-metallic.
III.	Power resources.	Animate. Inanimate.

From a geographical standpoint, *i. e.*, considering the original elements and not the basic products derived from them, and keeping in mind the sources, resources are classified as follows* :—

I. Classes of Land utilizing the Earth's surface.

1. Agricultural Land.

(*a*) Humind Area. { Cultivated Land. / Pastures. / Woodlots.

(*b*) Arid Area. { Irrigable. / Non-irrigable. { Grazing. / Dry farming / Desert.

2. Forest Land. { Forested. / Cut-over

3. Environment and Recreational Lands.

4. Site Purposes. { Urban. / Non-urban.

II. Water Resources. { Usufructary uses { Riparian. / Water power. / Fishing. / Navigation

Proprietary uses { Irrigation / Domestic, and / Urban uses.

III. Sub-surface appropriation. { Minerals. / Land beneath water.

IV. Super-surface uses. Aeroplane, radio, air rights, etc.

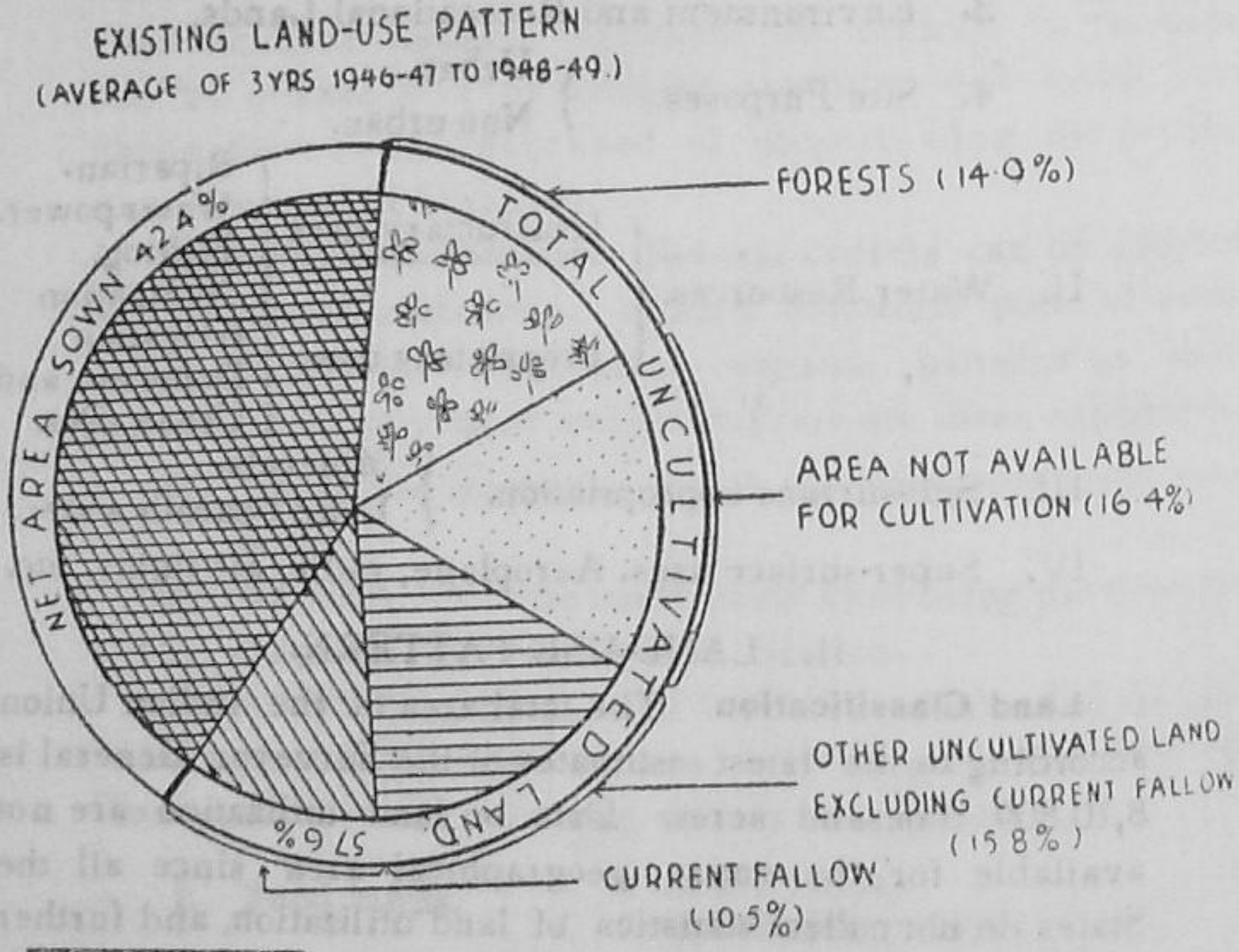
II. LAND-USE PATTERN.

Land Classification. The total area of the Indian Union according to the latest estimates of the Surveyor General is 8,10,809 thousand acres. Data on land utilization are not available for the entire geographical area since all the States do not collect statistics of land utilization, and further there are pockets which are left out of account even in the States where such statistics are collected. In 1947-48

*These broad classes are used by Hise and Havemeyer : The Conservation of Our Natural Resources, 1930 ; quoted by Ely and Wehrwein : Land Economics. p. 49, 1949.

figures of land classification were available for 5,83,682 thousand acres, *i. e.*, for 72% of the total area. The existing land-use pattern of the Indian Union is as follows[1] :—

Land Classes. (1948—49)	Thousand acres.	% to total.
Total area according to village papers.[2]	5,81,148	100'0
Area under Forests.	86,960	14'9
Area not available for cultivation.	93,117	16'1
Other uncultivated land excluding current fallow.	93,136	16'1
Current fallow.	63,124	10'9
Net area sown.	2,43,825	42'0



1. From an unpublished Govt. Report. Most of the unclassified area appears to be unsuitable for cultivation because of being hilly or mountainous, or desert or arid and is mostly situated in part B and C States and Andaman and Nicobar Islands.

2. Includes 986 thousand acres for which details of land classification are not available.

Land Classification in different States formed on the basis of post-Independence administrative set-up is as follows :—

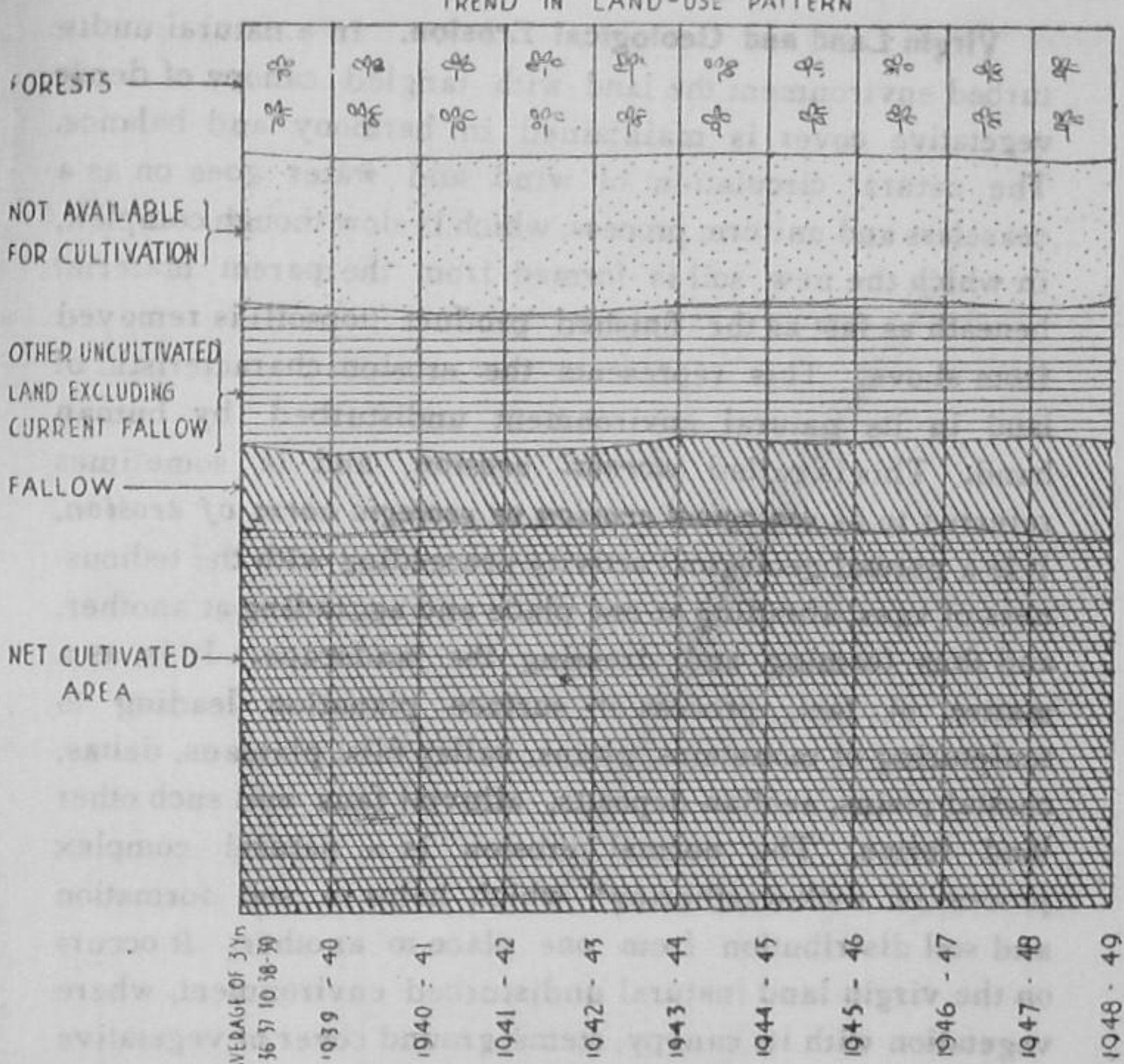
(Thousand acres. 1948—49)

States.	Total area.	Forests.	Not available for cultivation.	Other uncultivated land excluding current fallow	Current fallow	Net area sown
Assam	33,400	4,200	4,248	16,887	1,708	5,371
Bihar	44,330	6,612	6.382	6,516	7,174	17,646
Bombay	58,049	8,913	7,056	1,934	6,883	33.263
Madhya Pradesh	82,997	23,572	5,965	20,098	4,784	28,578
Madras	80,796	13,515	14,424	11,874	10,049	30,934
Orissa	18,053	2,412	4,775	2,997	1,415	6,454
E. Punjab	23,236	769	6,172	2,454	2,315	11,526
Uttar Pradesh	71,428	7,502	11,859	10,311	2,727	39,029
W. Bengal	19,549	1,709	3,044	1,925	1,244	11,627
Hyderabad	52,927	6,187	8,232	1,016	15,171	22.321
Jammu & Kashmir	3,360	417	1,102	408	487	1,036
Madhya Bharat	22,552	2,738	4,899	5,032	927	8,956
Mysore	17,385	1,957	5 705	1,460	1,807	6,456
PEPSU	6,491	78	469	902	656	4,386
Rajasthan	20,669	655	4,223	4,544	2,862	8,385
Saurasthra	1,397	7	155	222	...	1,013
Tranvancore & Cochin	5,350	1,542	482	429	68	2,829
Ajmer	1,561	47	596	305	274	339
Bhopal	4,432	988	914	592	358	1,553
Bilaspur	285	36	29	131	11	78
Coorg	1,012	331	250	226	40	165
Delhi	366	...	75	54	13	224
Himachal Pradesh	2,305	747	412	527	42	577
Kutch	4,974	108	1,407	1,200	1,868	222
Tripura	2,634	1,715	17	501	4	397
Vindhya Pradesh	1,610	203	315	440	192	460
Total	5,80,162	86,960	93,117	93,136	63,124	243,

Trend in Land Classification. The area under different land classes is not strictly comparable between different years because of the different areas covered in different years. Their relative importance, as indicated by the percentage of area under various land classes to the total area, is meaningful, and is given in the following table :—

Land Classes.	Average of 3 years.		Adjustment during the last decade.
	(36-37 to 38-39)	(46-47 to 48-49)	
1. Forests.	14·9	14·9	...
2. Area not available for cultivation.	16·6	16 4	−·2
3. Other un-cultivated land excluding current fallow.	16·0	15·8	−·2
4. Current fallow.	8·9	10 5	+1·6
5. Net area sown.	43·6	42 4	−1·2

There seems to be no significant variation in any land class. It is really surprising that in spite of the population pressure and the price incentive the net cultivated area has almost stablized around 242 mil. acres or about 42% of the total. This is primarily due to the difficulties of bringing fresh land under the plough and the defective land tenure system, (detailed discussion under agricultural extension). In the first three classes also there is almost no change. But the most conspicuous feature is the gradual increase in the fallow land. The position is expressed in the following diagram and the table.



Increase in Fallow Land.

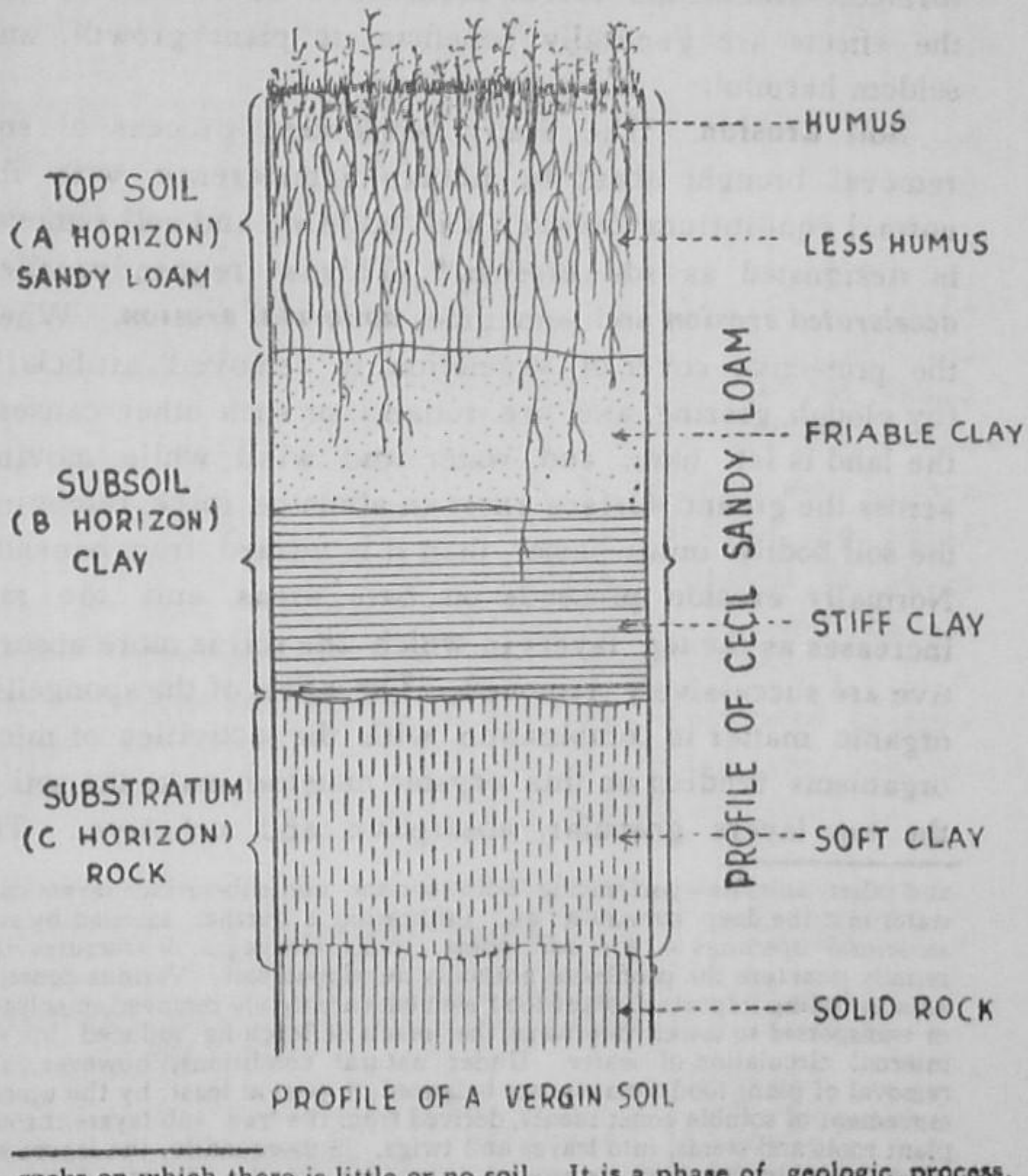
Years.	Area, (Thousand Acres.)	Percentage to Total area.
36—37 to 38—39	48,665	8·9
39—40	51,093	9·2
40—41	47,663	8·6
41—42	50,823	8·6
42—43	48,529	8·7
43—44	48,042	8·6
44—45	49,193	9 0
45—46	55.042	10·0
46—47	57.559	10·2
47—48	60,942	10·5
48—49	63,124	10·9

III. SOIL CONSERVATION.

Virgin Land and Geological Erosion. In a natural undisturbed environment the land with tangled canopy of dense vegetative cover is maintained in harmony and balance. The natural circulation of wind and water goes on as a ceaseless and uniform process, which is slow though complex, in which the new soil is formed from the parent material beneath as fast as the finished product (topsoil) is removed from above. This represents the erosion characteristic of land in its natural environment undisturbed by human hand. This is called ***normal erosion***, and is sometimes referred to as ***geological erosion or geologic norm of erosion.*** It is a normal geological activity proceeding with the tediousness of ages, abrading at one place and aggrading at another, and thus forming and dressing the landscape. It is, as a matter of fact, process of surface planation leading to sculpturing of mountains, plains, valley fills, plateaus, deltas, coastal plains, aeolian deposits, alluvial fans and such other land forms. The normal erosion is a natural complex process of rock-weathering* which helps in soil formation and soil distribution from one place to another. It occurs on the virgin land (natural undisturbed environment, where vegetation with its canopy, stems, ground cover of vegetative litter, with under-ground network of binding roots together with the absorptive stable character of normal humous bound soil), under the impact of forces associated with the natural soil environment (collective influence of vegetation, micro-organisms, climate and physical and chemical activities, etc.). Normally the soil is so processed as to give it those characteristics which impart it a marked resistance to

*Technically speaking there is a difference between 'rock-weathering' described above as normal erosion, and 'rock-erosion'. The latter is that phase of surface wearage having to do with the abrasion of consolidated

surface removal,* and generally the transportation of surface soil by water, wind and gravitational movement takes place



PROFILE OF A VERGIN SOIL

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rocks on which there is little or no soil. It is a phase of geologic process, and man has no causative association with this type of activity ; it is ascribed to the process of normal or geological erosion. But it generally refers to rock surfaces where vegetative cover probably never has been very effective under existing climatic conditions. This erosional activity is the principal contributor to the development of rock gorges and bad lands.

*Mellow, granular, and spongelike, the topsoil absorbs rainfall. Hidden conduits—root holes and the burrowing of insects, earthworms,

at a pace not more rapid than that at which new soil is formed. Hence the soil is maintained in a balance, and the effects are generally beneficial to plant growth, and seldom harmful.

Soil Erosion. 'The vastly accelerated process of soil removal brought about by human interference with the normal equilibrium between soil building and soil removal is designated as soil erosion.'* This is frequently called *accelerated erosion* and sometimes *abnormal erosion.* When the protective cover of vegetation is removed artificially (by plough, grazing, axe, fire, rodents, or such other causes), the land is left bare, and water and wind while moving across the ground surface exert an abrasive force, removing the soil bodily much faster than it is formed from beneath. Normally erosion proceeds on bare areas, and the rate increases as the top layers in which the soil is more absorptive are successively removed. The effect of the spongelike organic matter in combination with the activities of micoorganisms feeding on this organic material make the soil in the top layers granular, absorptive and cohesive. The

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and other animals—perforating both surface and sub-surface layers carry water into the deep substrata; and infiltration is further assisted by such structural openings as the soil pores, cracks, cleavages, or fractures that usually puncture the profiles of normally developed soil. Various constituents including important plant food elements are slowly removed in solution or transported to lower depths as the result of leaching induced by this internal circulation of water. Under natural conditions, however, this removal of plant food elements are balanced, in part at least, by the upward movement of soluble constituents, derived from the 'raw' sub-layers through plant roots and stems, into leaves and twigs. Subsequently, the leaves and twigs return to the earth as ground litter, and, finally through decay, are returned to the soil. In addition to these physico-chemical activities, percolating water further alters the soil profile, especially of the more stable, less sloping areas, by the slow physical transposition of fine soil particles to lower depths (from the A into the B horizon). In time sub-layers thus increased in density may serve to quicken runoff by impeding infiltration. Nevertheless, some degree of balance persists regardless of these natural alterations through the soil profile; and topsoil is developed and maintained. (H. H. Bennett. Soil Conservation, pp. 93—94, 1939).

*H. H. Bennett: Soil Conservation, p. 94, 1939.

underlying layers which are deficient in organic matter are more erodible. These subsoils when exposed absorb water so slowly that heavy precipitation results in rapid runoff increasing the rate of erosion, since the runoff concentrates in greater volume and moves with mounting speed tearing the body of the earth with increasing abrasive effect as the gullies are cut deeper.

Types and Forms of Erosion. Water and wind are the two active forces of soil erosion. Their nature of action is different and so also their outward manifestation. Hence according to the agencies erosion can be said to be of two principal types, which according to the forms may further be classified into several sub-divisions. Besides, the actual soil removal is sometimes a gradual process in which soil is blown or washed away gradually in comparatively small quantities from one place, and sometimes it is a sudden mass movement, in which soil is removed in huge quantities enblock. In brief the two broad types can be classified according to the form of erosion as fellows :—

I. Water Erosion.
- Gradual soil Removal.
  - Sheet erosion.
  - Rill erosion.
  - Gully erosion.
    - U. Shaped.
    - V. Shaped.
    - Combined U & V type.
    - Tunnel type.
    - Cave type.
  - Bank erosion.
  - Wave erosion.
  - Waterfall erosion.
- Mass Movement.
  - Soil flowage.
    - Soil creep
    - Solifluction.
    - Earthflows
    - Debris Avalanche.
    - Mudflows.
  - Soil slippage.
    - Slumping.
    - Terracettes.
    - Subsidence.

II. Wind erosion. (Sheet erosion).
- Black storms.
- Brown storms.
- Local small dust clouds.
- Spirling dust clouds.

1. ***Erosion by water.*** It involves transportation of soil by running water (including rainfall, river, waves, waterfall and moving ice). It is conditioned by several factors, such as slope, type or soil, amount and intensity of rainfall, and land-use practices, etc. Land is more susceptible to washing on sloping areas and where the surface is stripped of the protective cover of vegetation. It is a progressive process intensified by the degree of slope and the intensity of rainfall. Erosion caused by rain water is of the following forms.

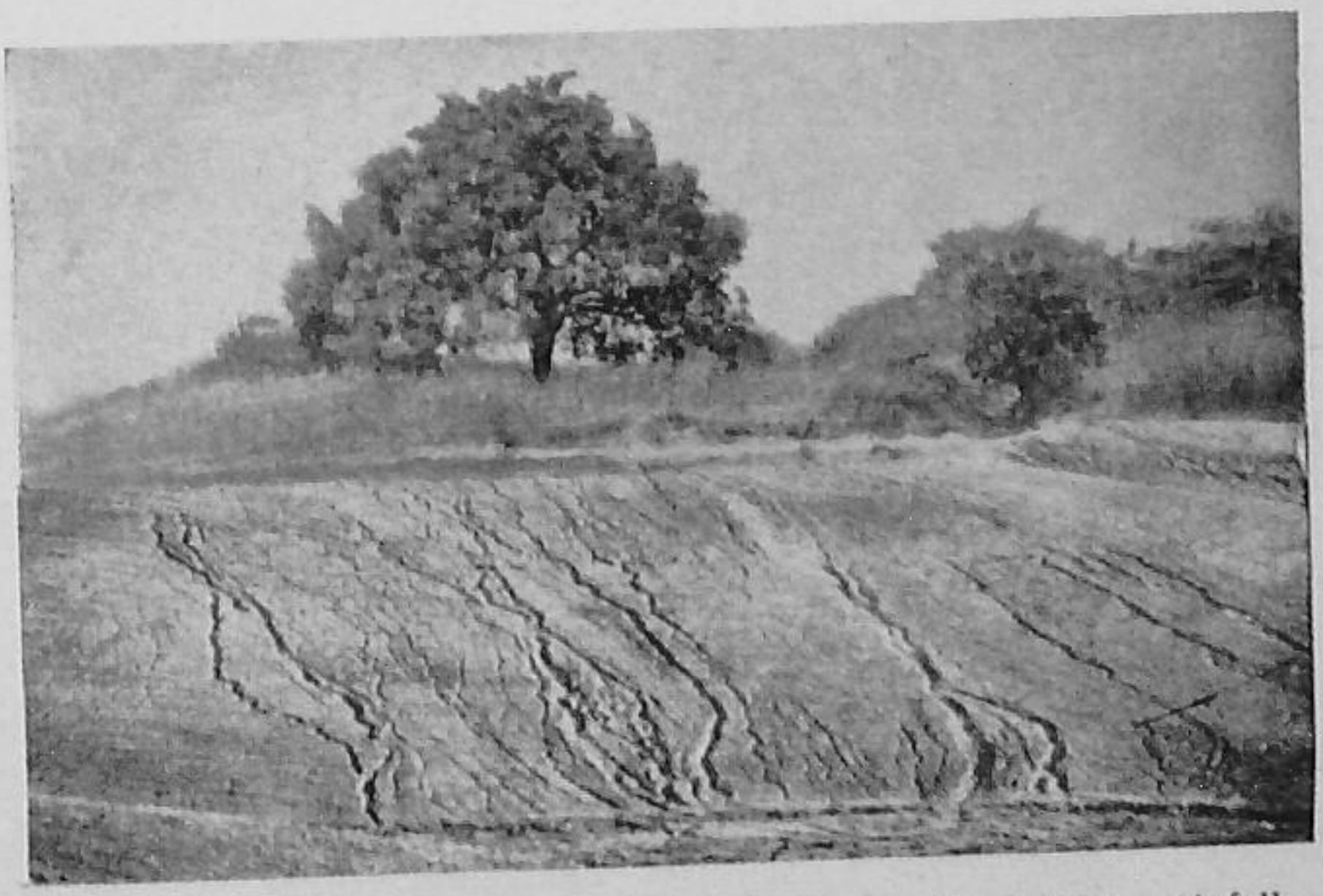
Sheet erosion. When a thin layer of the soil is removed more or less evenly from over the entire segment of the sloping land, it is termed as sheet erosion. Generally it changes the colour of the land, and leads to a progressive decline in the yield. The susceptibility of different lands to sheet washing depends on the character of the soil, topography and climate. Ordinarily it occurs wherever water flows across unprotected sloping areas, but fragile sandy soils, stiff clays, and soils with high silt content and deficient in organic matter are specially prone to sheet washing. Since it proceeds very slowly, it is not conspicuous, but its effect is most insiduous.

Rill erosion. The runoff water instead of flowing evenly over the sloping surface generally concentrates in stream-

*Bennett thinks that this line bends back, i. e., the process begins to reverse after a very long period. On the skeletonized abandoned areas voluntary vegetation comes in and increases in density. Gradually, though exceedingly slowly, the soil rebuilds, and on it vegetation progresses in the direction of the climax type. The grass cover is re-established and eventually the forest returns in original form. But this completion of the circle (eroded land, regenerated soil, and again the rich vegetative cover) takes very long, and the period has not so far been determined. There is, however, some evidence that under natural conditions soil builds back from the raw material of the substrata so slowly that not less than 300 to 1,000 years or even more may be required to replace one inch of top-soil. If soil builds downwards from the surface, as it probably does, much longer time is required to rebuild the second inch, and still longer to restore the third, and so on, until 6 to 9 inches of normal topsoil-depth is thus recreated through nature's slow but persistent efforts.



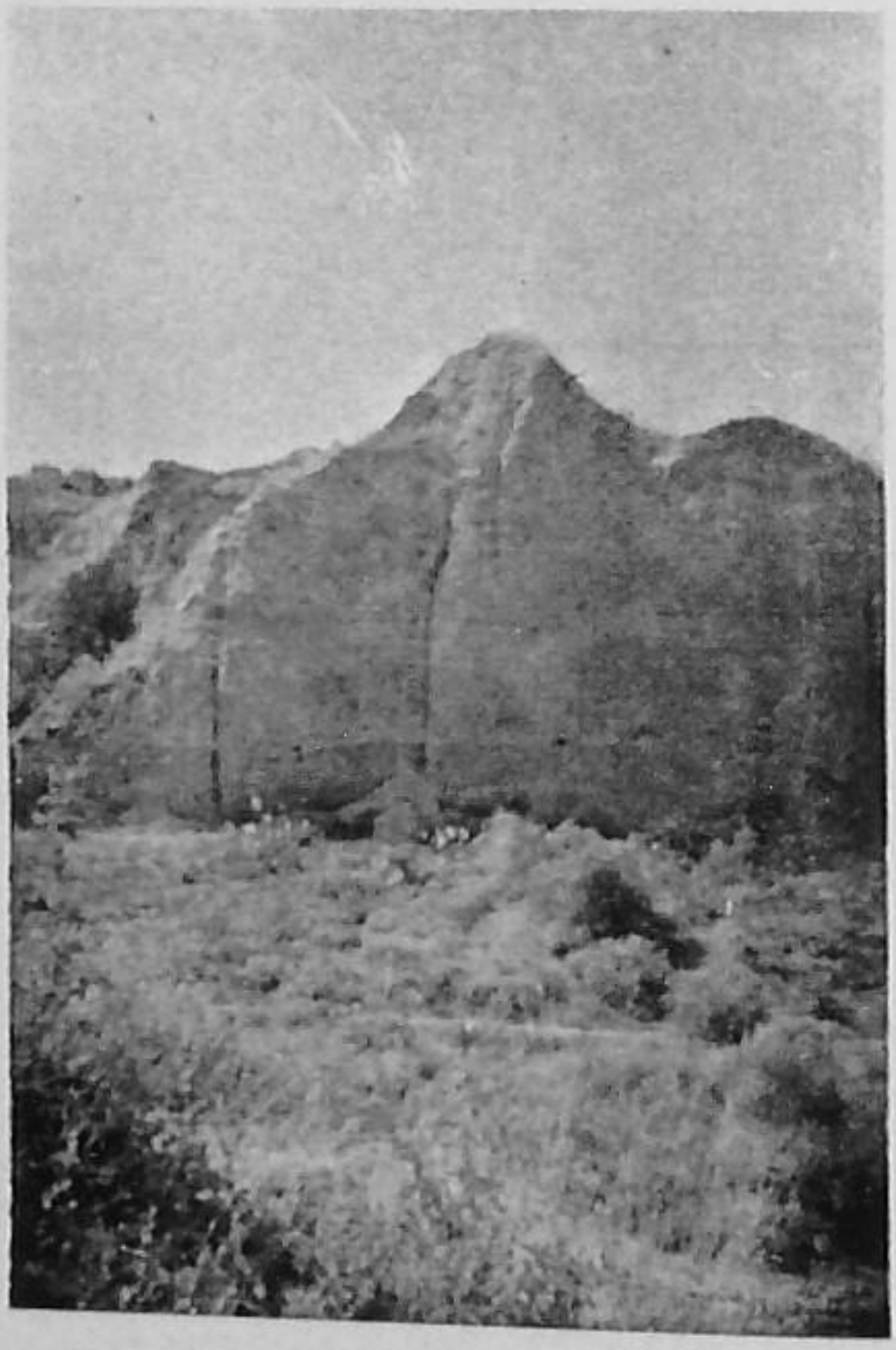
A sloping field washed by rain after being ploughed.



Rills formed in cultivated land along the Jamna after a heavy rainfall.



Gullied land along the Chambal.



A steep cut showing depth of gullies along the Chambal.

lets gathering volume and velocity, and generating cutting power. This cutting action of water carves out small but well-defined incisions on the land surface. Till the small channels so formed are not deep and can be obliterated by ordinary methods of tillage and commonly used agricultural implements, they are termed as rills. It is more apparent than sheet erosion, but as often neglected ; and in respect of damage it is equally serious. It is most common where precipitation is intense and land has a low absorptive capacity. It occurs during heavy rains on all areas where loose soil overlies dense subsoil, but soils with high silt content are more vulnerable. The typical trenching is straight-lined, but frequently the incisons join in intricate criscross pattern.

Gully erosion. When concentrated runoff gathering sufficient volume and velocity cuts deep incisions or gullies, or where concentrated water continues to cut the same groove long enough, land surface is made rugged by deep gullies. Gullies usually cannot be obliterated by normal tillage, and land is rendered unfit for cultivation. Usually it follows sheet erosion, or results from the neglected rills, but often it begins in slightly depressed lands where runoff water normally concentrates.

Bank erosion. It implies widening of streams by cutting the banks. It is a sort of mass movement, and should be considered under soil slippage.

The three forms of erosion caused by rainfall runoff are closely related, and are not mutually exclusive Two or more of them may occur simultaneously in the same area, and one develops into another, Sheet erosion and rill erosion cannot everywhere be sharply differentiated, because the former imperceptibly develops into the latter form. As a matter of fact, in respect of much or most of the erosion commonly considered as sheet washing, there is some grooving of the soil. But broadly speaking sheet erosion implies a more or less uniform removal of a thin soil sheet from over the entire exposed area, and rill erosion refers to the formation of small shallow channels distinctly visible.

Wave erosion. It implies recession of shores, and takes place on sea coasts. This is also a sort of mass movement, and should be considered under soil slippage.

Waterfall erosion. By undercutting the sub-layers mainly at the heads of the trenches it contributes to gully extension, and also helps in development of contributory gullies. The process is more active in soils having soft or unstable sub-strata. This type of erosion is also distinctively effective in cutting away soil at the base of neglected field terraces, particularly where the channels have filled to such an extent that runoff overtops the benched strips.

Mass movement[1]. According to the manner in which it takes place, it is classified into two categories : that which take place by flowage, and that which take place by slippage. The difference is not sharply defined, but is related to the causes of displacements, and hence useful.

Soil flowage : soil creep. Sharpe has defined it as 'slow down slope movement of superficial soil and rock debris, usually imperceptible except to observations of long duration.'[2] It operates on bare lands as well as forested and

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When the process of gully formation starts, the shape is determined by the relative resistance of soil strata, and the underlying rock material. The gullies take several shapes, according to which gully erosion can be said to be of several forms. (a) U-shaped, (b) V-shaped, (c) A combination of both U and V shapes, (d) Tunnel shaped, and (e) A peculiar type generally called Cave shaped. V-shaped gullies change into U-shaped ; the c type, therefore, is a temporary phase till V-shaped gully finally develops into U-shaped. U-shaped gully is the most destructive form of erosion, and most difficult to control. Ordinary dams have not succeeded in checking their growth. Diversion of water from the head and sides is said to be essential for success, and stabilization can be effected by establishing protective vegetation in ravines.

1. Generally the discussion of 'mass movement' is made separately, and is not put under the category of water erosion as we have done. Taking into account the literal sense of the word erosion, a separate treatment seems justifiable. But in the study of the nature of process of erosion, agencies, principles and forms, a broad classification like the one we have made may not be considered very inaccurate.

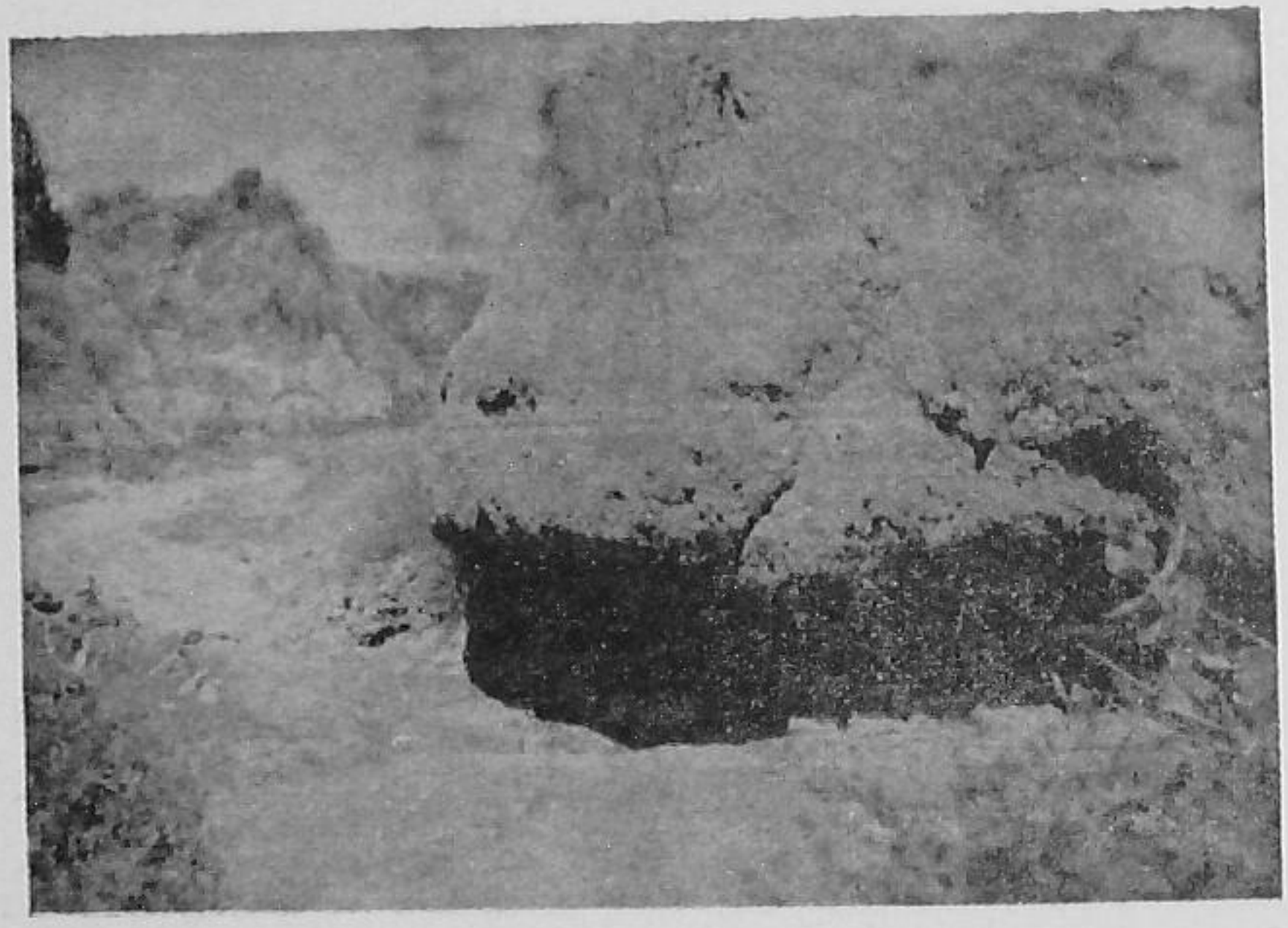
2. Sharpe : Landslides and Related Phenomena, 1938.



Soil slippage along a slope.



A small stream, joining the Chambal, has washed away all the soil from its bed exposing the rocks beneath.



Typical Example of Cave type Gully.

grass-covered areas. It is a surface phenomenon, extending to a depth of a few feet only, and transports vegetation as well as man-made structures. Unlike stream erosion and gullying it proceeds over the entire interstream areas. In different regions the causes are different, but forest is supposed to be the most active agent. The process is specially effective in the climate characterized by frequent alterations of freezing and thawing.

Solifluction. This type of mass movement is most common in colder climates at high altitudes or high latitudes, specially where the soil is frozen to sufficient depths for pretty long. It is not paid much attention, and is not considered very important because it occurs in the climate where human activity is very much restricted.

Earthflows. After the prolonged rains, masses of locally saturated soils, move downhill as earthflows. They are more common in temperate and humid climates; and are commonly termed as slips.

Debris avalanches. It is a rapid form of mass movement, more common in humid areas having good vegetative cover. It usually takes place during or after heavy rains, when the saturated soil becomes heavy and overcomes the force that previously held the soil on the slope. The mass flows rapidly downhill, strips soil down to bedrock, destroys vegetative cover, and usually floods agricultural lands by chocking the channels of streams.

Mudflows. This is peculiar to arid or semi-arid areas, specially where the topography is rugged and vegetative cover is poor. Their frequency and violence is generally increased by man's misuse of land. When heavy rain occurs soil and loose rock are picked up and carried by streams, which can transport boulders and blocks of sufficiently large size.

Soil slippage : Slumping. Mass movement by slippage is commonly termed as 'landslides', which are more commonly smaller, but sometimes very large. Mass of unconsolidated material moves as one unit or as several subsidiary units, down the slope. Slumping is said to be an important process in the recession of shores, widening of stream channels and gullies. The most common cave is undercutting, but slippage of ground water from the base of the bank helps the movement considerably.

Terracettes. This form of mass movement occurs on sloping areas, mostly on pastures. They are only a few feet wide, and are most commonly attributed to trampling of cattle and sheep and goats.

Subsidence. Gradual lowering of the surface resulting from mining operations, or as a result of brick preparation around towns and cities, damages agricultural land. As a matter of fact that is no soil removal as in previous cases. Shallow depressions are produced, where water accumulates and drowns the crops if grown there. The active agent is the human hand. Sometimes subsidence results in deep and sharp open cracks and pitholes, making the land severely broken and unsuitable for cultivation.

There are differences between mudflows and earthflows. One difference is the character of the material carried away. Secondly, the former are found most commonly in stream channels, while the latter are found on valley sides, terraces and convex portions of slopes. Thirdly, the former, like floods recur in the same place, while the latter have no marked tendency to recur in the same area.

Unlike other forms of erosion by water and wind, mass movements do not carry soil or rock out of the region in which they are formed. They simply cause downhill migration of sloping soil, and prevent the formation of deep profiles. Further they prepare the way for erosion.

Wind erosion occurs on lands where water erosion is quite active, but in the same locality the two types rarely assume equal importance,

II. ***Wind erosion.*** Soil blowing generally takes place on all bare areas (level and slope) when soil is loose and dry, but is most serious in areas where there is a considerable slope and low rainfall. It is believed that wind erosion is confined to arid and semi-arid areas. Of course, the most severe damage is done to such areas, but it frequently affects sandy soils of humid regions. The action of wind is like that of a sieve. The lighter and more fertile soil particles are picked up, and lifted to the pathways of high air currents, which carry them to long distances. The coarser and less fertile soil particles skip and roll on the surface, and pile up in drifts behind obstacles. So long as the normal soil equilibrium is maintained under protective vegetative cover, wind erosion proceeds with the slowness of normal geological process. But on bare and relatively flat and undulating areas where wind sweeps unchecked by topographical irregularities, the process is highly accelerated. Unlike water erosion wind erosion cannot be classified into different forms or sub-types. One case of soil blowing is distinguished from another in degree rather than in kind. The severity

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Dust storms, differing mainly in magnitude, are of four types : *Black dusters*. They are associated with westerly winds, travelling at a very high velocity, lasting for about 6 to 8 hours, covering an area of about 1,000 miles in length and 4 to 5 hundred miles in width, and a ceiling height of about 7,000 feet. They occur in summers and are not frequent. Thick clouds of dust ranging from light blue to black colour overcast the sky. *Brown coloured storms*. They are not so spectacular as black dusters, but are more frequent. They are also associated with westerly winds and occur in summers. They generally cover smaller areas than the former, and the velocity of wind is also less. The soil blown is of yellow and brown type, and lesser in magnitude than in the previous case. *Small dust storms*. They are local, and occur on dry and ploughed lands, under the force of gentle winds. They can take any direction, cover comparatively very small areas, wind velocity being less, the soil carrying capacity is also less. *Spirling dust clouds*. They are still more local, and are caused by whirl winds. Sometimes they are only a few feet high, and move a few yards, subsided by smaller obstructions like buildings and trees.

ranges from slight disturbance of surface soil over a small area to major catastrophic storms removing countless tons of soil and sweeping across vast areas.

Water erosion and wind erosion appear to be similar in the sense that both transport the surface soil. But water and wind differ in the nature of their erosive action and also in the outward manifestation. Water erosion takes place down the slope, is controlled more by gravity, and the transported material concentrates along drainage lines, and is carried to or part way to the sea. Wind erosion takes place both on sloping and level areas, and in any direction depending upon the direction of air current. The wind-borne material is laid down anywhere usually so thinly as not to constitute a hazard by accumulation in reservoirs and streams. A basic difference is that slope is essential to water erosion, but it has no direct causal effect on wind erosion. The washed away soil from a field cannot be transported back to the original place by the same agency, but the blown away soil can be transported back under the impact of the shifting wind.

Factors Affecting and the Causes of Erosion. The process of soil removal is four-phazed : runoff, infiltration, absorption, and erosion. These processes are interdependent, and are affected by many factors separately and interdependently. This introduces an almost inconceivable number of factors, some of which are directly related to and are highly significant in the process of soil removal, while others are only indirectly related to and help other factors in their erosive activity. While analysing these factors one feels that 'it would be difficult to conceive an agency involving more modifying factors than soil erosion.' To be brief, it is profoundly and directly affected by the kind and condition of

soil, type and condition of cover, degree and length of slope, and climate* (including rainfall intensity, wind velocity, relative humidity and temperature, etc.). In the second category of factors may be included the changed conditions of surface. Soil and sub-layers resulting from the land-use practices (*i. e.*, methods of cultivation and other practices of farming and grazing), and the conditions and character of different sub-layers successively exposed by progressive planation. In addition to these more evident factors there are some less obvious variables, *e. g.*, mechanical relation of gravitational creep, sliding, soil granulation, fragmentation, dispersion, alternate freezing and thawing and sedimentation.

The causes of erosion may briefly be summarized as: deforestation, over-grazing, shifting cultivation, faulty methods of ordinary cultivation, and the deterioration of village forests and pastures. It is not possible to rate these factors in the order of seriousness. Sometimes a few of them combine to accelerate the abrasive action of water and wind, but more generally one of them is the predominating

*Bennett has explained in detail the nature of activity of these factors. Soil type alone introduces an almost endless variety of conditions that appreciably and profoundly influence the rate of infiltration and absorption, and therefore of runoff and soil denudation. The texture of surface material, its inherent structure and consistence markedly affect rate of water intake, as do also similar characteristics expressed in widely divergent sub-layers through the soil profile, down to and including the horizon of parent material. Cover effects rate of soil removal and runoff more than any single factor Declevity of land and length of slope powerfully affect hydrologic processes inseparably involved in soil planation and runoff. Climate determines the conditions for the type of vegetation. It also influences the distribution of soil, and indirectly the soil type. This can be understood by considering the way in which the soil is formed The surface configuration is also an example of the influence of climate on landscape (e. g , gentle rounded slopes are characteristic of humid areas, and sharp angles and deeply trenched surface are typical of arid regions). Lastly, the types of soil erosion also vary from climate to climate, e. g., gullying and sheet wash are the mechanisms of accelerated erosion in humid regions ; wind is effective mainly in arid and semi-arid climates ; frost action is at the maximum where the temperature crosses the freezing point the greatest number of times annually ; and ice action is mainly limited to polar regions, tundras, taigas and microthermal climates.

cause of erosion, *e. g.*, deforestation is the main cause in the Himalayan foothills specially North Bengal and Assam and Chhota Nagpur hills; shifting cultivation in Assam, Orissa and Bengal; over-grazing in western foothills of the Himalayas, Bihar, Madhya Pradesh, along the Jamna in Uttar Pradesh (the ancient Braj Bhumi), Siwaliks in the Punjab and the lower hills in Poonch in Kashmir; faulty agricultural practices specially in potato cultivation on the Himalayan foothills and the Nilgiris, and the failure to terrace and embank the fields in cultivated lands, and the deterioration of village forests and pastures almost throughout the northern plain.

Effects of Erosion. The most immediate and the most frequent result of the bodily removal of soil by erosion is the change in topographical details of the ground surface. Washing and blowing away of the productive topsoil carry away the available and potential plant food. Gradually the subsoil is approached, which is less productive and more difficult to cultivate. And when the ground is cut into rills, and further into gullies, work of cultivators is multiplied, agricultural operations become more difficult, crop yields decline, cost of cultivation increases, and gradually agriculture becomes more expensive and unprofitable, and ultimately the land being rendered unfit for cultivation, agriculture is abandoned and population migrates to other areas.* The effects of erosion are not confined to those areas only which are stripped of their productive topsoil by water or wind, but adjoining areas, sometimes to a long distance, are also affected.

*This erosive process of biting, cutting and tearing the landscape continues in a vicious straight-line process to impoverish the soil, to ruin the land, to make agricultural land barren, to disintegrate rural communities and ultimately resulting in the decline of the nation.

Considerable damage is done by erosion deposits. The finer, lighter and more fertile material is carried to long distances, or is transported to sea. The material carried in suspension by running water, and the wind-assorted sand (subsoil material and heavier residue) are spread over adjoining lands. The deposited material is unproductive, it impoverishes lower slopes and alluvial plains, and flattens the low-lying areas where the rate of flow is diminished. Damage by deposition increases to tremendous proportions and extends to larger areas during floods and violent dust storms. The creeping of the Thar desert towards the east threatens the portion of Rajasthan and South West part of U. P. specially the Agra Division, is a conspicuous example.* Besides, the deposits pile up in huge quantities behind dams, in natural and artificial waterways, and in harbours. Silting of reservoirs reduces their storing capacity, cuts short their life and tends to spread out stored water, and exposes a broader surface to losses by evaporation. It reduces the life and value of costly structures constructed for the purpose of irrigation, flood control, power production, municipal water supply and recreation. Erosion debris clogs small streams, shoals navigable waterways, reduces the carrying capacity of drainage canals and impaires the effectiveness of irrigation system. Sometimes streams are forced from their natural course, damaging the banks, and accentuating the problem of flood control. Navigation is threatened in harbours and streams, and expensive dredging operations are n (c ssitated. When the absorptive topsoil is removed,

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*Recent topographical surveys show that the Indian de of Rajasthan has been spreading outwards in a great convex arc th ro Ferozpur, Patiala and Agra towards Aligarh and Kasganj at the of about half a mile per year for the last 50 years, and is encro ing upon approximately 50 square miles of fertile land every y

tively impervious sub-soil is exposed on which water moves with increased speed. The concentrated runoff discharges into streams, at a great speed and an enormously increased quantity of water, causing floods. Besides, erosion debris which accumulates in channels reduces their carrying capacity, and helps in raising the crest of floods. In addition to the creation of the problem of surplus water, erosion is connected with drought, and intensifies water shortage, by interfering with the normal process of intake and percolation, and consequently reducing the soil and sub-soil water leading to the decline in water-table. It also damages the transport system. Roads, railroads and embankments are undermined, cut and sometimes washed away, and traffic is impeded and sometimes blocked by erosion debris.

Considered in terms of economic and social consequences, it is a threat to human security since it removes the soil which is the basis of human life. It is termed as a 'creeping death." Besides, the effects are not confined to land, man and animals are permanently undernourished. 'It is not merely soil that is going down the slopes, down the rivers, down to the wastes of the oceans. Opportunity, security, the chance for a man to make a living from land, these are going too.' The effects on agriculture are far reaching and profound, and the economy that fundamentally depends on soil is adversely affected. It leads to lower returns, sub-marginal cultivation, and in extreme cases abandonment of agriculture and rural migration Farmers run into debt, land mortgages increase, tax base is reduced, and the market for industrial products shrinks. Summarizing the effects of soil erosion Bennett observes that 'the process, if

uncontrolled, impoverishes not only the land but those who live on and by the land, as well as communities and urban areas dependent in part or entirely on the welfare of the farmer.'[1] The effects of soil erosion are exhibited in the most striking form by the downfall of former civilizations and empires whose ruined cities now lie amid barren wastes that once were the world's most fertile lands.

Extent of Erosion. The extent of erosion is referred in two ways: the total area affected and the extent of soil loss. Information in India about both these aspects is rather inadequate. Spectacular damage on slopes in the form of gullies has been commonly observed, and for long, but the less spectacular damage on flat lands in plains in the form of sheet erosion and loss of fertility is not properly realized. It has been noted only recently.

As a matter of fact accelerated erosion is as old as agriculture itself, and on all sloping grounds which are stripped of the protective vegetative cover or permanent grass, and on all arable areas not properly terraced and embanked throughout the country, erosion is always going on. The peninsular India is geologically an eroded peneplain, which assumed its present shape much earlier to the seismic changes resulting in the uplift of the Himalayas. In the hilly and mountainous portions of Northern India erosion is of comparatively recent origin. But at present a very large area is affected. A rough estimate is that 'erosion is lowering the productivity of 150 million acres.'[2] This refers to the land under cultivation at present being damaged by erosion gradually, and is in addition to the badly eroded gullied land which has gone out of cultivation.

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1. H. H. Bennett : Soil Conservation, P. 91, 1939.
2. H. Glower : Soil Erosion, p. 4, 1944.

The areas badly eroded are : Severely gullied areas are the Siwalik foothills (Gurgaon, Kangra, Hoshiarpur and Gurdaspur districts in Punjab, and the hilly districts of Kumaun Division in Uttar Pradesh), the Jamna-Chambal Tract (Agra, Jalaun and Etawah districts of U.P., South-East portion of Rajasthan specially Dholpur and Karauli ; North-West portion of Madhya Bharat specially western districts of Gwalior) ; Chota Nagpur hills in Bihar ; uplands of Burdwan division in Bengal ; lower hills in Poonch (adjoining Punjab border) in Kashmir ; portion of Satlaj Valley in Bashr in PEPSU ; the upper portion of the Narbada Valley, and the hilly north-western districts of Orissa specially Mayorbhanj, Sambalpur and Dhenkamal. Areas badly affected by sheet erosion are : The Bundelkhand region, Surma and Brahmaputra valleys in Assam, dry northern districts of Madras, drier portions of the slopes of Western Ghats (areas with less than 40″ rainfall) specially Bijapur district in Bombay, Chota Nagpur Plateau in Bihar, and hilly districts of north-western Orissa. Besides, sheet erosion is seen in almost all the bare areas whether slopes or level ground and whether cultivated or not. Wind erosion is serious in light soils in arid climate specially in Patiala in PEPSU, in Gurgaon, Hisar and Karnal in Punjab, and the dry parts of Madras, Madhya Pradesh, Uttar Pradesh, Bombay and Rajasthan. Bank erosion occurs to some extent along the channels of all the rivers, specially in alluvial plains, but it is most serious in Lower Bengal along all the major rivers. Wave erosion is not serious in India in the form of slumping. Waterfall erosion and mass movements are more common to lower Himalayas both western and eastern. The most severely eroded and the worst area is the Jamna-Chambal Tract which has been turned into deep ravines.

Regarding the rate of erosion and the extent of soil removal detailed and very accurate information is not available. The foreign experiments are not very helpful since the local soil and climatic conditions are the determining factors. However, it is estimated that on a moderate slope of 1 in 80 (1·25%) the annual loss of soil per acre per inch of rain varies from 1·6 to 4·3 tons of soil. Once gully erosion starts, the damage resulting from it is very serious, the soil flowing down the gully with ever increasing velocity and volume. The velocity increases with the slope, and, when the velocity of the runoff doubles, its carrying capacity is increased to 64 times.[1] Besides, a few runoff measurement experiments are as follows[2] :—

A. Dry Farming Research Station Sholapur, Bombay. (soil loss per acre per annum in tons, on an average slope of 1·25%)

(i) Fallow, with weeds preserved.	·6
(ii) Bare (uncultivated) fallow.	25
(iii) Jowar field (cultivated)	115

B. Punjab Irrigation Research Institute. (scrub jungle, Kangra District, Punjab, soil cost per acre.)

	32 wet days.	Single Storm.
(i) Grass (80% cover)	1·56	·116
(ii) Grass and Shrubs (90% cover)	1·74	·137
(iii) Bare soil.	82·58	1·567

It is really a pity that seriousness of this growing menace is not well appreciated. That the Government are conscious

1. Planning Commission : The first Five Year Plan, p, 131, 1951.
2. The Indian Journal of Agricultural Science, Aug, 1941.

of it appears from the Report of the National Planning Committee and the first Five Year Plan of the Planning Commission. But the proposed programmes are far inadequate in comparison to the needs, and greater attention is required on the part of both the local bodies and the individual farmers before it is too late. As a matter of fact, the neglect of erosion could be tolerated so long as land was ample and cheap. But in view of the growing population and increasing demands of agricultural and forest products, any further neglect implies inviting poverty and undermining the future. The major cause of neglect seems to be ignorance about what is happening and its ultimate consequences.

Methods of Control. The basic principle is to reduce the erosive effect of the different agencies, *i. e.*, slowing the speed of runoff and reducing the velocity of wind, by obstructions across their respective lines of travel. The aim is that the nature must be allowed to heal the wounds created by the misuse of man, by setting in motion the processes of soil formation and growth of vegetation. Since the problem is multi-phazed, and factors are mutually stimulating ; the control activities have to be multi-phazed and should be taken simultaneously on several fronts. The report of the National Planning Committee on Soil Conservation and Afforestation gives the following schedule summarising the erosion control activities,* some of the which check the soil removal directly and others are helpful indirectly.

(*a*) ***Forests.***

1. Protection of existing forests.
2. Creation of shelter-belts.

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*National Planning Committee : Soil Conservation and Afforestation p, 73, 1948.

3. Control of *nautor* grants (breaking virgin land for cultivation).
4. Encouragement of the village as the unit for forest improvement and protection schemes under cooperative or panchayat organization.
5. Reclamation of ravine lands for grass and forest produce.
6. Reclamation of flat lands in torrent beds which are often cultivable after a period under forest conditions.
7. Village plantations for fuel and timber.
8 Planting of fodder trees.
9. Rotation of cropping of fodder trees.

(*b*) *Waste Lands.* (*Livestock and Fodder.*)

1. Reduction of surplus livestock.
2. Grading up of flocks and herds.
3. Grassland improvement.
4. Encouragement of voluntary and rotational closures.
5. Partition of common grazing lands to develop individual ownership.
6. Panchayat Management of grasslands.
7. Replace grazing by grass-cutting and stall-feeding of hay.
8. Develop grass markets for profitable disposal of surplus cut grass.
9. Use of green fodder crops and silage.
10. Restriction of immigrant flocks where these are a serious factor.

(*c*) *Plough Lands.*

1. Watt bandi and contour terracing to retain rainfall and reduce runoff.
2. Restriction of cultivation on very steep slopes.
3. Improvements of soil wasting cultural practices.

4. Legume or grass crop to be sown on fallow lands.
5. Consolidation of holdings to allow better layout of field terracing.
6. Encouragement for watt bandi and terracing through remission of land revenue.
7. Use of live hedge plants to replace dry thorn twigs.
8. Cooperative organization for land improvement projects.
9. Encourag ng the use of compost manure.
10. Strip cropping and suitable crop rotations.

The Idea of Soil Conservation. The term 'soil conservation'[1] is used in a very wide sense, and in the most simple terms, it implies 'using land as it should be used *i. e.*, treating land according to its needs, and using it according to its capability.[2] The aim is that, since the earth is the home of man, land resources should be conserved against loss and deterioration, and maintained at a high level of optimum productivity so as to permanently sustain national economy. (This is the implication of the word conservation). 'Soil Conservation connotes all methods of soil management and other measures required to preserve soil and soil fertility from total or partial losses caused in one way or another,'[3] (by erosion in any form, by floods, by waterlogging, by removal of soil fertility by exhaustive cropping or by grazing

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1, The terms 'Soil Conservation' and 'Land Utilization' are not synonyms. As a matter of fact, while distinguishing between them attention should not be paid to the technical meaning of the word 'Soil' in the former and the economist's interpretation of the word 'Land' in the latter. The difference is in their scope. Land utilization, more commonly interpreted, refers to land-use pattern and practices, and is a part of soil conservation programme which connotes a still wider scope including many other things also.

2. H. H. Bennett : Soil Conservation, 1939.

3, National Planning Committee : Soil Conservation and Afforestation, p. 27, 1948.

or the removal of the elements of fertility by leaching, etc.). Briefly speaking the specific aspects of the programme should include : control of soil erosion ; reclamation of sub-marginal land ; development of land so as to enhance productivity, e. g., conservation of soil moisture and maintenance of soil fertility ; adjustment of the distribution of land over various demands ; growing of right crops on right lands ; proper agronomic or cultural practices and rotations, so that productivity may not be impaired ; provision of irrigation facilities ; flood control ; proper drainage ; forests and forest products, etc. It should, however, be noted that the programme should not be related to the physical phenomena only but should also cope with the economic and social conditions that affect land-use, and secondly, the methods are not static because they are dependent upon social, economic and political reactions and the scientific developments which are always changing.

IV. FORESTS.

Extent and Distribution. In the Indian Union forests occupy, in 1948-49, according to village papers, an area of 86·9 million acres or 14·9% of the total area of 581 mil. acres for which the data of land classification is available. According to Forest Statistics the area is 132·9 mil. acres. A considerable part of the unclassified area in Assam, in part B and C States and in Andaman and Nicobar Islands, is under forests, and hence the actual area, which is not known exactly, (except for a part of the country, specially part A States) is a bit more, and the actual percentage is about 2% more, or roughly 17 or 18%. The first Five Year Plan mentions the area of 130 mil. acres or 19·2%. The distribution in different

states is as follows :

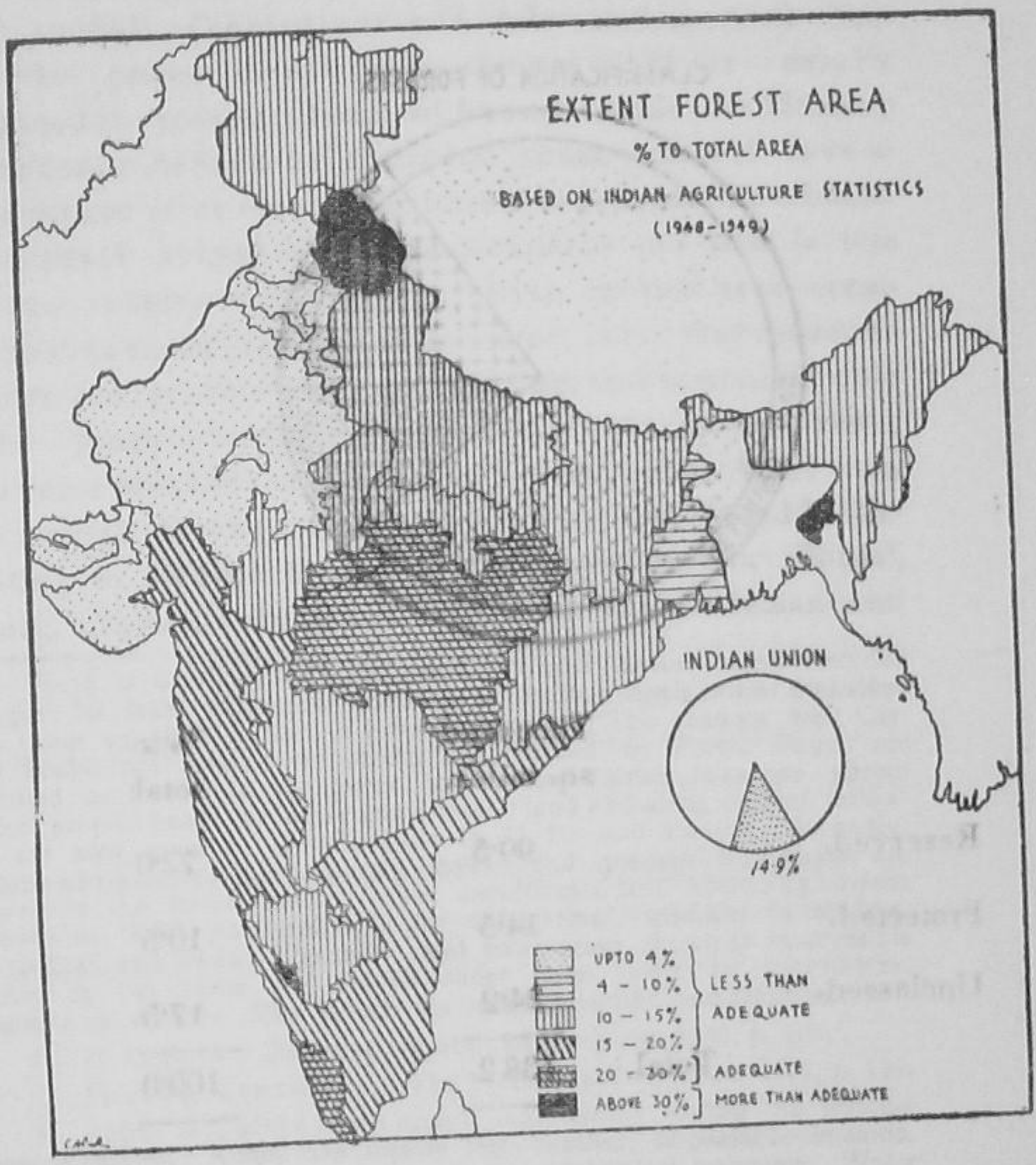
Percentage of area under forests.

States.	According to				States.	According to			
	Indian Agr.[1] Statistics	Indian Forest Statistics[2]				Indian Agr. Statistics[1]	Indian Forest Statistics.[2]		
		Merchantable	Inaccessible	Total			Merchantable	Inaccessible	Total
Assam.	12'6	6'3	19'5	25'8	Rajasthan	3 1	N.A.	N.A	N. A.
Bihar.	14'9	7'5	10 9	18'4	Saurashtra	'5	2'8	0'1	2'9
Bombay.	15'3	7'9	4 7	12'6	Travancore & Cochin	28'8	25'3	8'2	33'5
MadhyaPradesh	28'4	26'8	4'6	31'4	Ajmer.	3'0	24'5	0'0	24'5
Madras.	16'7	13'3	13'0	26'3	Bhopal.	22'3	22'6	...	22'6
Orissa.	13'3	2'5	5'0	7'5	Bilaspur.	12'6	10'8	33'3	44'1
Punjab.	3 3	1 7	8'7	10'4	Coorg.	32'7	44'8	28'7	73'5
Uttar Pradesh.	10'5	7'3	12'0	19'3	Delhi.	.....	N.A.	N.A	N.A.
W. Bengal.	8'7	8'9	5'1	14'0	Himachal Pradesh	32'4	21'2	6'2	27'4
Hyderabad.	11'7	11'5	.....	11'5	Kutch.	2'1	'9	...	'9
J. & Kashmir.	12'4	2'3	9'6	11'9	Tripura.	65'1	44 8	44'8	89'6
Madhya Bharat	12'1	10'8	4'6	15'4	Vindhya Pradesh	12'6	25'4	8'5	33'9
Mysore	11'2	2'4	.....	2'4	Andaman & Nicobar Island's	N.A	61'9	15'9	77'8
PEPSU	1'2	N.A.	N.A.	N.A.					
					Grand Total	14'9	10'9	8'3	19'2

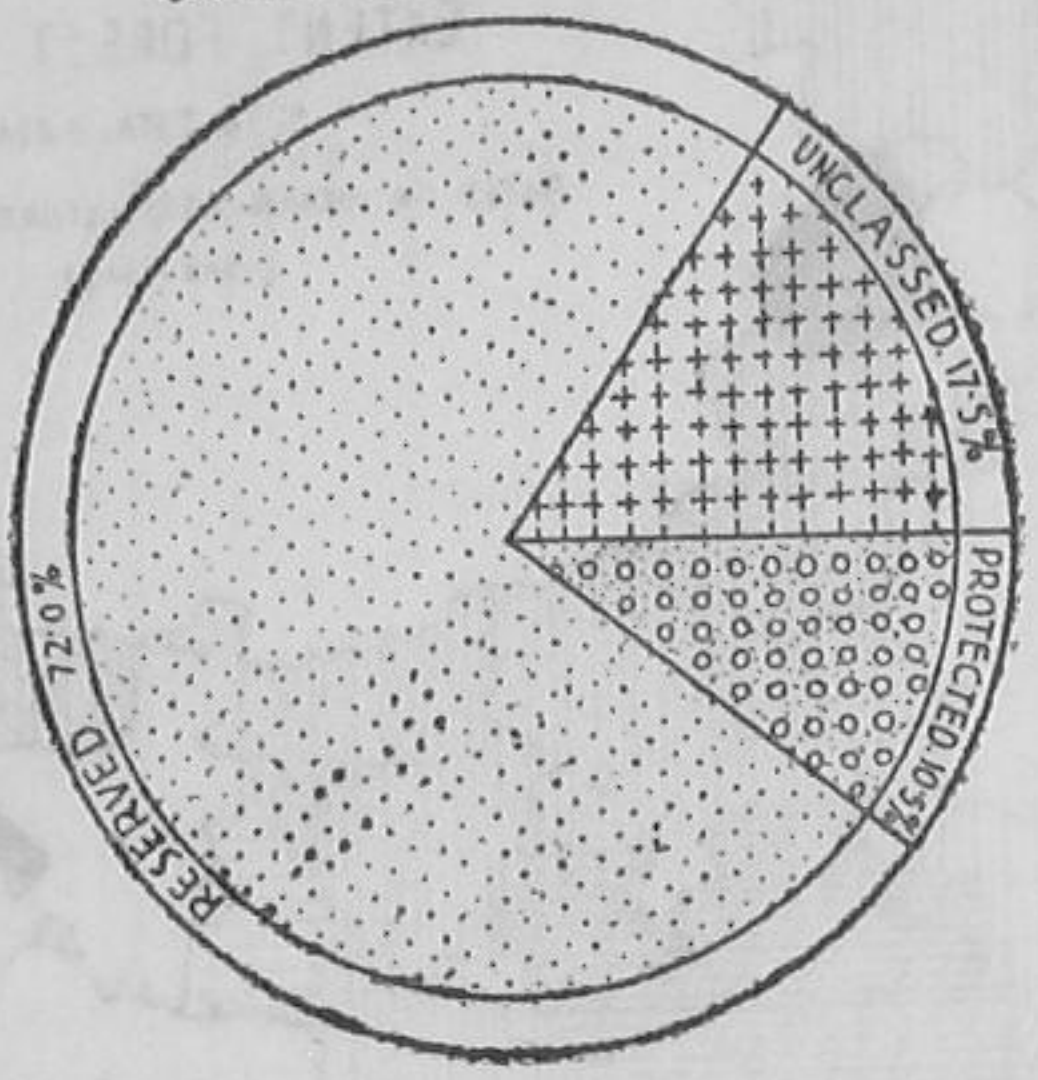
1. Unpublished Govt. of India Report.

2. Indian Forest Statistics. (1947-48), 1952 pp. 1-2.

Upto 1946-47 the statistical data regarding forests were issued through the 'Annual Returns of Statistics relating to Forest Administration in India'. Later on the publication was given a new name, 'Indian Forest Statistics', It includes data for a wider area, now statistics are collected for part B and C States also ; and some of the former statements have been integrated.


EXTENT FOREST AREA
% TO TOTAL AREA
BASED ON INDIAN AGRICULTURE STATISTICS
(1948-1949)
INDIAN UNION
14·9%
UPTO 4%
4 - 10%
10 - 15%
15 - 20%
20 - 30%
ABOVE 30%
LESS THAN ADEQUATE
ADEQUATE
MORE THAN ADEQUATE

CLASSIFICATION OF FORESTS.



	Thousand sq. miles.	% to total
Reserved.	99·5	72·0
Protected.	14·5	10·5
Unclassed.	24·2	17·5
Total.	138 2	100·0

The Sub-Committee (of the National Planning Committee) on Soil Conservation and Afforestation think that for the proper needs of a country 20% is usually reckoned the correct amount of forest,[1] while the Planning Commission believe that a tropical country should have at least a third of its area under forests to preserve its climatic conditions.[2] Judged with these standards the area is less for the country as a whole. Even in this area considerable portions are forests in name only, they have no timber but provide fuel and grazing, and sometimes only scrub jungles having fewer, and at places no trees; and some areas are of very inferior material. Apart from the overall shortage forests are badly distributed.[3] Excepting in Madhya Pradesh, Himachal Pradesh, Bhopal, Coorg, Tripura, Travancore and Cochin and Andaman and

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There is a considerable difference in area under forests recorded as part of land utilization statistics in Indian Agricultural Statistics, and those supplied by Indian Forest Statistics. The reasons are : Certain lands not covered by forests but worked by Forest Depts. are returned as forests in the latter, but in the former they are shown under proper heads, as 'other uncultivated land excluding current fallow' or 'net area sown'; this happens in U. P. and Punjab. Secondly, forests administered by corporate bodies and private individuals are treated in the former under 'other uncultivated land excluding current fallow' or 'land not available for cultivation', specially in Madras, W. Bengal and Madhya Pradesh; and some areas shown as inaccessible forests in the latter are treated under these heads in the former, specially in Assam. The former are more scientific and reliable.

1. N. P. C. Soil Conservation and Afforestation, 1948, p. 104.

2. Planning Commission, The First Five Year Plan, 1951, p. 129.

3. About 45% of the forest area is inaccessible having no suitable communications. Roads are mostly fair weather, impassable in rains, and with a few exceptions, are unfit for mechanical transport, Water transport, the cheapest means of forest transport, loses much of its usefulness because many species of Indian forests do not float, use of boats is not possible due to rapid streams, their shallowness and the presence of rocks After the partition this difficulty has further increased specially in transporting Kashmir timber, Freight charges by railways on forest products are said to be very high, causing considerable wastage in forests. Forest Depts. are handicapped in developing transport for want of funds, and at present the expenditure on forest communications is Rs. 67'55 lakhs or 4'6% of the total forest revenue,

Nicobar Islands, forests are insufficient in area. In Northern India the percentage is comparatively less in comparison to that in South India, and about 80% of the area is confined to the Himalayas and their foot hills, and a considerable part of the remaining lies within 30 to 40 miles from hills. And only a very small part (hardly 5 to 10%) lies scattered in cultivated lands. Distribution is a bit better in the South specially in Madhya Pradesh, Bombay and Madras where considerable forest areas are interspersed amongst cultivated lands. However, both in the North and South the great forests are located in hills, which makes a very large area inaccessible by increasing the difficulties and the costs of transporting forest products. Two very important consequences of the lack of forests within easy distance of populous parts are the enormous waste of the only source of cheap manure by burning cowdung, and the low standard of village dwellings, about which attention was drawn by Dr. Voelcker in 1893 and the Royal Commission on Indian Agriculture in 1928.

Types of Forests. The climatic conditions in the country are very favourable for forest growth, and their character is largely governed by rainfall, elevation and soil conditions. In the areas of heavy rainfall there are evergreen forests containing bamboos, palms, ferns and rubber trees, etc. Areas with a less copious rainfall have deciduous forests of teak, sal and shisham, etc. Under a still smaller rainfall vegetation becomes sparse, forests are known as dry or arid forests containing tamarind, acacia (kikar) and trees having thorny leaves. As the rainfall decreases further forests pass into scrub jungles having thorny bushes and thick small leaves. On the Himalayas, however, where climate varies from sub-tropical to arctic conditions, forests varying accord-

ing to elevation are pine, fir, deodar, oak, chestnut, and magnolia etc. The main types and their general distribution is as follows :—

(*i*) ***Tropical wet evergreen forests.*** They occur under a rainfall of over 100 inches, are evergreen, dipterocarps, and are found on Western Ghats in Bombay, in Madras, in a strip south-west from Upper Assam through Cachar and southward through Chittagong Hill tracts.

(*ii*) ***Tropical Semi-evergreen forests.*** They have dipterocarps and deciduous species, and usually adjoin the tropical evergreen forming a transition between it and the moist deciduous, found in the Western Ghats, widespread in Assam and lower slopes of the Eastern Himalayas.

(*iii*) ***Tropical Moist-Deciduous forests.*** They occur under a rainfall of 60 to 80 inches and 4 to 6 months of dry season. They are the most typical Indian forests, popularly called the Monsoon forests, found on a strip along the foot of the Himalayas, a strip along the east of the Western Ghats and a large block round Chota Nagpur. The northern half includes sal forests and the southern half teak forests, and open Savannah forests occur scattered throughout.

(*iv*) ***Tropical Dry Deciduous forests.*** They occur under a rainfall of 40 to 50 inches and about 6 months dry season, and are found in a wide irregular strip from the foot of the Himalayas to Cape Comorin, bounded on the north by the Himalayas, on the north-west by the desert, on the south-west by the Western-Ghats and on the east by the wet Bengal forests. Sal and teak are typical, but are not found everywhere, and are much inferior to that found in the tropical moist deciduous forests.

(*v*) ***Tropical thorn forests.*** They occur under a rainfall of

10 to 30 inches, are found in Rajasthan, Upper Gangetic plain and the Deccan Plateau, and abound in acacias.

(*vi*) ***Tropical dry evergreen forests.*** They are small-leaved thorny species found on the Carnatic coast.

(*vii*) ***Sub-tropical wet hill forests.*** They are found in the lower slopes of the Himalayas in Bengal and Assam and locally in Khasia, Mahabeleshwar and Nilgiri-Hills.

(*viii*) ***Sub-tropical pine forests.*** They are chir pine forests between 3000′ and 6000′ in the Central and Western Himalayas and other pines in the Khasia hills.

(*ix*) ***Sub-tropical dry evergreen forests.*** They are thorny species covering only a small patch in the north-west corner on the higher reaches of the Indus and its tributaries.

(*x*) ***Wet temperate forests.*** They are evergreen occuring on the Eastern Himalayas between 6000′ and 9500′ and on the top of the hills of South India.

(*xi*) ***Moist temperate forests.*** They are conifers and oaks, deodar, blue pine, spruce and fir, found on the inner ranges of the Central and Western Himalayas with rainfall below 40 inches and between 5,000 and 10,000 ft.

(*xii*) ***Dry temperate forests.*** They include deodar, pine, juniper and most broad-leaved European genera, found on the inner ranges of the Himalayas.

(*xiii*) ***Alpine forests.*** They include high level fir, birch and rhododendron etc., and occur over 10,000 ft.

According to ownership forests are classified as Government, corporate and private forests. After the merging of States and the abolition of Zamindari many private forests are now Govt. forests. and the village forests have come under the administration of panchayats. Out of the total forest area 72·9% is administered by State Governments, 0·7% by corporate

bodies and 26·4% by private individuals. Further the forests under the control of the Forest Dept., according to the control exercised by the Government in respect of the rights of users, are classified as : Reserved, Protected and Unclassed. The areas under them are :[1] (Sq. miles.)

States.	Reserved.	Protected.	Unclassed.	Total.
'A' Part.	68,373	6,683	15,053	90,109
'B' "	22,443	5,437	1,021	28,901
'C' "	7,162	1,839	7,951	16,952
'D' "	1,498	554	137	2,189
Total.	99,474	14,513	24,162	138·151
Percentage	70·0	10·5	17·5	100·0

Utility of Forests. Forests are an important resource and a great national asset. They have many direct and indirect economic uses. The direct utility is mainly due to their products. They provide timber for building purposes, fuel for domestic and industrial purposes, raw material for industries like match, paper, lac etc., other valuable products commonly known as minor products, fodder and grazing for cattle, and leaf mould for manure.

The indirect benefits are mainly through their influence on climate and the regulation of water supply. Forests are said to make the climate more equable by increasing humidity, by reducing evaporation, by increasing precipitation of moisture[2] and by moderating the temperature. Working

1. Indian Forest Statistics, (1947—48), 1952, pp. 113.

2. It has not been well established that forest have a direct relation with the amount of rainfall, and it cannot definitely be asserted that they increase the amount of rain.

like a huge sponge they increase absorption and produce a sustained feeding of springs and channels, and by checking the mechanical force of runoff reduce the violence and check floods. By preserving moisture they check or at least reduce the severity of drought. By reducing the velocity and volume of runoff they check soil erosion and by forming a rich vegetative mould they increase soil fertility. By changing the surface drainage into sub-soil drainage they help in maintaining the water table and also water storage of rivers. They are a shelter to agriculture against cold and dry winds, prevent the enchroachment of sand-dunes on coasts, fix the wind-borne sand in the interior, and reduce the velocity of air currents. By providing shelter to wild birds and beasts they provide game. Under certain conditions they help in improving health in a country and assist in defence. By enhancing the beauty of the landscape they produce a wholesome aesthetic influence on the people.

Lastly, they contribute a net output of about Rs. 60 crores or ·7% to the National Income, provide, directly and indirectly, employment to about 3 mil. persons, and provide incidental grazing in govt. forests to 2·5 crore animals at full and privileged rates and free.* In the days of famines and fodder scarcity forests render invaluable help. Really speaking it is not easy to appreciate and appraise fully what forests mean, and what role they play in the economic development of a country. There is much truth in the saying that for every ill there is a plant curing.

Need for Conservation. Let it be fully realized that life is a phenomenon of norms, a balance between the organic and the inorganic world. Stability of agriculture and its

*Report of the National Income Committee, 1951, the Report N. P. C. on Soil Conservation and Afforestation, 1948, and the Indian Forest Statistics (1947—48), 1952.

progress depends upon the equilibrium between various ecological forces. Destruction or exhaustion of one upsets the normal equilibrium, liberating some destructive forces which recoil on civilization and endanger life as such. Hence the need for maintaining this equilibrium is obvious. But the pity of things is that the environment cannot be left untouched by human hand, and the very touch of man in the process of evolution, while advances civilization, misuses the resources. In the beginning forests looked like a hostile element since they occupied the ground which was needed for growing food. Therefore, in the human struggle for existence the use of axe or fire against forests was considered not only fair but the only course, and hence the attitude and institutions of man leading to a reckless depletion were quite natural. But now the problems arising from the pressure of human and bovine population have gradually become so intense and have developed to such an extent that this settler's psychology of conquest and destruction is not only unjust but also dangerous. Almost throughout the world forests are cut to give place to crops, and it has been seen everywhere that the natural process of reproduction and growth by which forests keep alive are incapable of keeping pace with man's destruction. Fortunately in India this process has been gradual and slow than in other countries (*e. g.*, England, France, Spain, Italy and Greece etc.) where mechanization took place fast. But even here the destruction (without replenishing) has been so reckless, spectacular and has gone to such an extent that, through direct and indirect influences, that it has already considerably impoverished land and the people ; and the process is in operation.

The need for conservation is obvious from the discussion of utility of forests in the previous section. It can further be appreciated by considering the dangers of deforestation.

The ravine lands of Northern India specially the Jamna-Chambal tract, the scantry desert flora seen on the banks of the Ganges and its tributaries, and in parts of Rajasthan, Bundelkhand and in and near Mathura district, formerly dense forests, the vast erosion caused by it as pointed out by the Central Fodder and Grazing Committee, the irregularity and decline in the rainfall in Madras and South Peninsula as pointed out by Robertson and Temple, the gradual silting up of the Mahanadi, Godawari, Krishna, Brahamani and Son etc., and the greater violence and the increasing frequency of floods in east U. P., Bihar, Assam and Bengal, are some of the important consequences of reckless deforestation. For a more spectacular phenomenon we can look to Arabia, Persia, Syria and Egypt. The need for conservation can still further be understood by considering the growing needs for forests and forest products specially in view the growing pressure of human and bovine population on the one hand ad the deteriorating land resources on the other.

Forest Products and Industries. Forest products are generally classified into two categories : (i) major products which include timber and fire-wood, and (ii) minor products which include all kinds of forest produce other than timber comprising all animal, vegetable and mineral products found in forests. The increase in total revenue of the Forest Dept. from forests is from Rs. 125 lakhs in 1899-1900 to Rs. 1449 lakhs in 1947-48. The average yearly production of the former category is about 375 mil. cubic feet of which 290 mil. cubic feet is timber alone. The more important timbers are teak, deodar, sal, shisham and mahogani etc. In market there are more than 30 varieties of timber each having a number of recognized grades. But we are not

self-sufficient in timber and import considerable quantities from outside. In minor forest products the country is, however, very rich. Among the more important classes are : bamboos, grasses (including grazing), leaves for fodder, litter and manure, fibres and flosses; oil seeds, tans and dyes, oils, gums, resins, rubber, drugs, edible products of various kinds, lac, honey, wax, silk, hides, horns and inory, and a variety of mineral products. The country has almost a monopoly in lac. It is largely collected in Chhota Nagpur in Bihar, Madhya Pradesh, Vindhya Pradesh, Orissa, Hyderabad and Assam. Of the total quantity about 60% is collected in Chhota Nagpur only, and about 98% of the total produce is exported principally to U. S. A., U. K., Germany and Japan. The imports and exports, the out-turn and the income of forest produce during 47-48 in the Indian Union was as follows* :—

(a) The Imports and Exports. (Lakhs Rs.)

Products	Gross Imports	Gross Exports	Net imports (+) or Net exports (—)
(i) Wood and Timber.	337·7	62·8	+ 274·9
(ii) Wood Products.	1,255·4	45·8	+ 1,209·6
(iii) Minor Forest Products.	304·2	419·4	— 115·2
Total	1,897·3	528·0	+ 1,369·3

A classification together with a brief description of the more important products is found in Troup's Indian Forest Utilization, 1913, and much useful details are contained in Watt's Commercial Products of India. 1908.

*Indian Forest Statistics, (1947-48), 1952, Statements XI and XIV.

(b) Total out-turn.

Forest areas.	Timber & Fuel (—000 c. ft.)	Minor Produce. (lakhs Rs.)
(i) Reserved Forests.	296·8	207·79
(ii) Protected Forests.	32·3	44·34
(iii) Unclassed Forests.	16·9	8·45
Total	362·0*	302·75*

(c) Income and Expenditure.

(i)	Total Revenue.	(Lakhs Rs.)	1,449·34
(ii)	Total Expenditure	(,,)	661·08
(iii)	Net Revenue	(,,)	738·26
(iv)	Percentage of net revenue to gross revenue.	(%)	54·39
(v)	Net revenue per sq. mile of Forest area under the control of the Forest Dept.	(Rs.)	571·00

Recently some minor forest products have assumed great economic importance, *e. g.*, sandal-wood oil for perfumery, neem for making soaps for skin diseases, and some herbs and drug plants for preparing medicines.

Some important industries and occupations based on forest products are : building industry, railway and tramway sleepers, highway bridges, matches, packing cases, transport vehicles, furniture, boats and dugouts, agricultural implements, tool handles, toys, textile machinery parts, wood distillation, sandle-wood carving, and paper making etc. The possibilities of further development of the forest resources are suggested specially in the case of : growing stock, wood

*Include figures for Jammu & Kashmir, Mysore, Tripura and Assam for which details are not available.

pulp manufacture, plywood and veneers, tool handles and textile machinery parts, preservative treatment and seasoning of timbers, wood and charcoal gas, pine resin, improvement in methods of extraction, tanning. lac, artificial silk and other forest cottage industries.

Forests as a crop. Forestry is a very slow business because of the length of time required to grow a crop of trees, which is, however, governed by soil, climate and species. Usually it takes 40 to 150 years or more to grow a forest. Even experiments seldom take less than 5 years to complete, often they take 10 to 15 years, and even 30 years. There is a lower rate of return on forest investments than on business investment.* Besides, nature plays a more important role than in agriculture, and therefore large areas are needed for profitable forestry. Lastly, forests can grow on sub-marginal lands, and being pushed more and more by agricultural extension to the margins of cultivated lands, they tend to occupy the residual lands. This should not give an impression that they can grow anywhere. Like other crops they are also limited by soil and climatic factors.

Administration. The government became alive to the consequences of reckless deforestation long back, and during the British period the first organised step to protect them was taken during Lord Dalhousie's time, about 1855, when conservators of Forests existed in Bombay, Madras and Burma. Other appointments followed soon, and in 1864 an organized State Dept. under an Inspector—General of Forests

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An understocked forest often has to wither again to lose all increment to date or be kept perhaps for 50 years, give a low yield, and then start again. (N. P. C.)

*F. Heske, German Forestry, 1938, quoted by Ely and Wehrwein, Land Economics, 1940

was established. Since then the Central Dept. has grown and the State Depts. have been established.

The old forest policy was announced in 1894 when the Government of India issued a circular with regard to forests, based on the following principles :

(*a*) The preservation of climatic and physical conditions of the country being most important sufficient forest area was to be retained, (*b*) the general well-being of the people comes next, (*c*) though cultivation is of greater importance than forestry, permanent cultivation should not reduce forest below the prescribed minimum, (*d*) Revenue should be realized to the maximum but only after meeting the requirements of the rural and local population free or at concessional rates.

In order of importance they classified the forests into four heads :

(i) Forests the preservation of which was essential on climatic and physical grounds ;

(ii) Those which supplied valuable timber for commercial purposes ;

(iii) Minor forests including tracts which, though true forests, produced inferior timber or smaller growths of better sorts ; and,

(iv) Pastures and grazing grounds proper, which were usually forests only in name.*

Though the main concern of forest administration has been to increase the revenue, forest administration has been aiming at eliminating the danger of overworking the forests, and increasing the yielding capacity. This has been done successfully, as was apparent from the replies given by various States to the questions of the Sub-

*Report of the Royal Commission on Indian Agriculture, para 215, 1928.

Committee on Soil Conservation and Afforestation. They were unanimous about the general mismanagement and rapid destruction of all private forests, but about State forests they held that, though most of the States had their own working plans, they were managed better and scientifically as far as policy, knowledge and funds permitted. For about 50 years of the existence of Forest Department in India, the value of research in forestry was not recognized and promoted. In 1906 the Forest Research Institute was established at Dehra Dun, which was further enlarged in accordance with the recommendations of the Indian Industrial Commission, 1918. It provides training for the forest services in India and carries on research in forestry and forest products. It is in close touch with the Forest Departments of the States, and hence the results of research find quick and effective application by the States. Many valuable investigations have been undertaken and a steady progress is made in scientific and practical knowledge which has considerably improved the productivity, and has ensured fuller and better utilization of forests. At present some important problems to which they are paying attention are to find suitable wood for aircraft production, for battery separators, for electrical purposes and for producing cheap printing paper. The Planning Commission, however, feel that there is considerable scope for improvement in securing the utilization of the results of research on the forest products by commercial and industrial interests. For ensuring closer contact between the Institute and the interest utilizing timber and forest products, liaison and publicity arrangements at the Institute need to be strengthened '*

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* Planning Commission, The First Five Year Plan, p. 131. 1951,

The Future Outlook. It should be appreciated that even in the most favourable conditions forest take at least 30 years to be created, but can be lost in an incredibly short time either as a direct consequence of injudicious interference by man, or indirectly, from his neglect or lack of knowledge and supervision. The extent of actual deforestation, their depletion and deterioration have gone to an extent that they are now inadequate, badly distributed and, are, in many ways, adversely affecting the productivity of land and impoverishing the people. Hence the need for preservation and development is quite obvious. But it should be remembered that utility is measured in terms of the satisfaction of social needs. Though the principle function of forestry is to conserve and develop forests, it has an important role of serving as the handmaid of agriculture, a fact that was emphasized by the Royal Commission on Indian Agriculture that as a general principle the policy of the Forest Department should be so directed as to serve agricultural interests and administer for the public benefit. The Planning Commission, however, rightly observe that a stage has been reached where forestry should no longer be regarded as a handmaid of agriculture but as a necessary complement to it

The role of forests in agriculture is tremendous specially in view of the provision of fuel which helps in saving the so extensively available and cheap manure,* timber for implements and houses, grazing and fodder for cattle decreasing the pressure on land by providing employment, regulating water supply, checking floods and erosion and moderating the climate. But that is not their only role, and the only criterion for forest policy and administration. They have

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*A recent experiment in Madhya Pradesh shows that charcoal is able to compete under certain circumstances with petrol as motor fuel. (N. P. C.)

other equally important roles to play, *e. g.*, preservation of physical and climatic conditons, provision of raw materials for industrial and commercial purposes and industrial fuel. The forest policy should keep in mind these needs also.

Forests are a renewable national asset capable of yielding under proper scientific management not only a steady annual income but also a variety of products essential for human welfare. They should be treated as a capital which has been handed to us in trust by our ancestors, and which we should pass on intact, and if possible improved, to future generations. Inroads have been made into the forest capital during the war and in the post-war years, specially in private forests, as a result of the threat of the extinction of private ownership. This has to be made good as far as possible, and forests have to be preserved as a national heritage.

Some important aspects are: management, finances, research, transport, fires, and forest tribes, etc. In government forests the management is said to be satisfactory, but not so in private forests. In some parts, after the abolition of private rights forests have come under state management, but in the remaining parts it should be improved through legislation. In states organized working plans should be created where there are not, and the level of working plans should be kept to the state of progress in forests. Besides, forestry should be judged by the long run financial results rather than by the immediate surplus; and adequate money and technical know-how should be provided for silvicultural research. Suitable means of transport should be developed so as to make forest more accessible, and the transport costs must be reduced. Water transport is said to be cheapest; in Germany, Canada and Finland waterways have been found to create industries; here also rivers flowing through

or near forests should be examined to float timber. Destructive fires in summers, which are a common feature specially in drier forests, should be minimised by departmental light winter firing and other protective and preventive measures.* And lastly, the welfare of forest tribes is linked up with development of forests. They provide labour for forest operations and collect most of the minor products. They should be organized into cooperatives, and forest produce should be collected through them, instead of auctioning the rights to contractors who exploit them.

Forests cannot be grown in cities, but in rural areas, and even there in view of the urgent needs of agriculture, they will be pushed to sub-marginal lands. But they cannot be grown everywhere; like crops they have also limiting factors. Besides, in view of transport costs, it is not economical to transport forest materials to plains. Fuel can never be carried so cheaply as to compete with cowdung. The only solution to this problem is to grow forests in plains near villages.

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*Forest fires do a tremendous damage in the form of burning wood, soil runoff, and inundation etc. The first measure is controlled grazing in hot weather, and the later measure is deliberate light winter burning to prevent later destructive conflagrations. It is a lesser evil, and is said to have little deleterious effects on tree growth and soil erosion. But in the interest of preserving grass growth for grazing, controlled grazing as a measure of fire protection is now considered a better alternative Besides, in Bihar the early experiments were found positively injurious in drier forests, and the practice is given up. But in the moist forests of Bombay it is regularly practised, and has not promoted either erosion or floods. In U. P. the effects on grassy forests are not injurious, but in Bundelkhand and Chirpine forests, though erosion has increased, it has been a lesser evil. In drier mixed forests some deleterious effects may occur, but it is pointed out that burning stimulates the activity of soil bacteria and no alternative and equally effective practicable treatment for minimising the damage from late fires has so far been found. (N. P. C.)

In 1947—48 of the total forest area under the control of the Forest Department, 57'8% was attempted to be protected against fire. The percentage of failure to area attempted being about 5, about 76 thousand sq. miles or nearly 95% of the attempted area was protected, (I. F. S.)

V. LAND RECLAMATION AND AGRICULTURAL EXTENSION.

Idea of Land Reclamation. Ordinarily it is not appreciated that in every country land reclamation has been a major factor in advancing civilization. Though the processes, the standards and the results have been different in different countries, it has everywhere increased land resources, and thereby enlarged the opportunities of earning livelihood from land. The advantages may be nation-wide, regional, local or merely individual, but broadly speaking, it has promoted national welfare.

Technically defined it means 'the operations and processes of bringing into high grade of usefulness in crop production lands which at the inception of the undertaking are either in an unproductive state or are of inferior or limited capacity to produce'.[1] This is an advanced view, and projected to its full meaning it will include all the processes and stages from making land fit for agricultural operation upto complete settlement. But more generally, by the term land reclamation is understood the actual land improvement so as to make it productive ; and the subsequent steps (*e. g.* financing, actual settlement, cropping scheme etc.), may be attempted unrelatedly or may be motivated by different purposes. It implies some degree of betterment in making land useful. As such its forms, depending upon the type of land and purpose, are divergent, and it may involve : washing of alkali areas, soil corrections in arid and semi-arid portions, clearing of weeds and other undesirable flora, draining of swamps and too wet lands in humid areas, recovering of submerged land or land from sea[2], and

1. F. Adams, Encyclopedia of Social Sciences, Vol. 13-14, p. 160,

2. The natural process of recovering land from sea is called 'accretion,' and rightly speaking is not called reclamation which refers to artificial arrangements,

also irrigation which is said to be fully examplifying reclamation as an economic and social institution.

Agencies. It can be done by governments, organized bodies and institutions and individuals. But large scale operations cannot be attempted by individuals on technical and financial grounds. The powers of organized bodies like the co-operative societies, corporations and authorities are also limited on legislative side. They have to be armed with such powers through special legislation. The best agency for any large-scale operation is the government, whose part is not confined to financial aid only. Even when no finances are involved, many other things are to be done by the government, e. g., investigation of opportunities for the best means of carrying out reclamation, administration of reclamation laws and settlement etc. Besides their financial aid ranges from bearing the entire cost to simply subsidising individuals to partly meeting the cost even through indirect means such as concessions in rent and irrigation charges on reclaimed lands. However, even government activity and initiative is limited so long as private interests are involved. For success their cooperation is necessary. Further nationalization of land before reclamation operations are not necessary, as is believed by some economicts.*

Methods of Reclamation. They have partly been discussed under the section 'methods of erosion control', specially refering to reclamation of ravine land. Further the methods of reclaiming other types of lands have been discussed in detail by the Committee on Soil Amelioration (of the Board of Agriculture and Animal Hus-

*Dr. Baljit Singh believes that '..... for a planned scheme of land reclamation and improvement all land to be brought under operation should first be nationalized'. (Whither Agriculture in India, p. 44, 1945).

bandry in India) and the Usar Land Reclamation Committee, U. P. As a matter of fact the type of land determines the method of reclamation.

Alkali lands are mainly of two types: Soils characterized by excess of soluble salts, and soils having abnormal amounts of replaceable sodium. The former can be reclaimed by leaching only, while the latter require the conversion of sodium clay into calcium for which heavy doses of irrigation water followed by suitable crop rotations are most effective. Systematic cropping is necessary to check the reappearance of alkali in reclaimed areas. In some places simple leaching combined with deep cultivation has given successful results. The alkali lands known as 'Bari' are said to respond well to the treatment with gypsum and calcium chloride, but it is an expensive method. In the case of the canal irrigated lands in the Punjab, where a rise in the sub-soil water level resulted in excessive alkali formation, deep open drains around blocks of suitable size followed by heavy leaching combined with the application of gypsum, have been adopted. The next stage was cropping with rice and then berseem. The waste lands in north Bihar, having high PH, and which cannot be definitely classed as *usar* or *kallar*, can be reclaimed through liberal doses of organic and green manuring. The use of molasses as a reclaiming and fertilizing agent is said to be hopeful, specially in areas near sugar factories, where the transport costs of molasses do not become exhorbitant. Similarly

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The U. P. Usar Land Reclamation Committee felt that electroculture for improving intractable alkali areas has not yet established its effectiveness; and gypsum, sulphur and iron sulphate will generally be too expensive as agents for reclamation. They suggest to explore further the possibilities of using molasses as a reclaiming and fertilizing agent.

leaching is recommended for areas where surplus canal water is available ; and sinking of wells and construction of bundhs is good on contour lines for impounding rain-water in other areas in addition to working out appropriate types of saltworts suitable for alkali soils. In water-logged areas construction of shallow drainage cuts is required. For the waste lands whose cultivation is not likely to be enonomic, a system of controlled rotational grazing by paddocks and utilization of pockets of good soil for plantation of trees, leaving the surrounding usar land for improved fodder, is suggested. The unculturable wastes consisting of ravines should be managed to produce the type of vegetation they are capable of and suitable for producing. This will indirectly benefit the nearby land and check further deterioration of ravines themselves. In areas having perennial deep-rooted '*kans*', specially in Bundelkhand, Madhya Pradesh and Bhopal, tractor cultivation is supposed to be effective, and the Indore Institute adopted a much simple method of eradication by occasional deep cultivation with the help of an adjustable '*bakhar*' drawn by four bullocks But the reappearance of *kans* shows that these methods have not succeeded.

Extension of Agriculture. There is a general feeling of optimism regarding the possibilities of bringing fresh land under the plough, and thereby enhancing agricultural production and solving the food problem, specially in view of the vast areas of culturable land lying uncultivated. But a closer study and the analysis of the nature and quality of this land, and the limitations to cultivate them, shatter that facile optimism. The earlier estimates of the total area of waste land which can be brought under cultivation ranging from 96 to 150 million acres, should not be taken to be very reliable. The most recently available data regarding land

classification is given in section II of this chapter, and a repitition of that is being avoided here. The Ministry of Agriculture, Government of India, thought that nearly 85 million acres of culturable waste land existed in the country and of this only 10 million acres was good, fertile and culturable. The 6 years reclamation programme worked out by the Food and Agricultural Ministry was to add 2 million tons of food grains annually. To fully implement the programme of the Food Grains Policy Committee estimates of the lands which were to be reclaimed were : Punjab ·5, U. P. 1·0, Bihar ·2, Assam 4·0, Orissa 1·0, Madhya Pradesh 1·0, Malwa Union 1·0, Madras Agency Tract 1·0 and Vindhya Union ·5, with a total of 10·2 million acres. The target of self-sufficiency included only expansion of 8 lakhs acres yielding 3 lakhs tons of additional food by March 1952.

The present programme aims at reclaiming 6 mil. acres which include about 4 million acres of weed infested areas which are mostly private lands and require deep ploughing with a view to eradicating the root system of weeds, and about 2 million acres of other idle lands termed as 'New', consisting mostly of government owned scrub jungles. They are as follows :

States.	New Land (mil. acres.)	Weed infested (mil. acres.)
E. Punjab	·5	Nil
E. Punjab States	·2	Nil
Orissa	·5	Nil
Madhya Pradesh	—	·6
Uttar Pradesh	·5	·3
Bihar	·2	·15
Madhya Bharat	Nil	1·4
Bombay	·3	·8
Bhopal	Nil	·4
Jaipur and Vindhya Pradesh	Nil	·11
Total	2·2	3·76

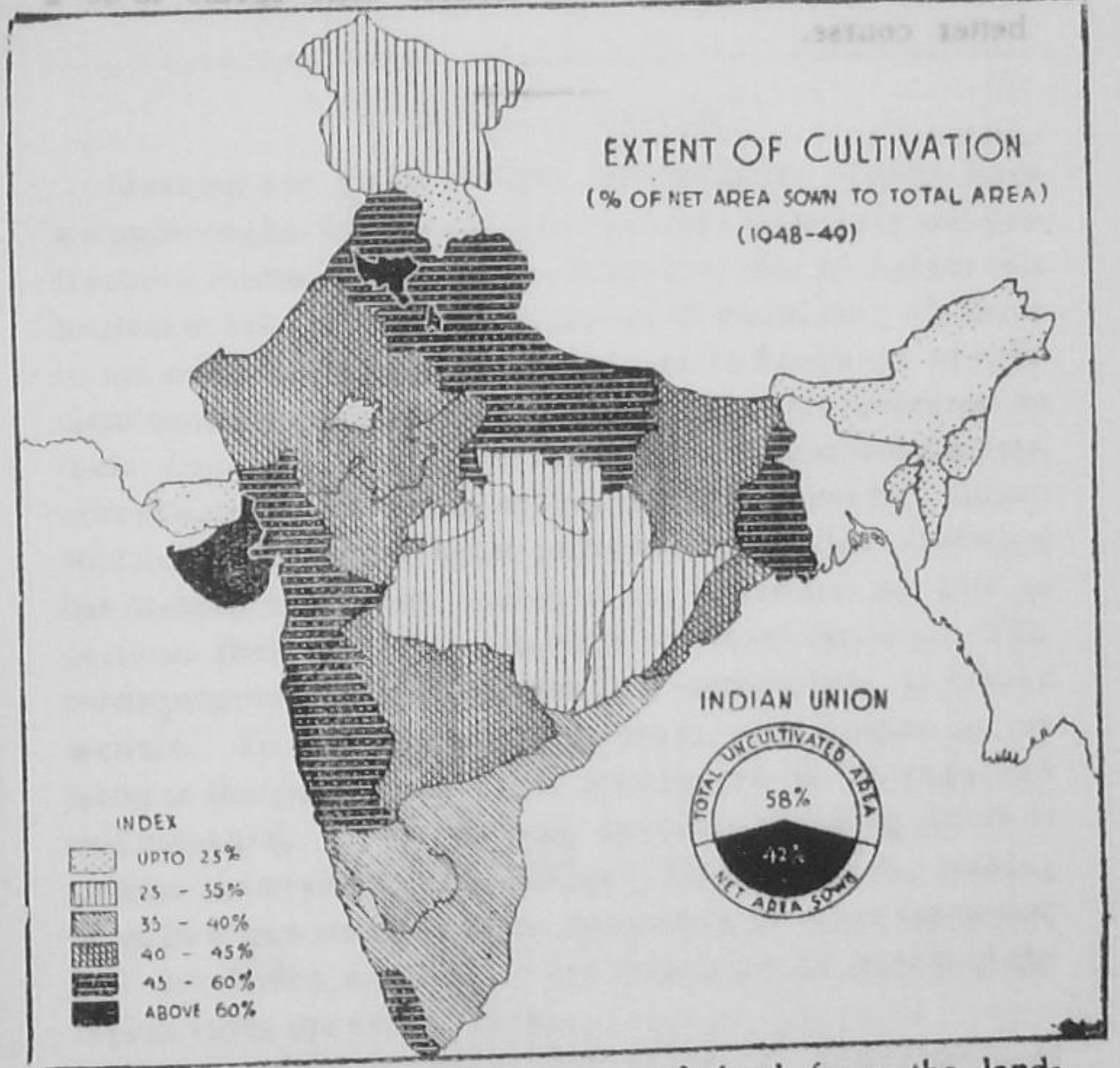
This plan is based on the data furnished by states which made an overall survey before supplying the figures. Large areas of waste land in other provinces which are reclamable are not included in this scheme, since the intention is to tackle those areas first which will lend themselves easily to mechanized operation so that maximum effort could be put forth in increasing food production within the shortest possible time. The fundamental point in the plan is to make lands immediately available for increased food production so as to reduce and ultimately wipe out the food imports. The plan, therefore, concentrates for the present on the reclamation of land in respect of which information is available, and which satisfies two conditions: (i) the lands are in large blocks of at least 500 acres each, so as to facilitate the mechanical reclamation, and (ii) they are either scrub jungles with spare tree growth or are weed infested, on which crops can be grown after reclamation. About 50 lakh acres was to be taken in the first year and then the area was to be increased subsequently. The entire cost is Rs. 266 crores. Various targets have been fixed for each part of the scheme, land reclamation being the largest item. The dollar requirements are Rs. 71·08 crores and the sterling requirements Rs. 64·93 crores; they will be spent within 3 years for purchasing requisite machinery and equipments. The Indian part of the expenditure is Rs. 130 crores to be spent over a period of 7 years. The scheme is self-sufficient in the sense that ultimately the entire costs are recoverable from the cultivators for whose benefit reclamation is done and who as colonists will be settled on those lands. In all possible areas irrigation schemes are being linked with reclamation scheme. The kans infested lands occur in areas where the rainfall is between 40 to 75 inches per year. Of the 2·2 mil. acres of New land to be reclaimed

1·5 mil. acres is rice land situated in heavy rainfall areas of tarai in U. P. and in Orissa. In these places special irrigation scheme is not necessary. The remaining area is in the wheat belt where the construction of tube-wells is to be linked up with the reclamation of these areas. The period of completion of the scheme is 7 years, and the estimate of annual yield of food from reclaimed land is 1 mil. tons. The work is carried out by the States with the assistance of the Central Tractor Organization, starting in 1947 with 180 tractors left derelict by the U. S. army after completing the famous Ledo Road in Assam. Tractors are organized into units of 15 each, and a mobile workshop is attached with each unit The actual operation started in March 1948 in Madhya Pradesh with kans infested lands where the cost of reclamation was Rs. 40 per acre. The biggest scheme is that of U. P., 47 thousand acres in Ganga Khadar in Meerut district and 50 thousand acres in Tarai in Naini Tal district. The official version of the results is encouraging since cost of tractor cultivation is said to have been reduced and good crops are reported. The actual areas reclaimed by the government are: 1947-48 32,531 acres; 1948-49, 71,497 acres and 1949-50, 98,000 acres, which are below the targets. The paper reports and the discussions in parliaments show contrary results, indicating the reported yields being based merely on a rough estimate of area sown multiplied by the average crops yields, irrespective of the actual output.

The Planning Commission in the First Five Year Plan fixed a target of 4 mil. acres to be restored to cultivation from fallow land and 1·5 mil. acres to be reclaimed by the C. T. O. The other land improvement schemes further cover 1·9 mil. acres. The total being 7·4 mil. acres upto 1955–56, which aims at an additional production of 1524 thousand tons which is 21% of the total production target.

The recent estimates of culturable waste land which can be used for agricultural purposes included in different land classes (inclusive of the current fallow land) is about 71 mil. acres. Out of this most of the land is such on which even after reclamation cultivation will be uneconomic. Considerable areas are of the nature where technical and financial difficulties of reclamation are unsurmountable. Really speaking hardly 10 mil. acres is of the nature on which cultivation can be extended within reasonable future, which means hardly 4% addition to the existing cultivated area. Most of it being sub-marginal land on which yield will be below average, the total addition in food supply from reclamation will not be considerable. The difficulties of technical nature, of irrigation, of land rights and of finances are tremendous. Merely the presence of a considerable area of culturable waste land does not lend support to that optimism. All such lands are not and cannot be made available for colonization by landless labourers. Besides, the fact that inspite of the price incentive the conspicuous increase in fallow land in the recent, past further shows the unsurmountable difficulties of bringing fresh lands under cultivation. Therefore, we cannot be very optimistic regarding the enhancement of agricultural production and thus solving the food problem mainly or largely through agricultural extension. Besides, the increased demands of industrial raw materials will not permit any considerable increase in the areas under food crops. Hence for enhanced food supply we have to depend mostly on intensification leading to increased yield per acre. This does not mean any neglect of efforts on the side of extension. As a matter of fact both are necessary. But there cannot be a high hope for a considerable enhanced food production or increasing the standard through agricultural extension.

Another interesting study is to determine the possibilities of extension in different parts of the country. The following map, showing the extent of cultivation is drawn on the basis of newly formed states.



The limits of cultivation, as judged from the land-utilization point of view, are considerably reached in the plains. The possibilities of extension of cultivation in these parts seem to be considerably limited. The central part, however, seems to afford greater chances. But in view of the difficulties of providing irrigation facilities

(the most basic need in extension) in this region, any chance of large-scale extension, at least in the near future is highly problematical. Under such circumstances, intensification of agriculture in the northern and coastal plains and extension in the middle zone seems to be a better course.

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CHAPTER VIII

Resource Utilization Continued (Water & Power Resources)

I. RIVER TRAINING.

Meaning and Scope of River Management. Rivers have a wandering habit, and thus are by nature disorderly and destructtive forces. Besides, man's interference with them (his neglect to take precautions in the use of water, and his error in not recognizing the rights of rivers to floodways of sufficient capacity to deal with the amount of water delivered to them, *i. e.*, restricting the flowage ways by enchroachments, occupations, construction of roads and railways without sufficient waterways being provided, and other obstacles) has created conditions under which rivers are not able to perform their function efficiently as flood carriers. The consequences involved are vast and antagonistic to human welfare. To prevent and cure them, and further to put water to the greatest use, river systems are to be regulated and managed. River training involves inducing rivers to submit themselves to disciplined behaviour, *i. e.*, making them flow in a stable regime, conserving of water resources, and developing the whole river system for the benefit of the region along the entire course.

The problem of River Regulation or Management is broadly speaking the problem of conserving the surface-flow. The activities are two-fold : On the one hand they include the problems of maintaining the rivers in efficient working condition, *i. e.*, the problems of prevention and of cure,

refering to the destructive aspect of rivers. They include some problems directly involved, *e. g.*, flood control, maintaining adequate supplies in dry season, avoiding of all sorts of encroachments on flood ways, reducing the quantity of debris to be transferred, dredging, and river sanitation, etc. Some problems are indirectly related, *e. g.*, methods of farming, forest management, kind and quantity of stock raising, windbrakes and field embankments, etc. They indirectly affect streams-flow (through soil deterioration) and cannot be ignored. On the other hand, (on the development side) river management involves the best utilization of water for different purposes, including the problems of irrigation, power, navigation, fisheries and river-bed cultivation, etc. The problems, as a matter of fact, vary according to the nature of rivers. Rivers of peninsular India and parts of the Narbada and the Mahanadi, excepting within 50 miles from their debouchment into the sea, and their tributaries, flow mostly in well-defined valleys and between comparatively definite bluffs, and do not meander about in a lawless manner like the alluvial rivers of northern India, and alluvial parts of the Narbada on the West Coast and the Mahanadi on the East Coast. The problems of control, specially on the negative side, are more peculiar to alluvial rivers, while those of the development and conservation may be common. Besides, there are highly complex problems of engineering and of governmental relations involved in it.*

II. PROTECTION AGAINST FLOODS.

Flood Ravages. The problem of floods is very old. The

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*River Training and planning of works is for multiple uses of water, and as such there is apparently a conflict of activities. Really speaking there is no conflict of activities, since from the view point of regional development such conflicts can be harmonized with least social disadvantages.

great deluge of legandry antiquity, which practically wiped out the population, left an almost permanent impression on the human mind of the overwhelming damage wrought by flood. In the recent past floods are becomming more frequent, more intense and more destructive. Some of the losses are direct and some indirect. The former include the physical damage to property such as destruction of crops, drowning of live-stock damages to buildings, railroads, bridges, water works, sewers, streets and telephone service, etc. The latter are those resulting from decreased agricultural, industrial and commercial activities during floods and during periods of recovery. Epidemics, usually malaria, further add to the ruin and desolation. Floods involve a terrible amount of human suffering, and engender a defeatist psychology amongst the people who frequently face famines. Scientifically speaking the loss of life can be avoided, but it usually occurs due to natural reluctance of the people to leave their possessions. Generally they occur in lower reaches of rivers. And what is important to remember is that they are largely the creation of man himself, who, unmindful of the risks involved in striving for livelihood, tries to occupy lands on which nature has not accomplished her work of making them fit for human habitation and for use to which man wants them to use.

Causes of Floods. The most common and the primary cause of floods is a heavy rainfall occuring in a short time, accummulating huge quantity of water in stream channels beyond their carring capacity, and thus overflowing their banks. The physical features of the drainage basin such as the geological structure and the ground inclination, etc., have an important bearing, since they affect the run-off of water. Other causes, usually termed as exceptional causes, are : rapid thawing of snow, volcanoes bursting beneath a flowing

current, earthquakes leveling up or reducing the channel section of streams, simultaneous or successive bursting of artificial reservoirs in a valley, and ice-jams or landslides closing the outlets of valleys, etc.

Generally it depends on a set of conditions, which, broadly speaking, are put under three classses differing in the aspects they present. (*i*) Non-alluvial, (*ii*) alluvial, and (*iii*) tidal areas. In alluvial tracts rivers are land-building, and being usually incompetent to discharge the water brought down in flood season, they normally overflow their banks. Floods are more frequent and destructive in such areas where rirevs are perpetually changing their courses. It is said that throughout the alluvial plains the history of civilization has been the history of river protection and training. In tidal rivers the process is different. The direction of flow is reversed as the salt water, having greater density than fresh water, forces its way against the current coming from the opposite direction. Sometimes other factors, such as formation of bars at the mouths of the estuaries and the operation of a steady littoral drift along the sea coast, also cause floods in tidal regions or the lowest river reachs.

Control of floods. Measures for flood control fall into two groups : (*i*) flood prevention, and (*ii*) flood protection. The former aim at preventing food stages, while the latter at minimising the effects of flood stages or at preventing the damages caused by them. Two things, however, have to be noted. First, that the two methods should be supplementary, and each should be sufficiently flexible to allow a change or elaboration when needed. And secondly, a complete flood control system can be planned and executed not as a single measure. The financial implications cannot generally be justified in the light of single specific problems. Really speaking the social benefits, multi-sided direct and indirect

advantages in the long run, leading to or affecting social prosperity, have to be taken into account. Water has multiple uses. The aim of river control cannot be achieved and financially justified by restricting it to a particular use. Therefore, the policy of flood control should form a part of the general national policy of conserving water resources in general. It is gratifying to note that the question of bearing the initial costs has recently been modified by the possibilities of future developments specially power, and high costs of flood control measures are juristified in the expectation of serving wider needs of the country.

(*i*) *Flood Prevention.* (*Storage Reservoirs.*) The remedy of floods lies in checking the rapid run-off of water, or its detention by storage whether underground or in surface reservoirs. Afforestation and better methods of cultivation facilitate the percolation of water into the ground, and its storage in subterranean reservoirs. But these measures cannot be taken as basic measures of flood control because there are considerable limitations to them. Storage must be provided in the form of furface reservoirs, to hold back water which would otherwise cause flood, and to regulate its release according to the discharging capacity of the channel. This is the most sound method of flood cotrol since the works can be constructed and operated with greater certainty and safety than in any other method of flood prevention. But there are limitations to this method also. Suitable sites may not be available to store huge quantities of water; artificial lakes may seriously injur other interest; even if a suitable site is found it may be very much upstream and the tributaries being left uncovered, it may not be benefiial to the area intended to be protected, and it may not eliminate the necessity of protecting the lower reaches. Besides, it should be noted that complete reief is not possible through

storage alone. Floods can best be mitigated by combining reservoir control with improvements of the river channels at critical places. The latter involve increasing the carrying capacity of channels, provision of outlets, lateral canals and cut-offs, prevention of caving of banks and sediment deposit in beds, dredging the bed and lining the banks, etc.

(ii) Flood Protection. (Levees). This is the most usual system of defence against floods, and was used by the Egyptians and the Babylonians. Holland affords a good example of successful defensive embankments. Embankments as a measure of river training are constructed to check the deterioration of rivers and to make certain reaches stable. But it should be noted that continuous levees without making an arrangement for drainage are harmful. It is said that this is the only method of controlling an alluvial river, but levees alone cannot be depended upon to serve the purpose. They must be helped by reservoir control.

Tidal Rivers. The problem of flood in the lowest reaches or tidal regions of rivers is of a peculiar nature. The conditions are so diverse—range of tide, presence or otherwise of an estuary, waves and currents forming bars, and the variations in the level of the sea, etc.—that no standardized methods of improving the outfall can be

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It Is said that embankments were originally conceived as a protection of vested interest, which in some cases was of great importance. Later on they were used as defence against flood or as a river training measure. Besides, confinement of flood waters within leveed trough is said to increase flood heights, and secondly, fertility of alluvial valley depends upon periodic overflow, and flood control in this way proves barmful to agriculture offsetting the benefits derived from occasionally protecting crops from flood. As a matter of fact there is no evidence to prove that levees raise river beds and increase flood heights. The existing constructions in U. S. A. and Europe do not support this theory. In the case of the Mississippi a tendency to lower the bed is noted. The conditions of the Nile are different because the floods reach its mouth early in spring before crops are planted.

suggested. However, many forces being at work fresh water cannot by itself maintain a sea outlet, and, therefore, nature is to be assisted in her attempts to discharge water of rivers into seas. But the expenses involved are so huge that only land reclamation may not be considered as a justified undertaking, unless navigation is of practical importance there. Floods in such areas are nature's method of land formation, and there should be no hindrance to the free passage of flood water by tidal obstructions. The best remedy is to remove the obstacles to the working of nature, since embankments in tidal regions aggravate floods instead of protecting them.

III. IRRIGATION.

Irrigation means artificial supply of water to soil for the purpose of plant growth. It implies maintaining the storage of water in the soil required for plant growth at times and places of deficient water supply *i. e.*, artificially regulating the moisture content of the soil to make possible the optimum growth of plants. Primarily it is a means of making up deficiencies in the moisture content of soils, but it is also a means of preventing or retarding the occurence of excessive quantities of water in irrigated soils. Fundamentally it is a practice of artificially supplementing the natural precipitation, since in nearly all areas where irrigation is practised crops receive some water from rains; and secondly, to remove the excess of water by drainage. In other words it is a method of changing soil sterlity caused

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The term 'duty of water' is defined as the ratio of the amount of water used to the area of land irrigated. When a large amount of water is applied to a small area the duty is said to be 'low,' and conversely when a small amount of water is applied to a larger area the duty is said to be 'high.' Alexander thinks that the term is a relic of early irrigation terminology, and Israelson suggests to discard it because of being misleading.

by drought into fertility, *i.e.*, overcoming low productivity due to dryness,* or excessive water-supply.

It can be viewed from different aspects: engineering, agricultural and economic and social. The first refers to designing and building structures required for storage, diversion, conveyance, delivery and distribution of water, determination of water yields of rivers and water supplies for irrigated lands, etc. The second refers to the use of irrigation water and agricultural practices, *e. g.*, rules applicable to different climates, soils and crops, methods of application and the quantity of water for single irrigation, etc. The third relates to the satisfaction of social needs and desires which is essential for any community enterprise. It must, however, be noted that there are no clear cut divisions between these phases and the problems in the different phases are interdependent. The following pages are devoted to the last phase.

Need and Importance. The main source of water supply needed for agriculture is the annual rainfall. Though the average annual rainfall in India, being about 45", is fairly high, it is seldom normal over the vast sub-continent. Excepting a few areas where it is high, regular and certain, by far and large it is scarce, uncertain, irregular and unevenly distributed. There are vast tracts in which annual

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*Soils formed under humid climate and those formed under arid climates differ considerably in their properties. Irrigated soils are more typical of arid climate soils. (Though some irrigation is found in humid regions, it is not extensive.) Barrenness and sterlity of arid region soils results from two major factors: drought and alkali. (Though alkali lands are typical of arid regions, they are neither of general occurence nor are uniformly distributed). Barrenness caused by drought alone can be checked and changed into fertility by irrigation, and not that caused by alkali for which there are other methods. Secondly, after long periods of irrigation arid region soils develop some of the properties of humid region soils, and some soils become sterile because of excessive irrigation, water-logging and alkali concentration.

precipitation is so light that cultivation is not possible without artificial water supply. There are still larger areas over which more than 80% of the rainfall being received between July and September, and the remaining year being dry, the uneven seasonal distribution results in the lack of moisture at the time required by crops.* Variations in different catchments and parts of catchments are more marked and frequent. Beside, the seasonal and local uneven distribution, the variation from year to year (at every place if separate tracts are considered) is so much that in every 5 years there is said to be one good, one bad and three indifferent years; in every ten years there is a scarcity of marked magnitude resulting in famine conditions; and in every about hal-fcentury the monsoon is abnormal over vast areas and there is a severe drought resulting in a widespread devastating famine. The results are that water is not available as and when requi-redfor most of the crops, during greater part of the year and over by far a larger area; and there is a great deal of insecurity of harvests. The Irrigation Commission 1901–3 expressed an opinion that 25% deficiency from average rainfall causes some injury to crops, and 40% deficiency generally causes severe drought. On the basis of the data supplied by the Meteorological Dept., and taking 20% defi-

*Where the annual rainfall is below 10 or 12 inches, cultivation becomes practically impossible without irrigation. On the other hand where the rainfall exceeds 70 or 80 inches and has always been so abundant that the chance of its serious failure may be regarded extremely remote, agriculture is relatively safe. Between these areas, in which the crops are thus rendered safe by exclusive reliance on irrigation or by an assured and abundant rainfall, lies a vast tract of about one million square miles of which, in the absence of irrigation, no portion can be deemed absolutely secure against the uncertainties of the season and the scourage of famine. (Irrigation Commission, 1901-3.)

From the view point of agriculture the most unsatisfactory feature of the Monsoon is its liability to failure or serious deficiency. It is mostly to overcome or mitigate the sufferings during these drought years that the great irrigation systems of India have been constructed.

ciency for considerable injury and 33⅓% for severe drought, the Sub-Committee on River Training and Irrigation calculated the average frequency of years of drought as follows.*

Divisions.	Average monsoon rainfall. (inches)	No. of dry yrs. or yrs. of draught expected in 62 Yrs.	
		Dry yrs, including yrs. of severe drought.	Yrs. of severe drought
Madras North Coast.	36	6	0
C. P. (Madhya Pradesh) East.	47	3	1
,, West.	41	8	1
Bihar.	41	11	2
Bombay Deccan.	24	11	3
C. I. (Vindhya Pradesh.) West.	31	12	3
Berar.	28	9	4
Hydrabad, North.	29	10	4
Uttar Pradesh, East.	35	10	6
C. I. (Vindhya Pradesh,) East.	35	14	6
Mysore, Maidan.	13	24	6
Uttar Pradesh, West.	33	11	7
Rajputana, East.	23	13	7
Punjab, East & North.	18	16	7
Madras, Deccan.	15	18	7
Hydrabad, South.	24	19	7
Gujrat.	31	12	9
Rajputana, West.	11	20	12

The table explains the necessity of protecting agriculture against the vagaries of the monsoon. Besides, it is necessay for carrying on cultivation in arid and semi-arid areas, for scientific agriculture providing diversity of production, for larger yields and longer employment to cultivating population, and for intensification of agriculture so as to maintain such a thick population in the country and such a huge pressure on land. The importance of irrigation is also obvious from the fact that inspite of considerable advantages of soil and climate crop production in India is not so efficient as in many other countries primarily because of the defective

*N. P. C. River Training and Irrigation, 1947, p. 33.

moisture content of the soils. And it cannot be over emphasized than to state that 'a sadder commentary on our economic situation cannot be found than the close, direct correspondence between harvests and birth-rates and inverse correspondence between harvests and mortality,'[1] and the security of harvests depends primarily on the adequacy of irrigation.

Irrigation Through Ages. Irrigation is said to be the oldest applied science in the world. It does not seem wrong because dependence of agriculture on rainfall renders cultivation precarious, and attempts to make agriculture safe against drought by providing systems of artificial irrigation must have been made since the dawn of civilization. On the basis of the available evidence it is difficult to say (though some have ventured to suggest) whether the earliest attempts were made by the Egyptians or the Babylonians or by others, and how far these attempts were contemporaneous. But it is true that in India systems of artificial irrigation were devised from ancient times and in the South storage tanks and in the North lift irrigation from wells and flow irrigation from rivers have been the usual methods of utilizing water for irrigation. For the sake of convenience the study may be divided into different periods[2]:—

(*i*) ***Prior to the Christian Era.*** The Vedas make mention of wells, canals, reservoirs and dams, and use the terms

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1. R. K. Mukerjee. Economic Problems of Modern India, Vol. I, 1939. p. ix,

2. For more evidences one can look to Irrigation in India Through Ages, Leaflet No. 7. Central Board of Irrigation ; W. Wilcox, Ancient System of Irrigation in Bengal, 1930.

Civilizations have risen in irrigated regions ; they have also decayed and disintegrated there. Some, therefore, hold that civilization based on agriculture under irrigation is destined to decline sooner or later. This can be true of any other basis. Really speaking the perpetuity of civilization depends on a number of factors, and of these permanently profitable agriculture is an important factor.

'*avata*' signifying well, '*kulya*' signifying canal and '*sarsi*' signifying dams. *Kausika Sutra* mention canal, and *Manu-smrti* wells, pools and dams. *Brihaspati* and *Narad* also refer to wells and dams. These ancient writers make mention of seven types and sizes of water works, *e. g. prapa*, *kupa*, *vapi*, *kulya*, *padmakara*, *sarsi* and *tataka*. *Kautalya* mentions construction and repairs of lakes, canals, dams and embankments. In Sanskrit literature we come across such terms as *pranali*, *kulya*, *sarasi*, *nika*, *nala*, and *nalika* for different types of canals, *kunda* and *tala* for different size of tanks, and *tataka* and *sarsi* for different size of dams. There is enough historical evidence, specially referring to later times, of different systems of irrigation followed in different parts of the country. Besides, there is reference to different types of instruments and hydraulic engineering. The most famous was the great feat of hydraulic engineering of diverting the course of the sacred Ganga by Bhagirath which is described in the spiritual language in the Story of Ganga Avataran. The whole operation was performed in several stages and took a very long-time.

(*ii*) *Beginning of Christian Era to 10th Century A, D.* An inscription of Rudradaman I, on the Girnar rock in Kathiawar records the construction and repairs of an artificial lake Sudarsan. It was repaired by successive Maurya and Gupta rulers. In the south the Chola rulers in 1st century A. D., constructed dams and controlled the river Kaveri. There are a number of other references to different types of works constructed at different times : construction of tanks is said to be common in Tamil tract in the 6th century ; Mahendra tank in North Arcot district in the early 7th century, and in the latter half a number of tanks in the Chingleput district ; a big lake near Conjeevaram and a tank in Walaja taluka in the 8th century, by Nandivaram ; a

number of tanks in Chingleput, North Arcot and Salem districts by Pallava King in 9th century ; a number of tanks and channels constructed by Parantaka I (also called Vir Narayan) in the 10th century, as proved by grants and inscriptions, a channel from the Kaveri near Trichinopoly, and a tank near Bahur near Pondicherry by Rajaraja in the latter part of the 10th century.

(iii) 11th Century to 17th Century. Rejendra Chola to commemorate his victories in the North is said to have excavated a tank and filled it with water from the Ganges, near his capital Gangaikonda Cholapuram in the beginning of the 11th century. Its present embankment is about 16 miles long. The Bhojpur lake (of proverbial size) was constructed by Raja Bhoj of Dhar near Bhojpur the remains of which are seen about 20 miles South of Bhopal. The story of its unusually large size has survived the test of tradition; and as an engineering feat it must have been a marvel. The copper plate grants of Anantvarman and Indravarman refer to the existence of two tanks in the 11th century. There are many other instances: Sindhuvalli tank in Mysore in 12th century, a tank in Musiri in Trichinopoly during Chola king Rajaraja III in the beginning of the 13th century, Pakhal lake in north of Warangal in the middle of the 13th century, Anantaraja Sagara (a huge resevoir) constructed by Bhaskara in the middle of the 14th century, Phirangipuram tank in Guntur district constructed by Surmitra in the beginning of 15th century, Haridra dam by Devaraja I in early 14th century, a big tank in Anantpur district by Narsimharaja towards the close of the 15th century, Nagalpura tank constructed by Krishnaraja of Vijayanagar in the early 16th century, Korrangal and Basaanna channels on the Tungabhadra by the same king, Siva Samudra (a big tank) constructed in the middle of the 16th

century near Bangalore, and a few canals constructed in the north, the most famous of which are those constructed by Firozshah Tughlaq, the old Jamuna Canal towards the end of the 14th century, a few others in Punjab and Sindh, the extension of the canals in the north, and construction of a canal from the Ravi by Shahjahan towards the middle of the 17th century. Besides, there is enough evidence of maintaining and repairing these works, of municipal supervision, of State help, of mutual feuds, of distribution of water, and of private enterprize, etc.

These are some of the instances furnished by legends, traditions and history. They prove that protection of crops against failure of rains through artificial systems of irrigation, suitable to topographical and other physical conditions, (*e.g.* storage works in the south and canals in the north) was provided by native rulers from the very beginning. They also prove that huge expenditure in money and material was made, and a high degree of technological development was reached in drainage and hydraulic engineering, specially with reference to the construction of dams and river training. But there seems to be no evidence of agriculture in the past being wholly or even mainly protected by artificial irrigation except in small localities. The available instances simply show scattered attempts; and throughout these ages agriculture was mostly dependent on the vagaries of the rainfall; and there were occasional crop failures as proved by the history of famines.

(iv) The British Period. Upto the middle of the 19th century the British Government did not pay any attention to irrigation works, and therefore some of the works which they inherited from their predecessors (inundation canals in Upper India and storage works and tanks in the South specially in Madras) were ruined due to neglect. After that

a change in the policy was noticed in the form of repairing and reviving the old existing works, such as the Western and Eastern Jamna canals, Ganges canal, works in the deltas of the Kishna and Cavery and replacing the old Halsi canal by the Upper Bari Doab canal in Punjab. Then began the construction of canals through private guaranteed companies such as the East India Canal Co. in 1858 in Orissa and the Madras Irrigation Co. in 1863. It was an unsuccessful experiment and the progress was very slow. On capital being exhausted the Orissa Co was taken over by the government in 1866, and then Orissa canals and some in Bihar were completed. Later on the government adopted a policy of construction and maintenance of productive works themselves by raising loans. Under this policy some of the greatest irrigation works of the country were constructed, *e.g.*, the Western and Eastern Jamna Canals, Lower Ganges and Agra canals, Sirhind and Colonization canals of the Punjab and the irrigation works of the deltas of the Krishna and the Cavery.

After the famine of 1877–78 the government specifically recognized it their duty to construct protective irrigation works in famine tracts, and accordingly steps were taken specially in the Deccan and also elsewhere, *e. g.*, the Rushikulya Project in Madras, Betwa canal in C. P. and Nira and Periyar canal systems in Bombay. But because of heavy costs, irregular demand for water and occasional failure of the monsoon these works did not pay their way,

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After the famine of 1877—78 the government decided to set apart Rs. 150 lakhs per year as the Famine Relief and Insurance Fund, half of it was to be spent on famine relief when need arose and the other half was allotted for canals and railways. Later on the whole of this amount was used for protective works. The Secretary of State in 1910 sanctioned a provision of an annual subsidy of Rs. 25 lakhs for the construction of protective works in addition to Rs 75 lakhs from Famine Relief Fund. This full amount was never utilized upto the war of 1914—18 when it was retrenched.

and, therefore, the government concentrated on more remunerative works in the Punjab. During this period the irrigation policy was considerably influenced by the recommendations of the Famine Commission of 1880, which emphasised the construction of railways as a measure of famine protection side by side with protective irrigation works. The Irrigation Commission of 1903, insisting on the increase of food supply, recommended the constructed of remunerative works in Sind, Punjab and parts of Madras which were not vulnerable to famines, and where a quick increase in food supply was possible. For famine areas they suggested the construction of protective works which, though not directly paying, would decrease the expenditure on famine relief. For Bombay Deccan they recommended canals fed from storage lakes in the Ghats, and also recommended the Kistna and Tungabhadra projects. As a result of their recommendations a large number of irrigation works were constructed between 1904 and 1914, specially the famine protective works in the hilly tracts in C. P., Bombay and Bundelkhand, Triveni Canal in Bihar and the Triple Canal Project (Upper Jhelum, Upper Chenab and Lower Bari Doab) in the Punjab.

Under the Reforms of 1919 irrigation became a provincial subject. The sanction of the government of India and of the Secretary of State was required only when the work was estimated to cost over Rs. 50 lakhs; the use of loan funds was no longer restricted to productive works and funds were also available from the Provincial Famine Insurance Grants when the same was not required for famine relief. After that, and specially after 1922, we notice a remarkable activity in irrigation, and many important irrigation schemes to have been taken up. The Royal Commission on Indian Agriculture advised the provinces to follow the example of

Bombay to investigate the natural resources for the protection of lands from famine, and further recommended more attention to be paid to the construction, preservation and improvement of minor irrigation works, formation of and assistance to Cooperative Irrigation societies to carry out and maintain protective works, establishment of closer relation between the Agriculture and the Irrigation Departments, creation of local advisory committees to deal with complaints about irrigation matters, and the establishment of a central bureau of information at Delhi. The last recommendation was given effect to in May 1931, when the Central Bureau of Irrigation was established as an essential adjunct to the Central Board of Revenue. Some of the important works completed during this time were: the Bhandardara Dam (the highest in India—270 ft.) and Nira Right Bank Scheme and Lloyd Dam at Bhatgar in Bombay in 1925 and 1926 respectively, Sarda Canals in U. P. in 1928, Sutlej Valley works in the Punjab in 1932-3, the Sukkur Barrage and Canals in Sind in 1932, Cauvery Reservoir and Mettur Project in Madras in 1934, and the more recent works like the Emerson Barrage in the Punjab, Damodar Canal in Bengal and the Ganges Tube-Well Scheme in U. P.

(v) ***After the Independence.*** The national government in their anxiety to solve the food problem have shown remarkable activity in respect of irrigation, which (together with power) occupies the first priority in the Five Year Plan having an allotment of Rs 561·41 out of Rs. 2068·78 crores. The new policy is based on the acceptance of the facts that water is the key to the solution of most of our problems, *i. e.*, food, industrialization and navigation etc., that agriculturists' greatest need is an assured water supply and that irrigation is the most potent agent for increasing crop-yields; and the

recommendations of the Famine Enquiry Commission, 1945, seem to form the basis of the irrigation policy in the Five Year Plan.* A distinction is made between minor and major or big schemes. The former are intended to yield quick results and are to be accomplished mostly by private individual efforts, assisted of course by the government, under the Grow More Food Compaign. The later involve huge financial expenditure, are in the form of gigantic dams across rivers, storing water in huge reservoirs and regulating its flow through canals at desired pace whenever needed, using water for several purposes, e. g., irrigation, navigation, generating power and fish culture, etc. The recently held

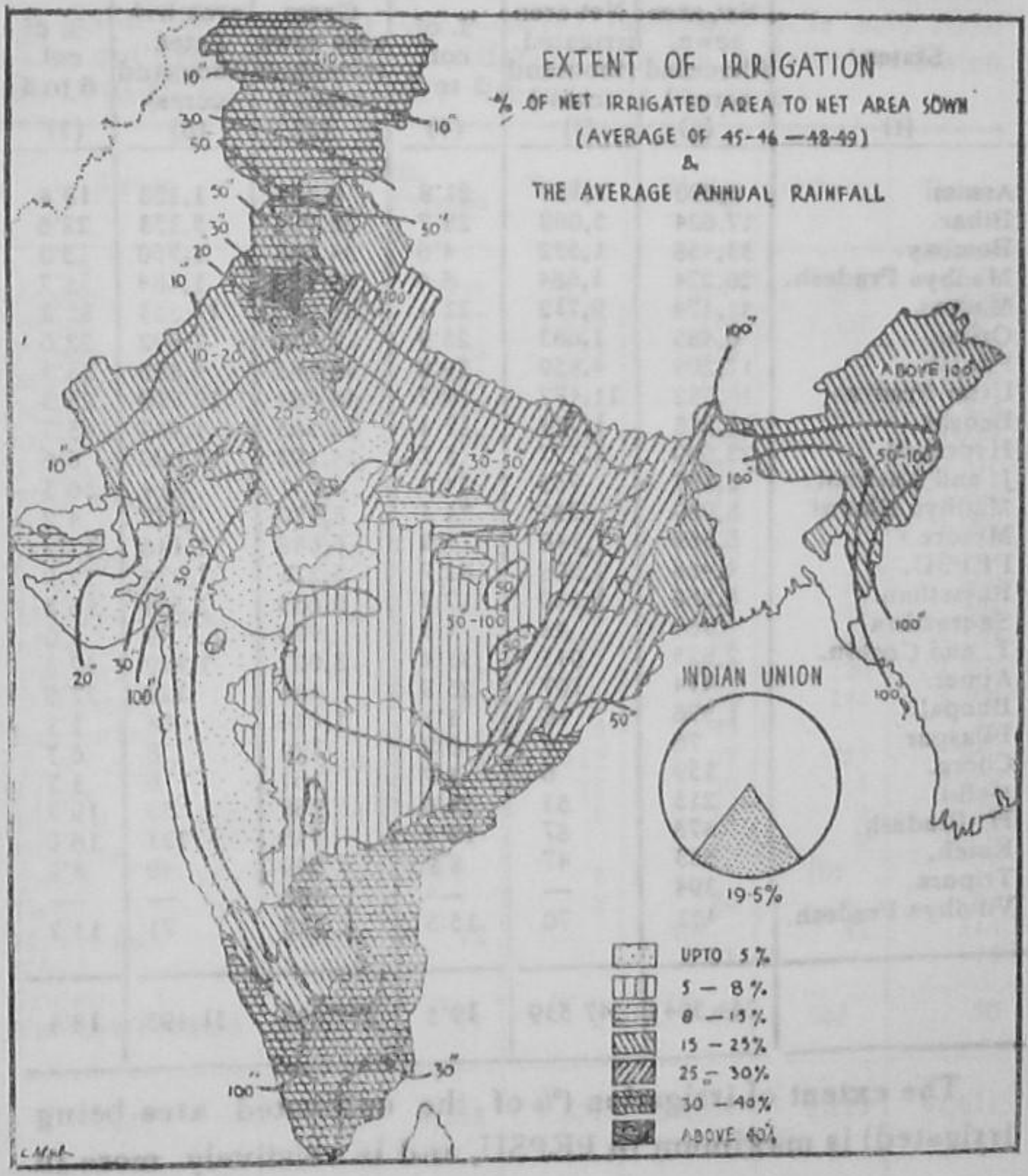
*Among the measures that may be adopted for increasing the area under cultivation and the yield of crops on the land already under cultivation, the first place must be assigned to works for the supply and conservation of water. (The Famine Enquiry Commission : Final Report, 1945 p. 129.)

The controversy 'irrigation vs railways' which was very prominent in the closing years of the last century, and in which R. C. Dutt took a leading part, has been abated now. The Famine Commission of 1880 recommended the construction of railways as a measure of famine protection side by side with protective irrigation works. As a result of this and also for military and administrative considerations there was a phenomenal expansion of railways. The result was that by 1902 the government expenditure on railways was Rs. 370 crores and on irrigation only Rs. 38 crores. The disparity appeared objectionable on account of the following reasons : (a) intensity and recurrence of famines at the close of the 19th century, (b) railways being losing concerns till then, (c) influence of British manufacturers and capitalists on Government of India to hasten railway construction under guarantee system, (d) protective irrigation works were not paying and hence progress was slow, but at that time a growing sense of responsibility for extending relief to famine tracts developed, and (e) undue hastening of railways accelerated the decline of indigenous industries, increasing the pressure on agriculture, and thus partially defeating the object of protective railways, namely to reduce the severity of famines.

As a result of the recommendations of the Irrigation Commission, 1901, the irrigation policy of the government became more liberal, and railways also began to pay And, therefore, the old controversy ended. But going to the merits of the controversy the proportion of expenditure between irrigation and railways at any time, though disputable, can be decided only with reference to the prevailing conditions. As a measure of protection against famine they are supplementary rather than antagonistic. But it should be noted that irrigation leads to additional food supply while railways lead to better distribution. Though both are inadequate in India at present, the pressing food problem necessitates more of irrigation, and we find this policy in the Five Year Plan.

International Engineering Exhibition at Delhi, the Fourth International Congress on large dams, a Sectional Meeting of the World Power Conference and the First International Congress on Irrigation and canals, in Jan 1951, have considerably stimulted interest and activity.

The Extent of Irrigation. Talking in absolute terms India's leadership in the field of irrigation is obvious. Our total irrigated acreage which is about 48 million acres at



present is not only largest in the world but also exceeds the combined acreage irrigated in U. S. A., U. S. S. R., Japan, and Italy, though they occupy an area of more than 10 times of that of the Indian Union. Our length of irrigation channels is over 60,000 miles, *i. e.*, more than $2\frac{1}{2}$ times the circumference of the earth. The extent of irrigation in different States on the basis of the average of 4 yrs. 45-46 to 48-49 is as follows.

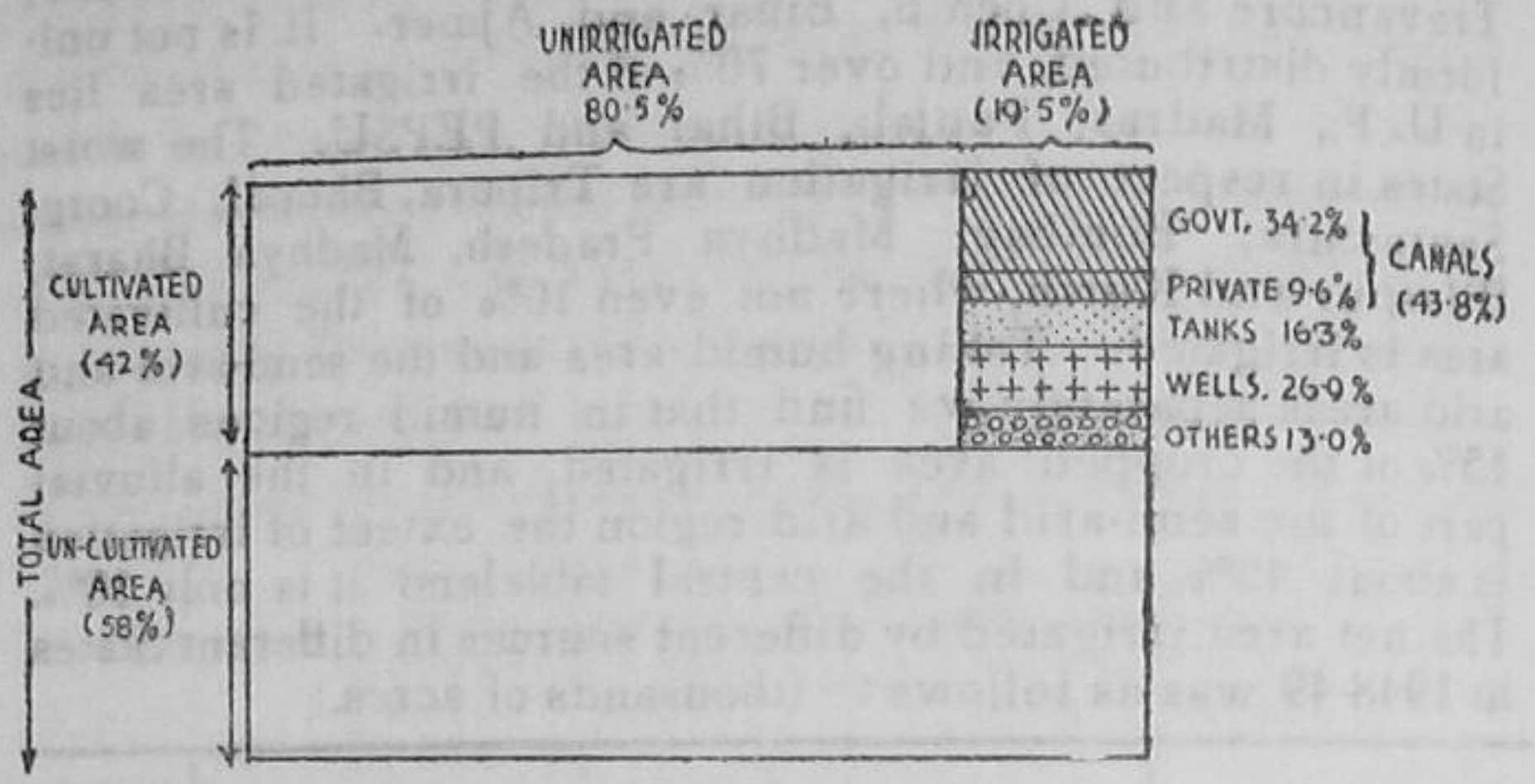
States. (1)	Net area sown, (thousand acres) (2)	Net area irrigated, (thousand acres.) (3)	% of col. 3 to 2 (4)	Gross area sown (thousand acres.) (5)	Gross area irrigated. (thousand acres) (6)	% of col. 6 to 5 (7)
Assam.	5,290	1,153	21·8	6,103	1,153	18·8
Bihar.	17,624	5,069	28·7	22,792	5,153	22·6
Bombay.	33,458	1,532	4·6	34,608	1,750	5·0
Madhya Pradesh.	26,274	1,684	6 4	29,416	1,684	5·7
Madras.	31,174	9,712	31·1	35,865	11,553	32·2
Orissa.	6,485	1,683	25·9	7,459	1,692	22·6
Punjab.	12,209	4,859	39·8	14.665	4,895	33·3
Uttar Pradesh.	38,582	11,477	29·7	48,084	12.299	25·5
Bengal.	11,238	1,924	17·1	12.583	1,977	15·7
Hydrabad.	23,909	1,377	5 7	24,192	1,609	6·6
J. and Kashmir.	2,197	755	34 3	2,241	814	36·3
Madhya Bharat.	8,089	357	•4 4	8,770	375	4·2
Mysore.	6,369	1,140	17·9	6,648	1,146	17·2
PEPSU.	4,468	1,908	42·7	5,221	1,934	37 0
Rajasthan.	8,566	1,520	17·7	9,635	1,561	16·2
Saurasthra.	964	48	4 9	972	49	5·0
T. and Cochin.	2,825	945	33·4	3,022	1,129	37·3
Ajmer.	414	107	25 8	461	129	27·9
Bhopal.	1,576	18	1·1	1,616	18	1·1
Bilaspur.	76	7	9 2	120	8	6·7
Coorg.	159	6	3·7	161	6	3·7
Delhi.	215	53	24·6	268	53	19·7
H. Pradesh.	478	87	18·2	715	121	16·9
Kutch.	533	47	8·8	549	49	8·9
Tripura.	394	—	—·	468	—	-—
Vindhya Pradesh.	452	70	15·5	515	71	13·7
	243,504	47 539	19·5	277,034	51,195	18·4

The extent of irrigation (% of the cultivated area being irrigated) is maximum in PEPSU, and is relatively more in

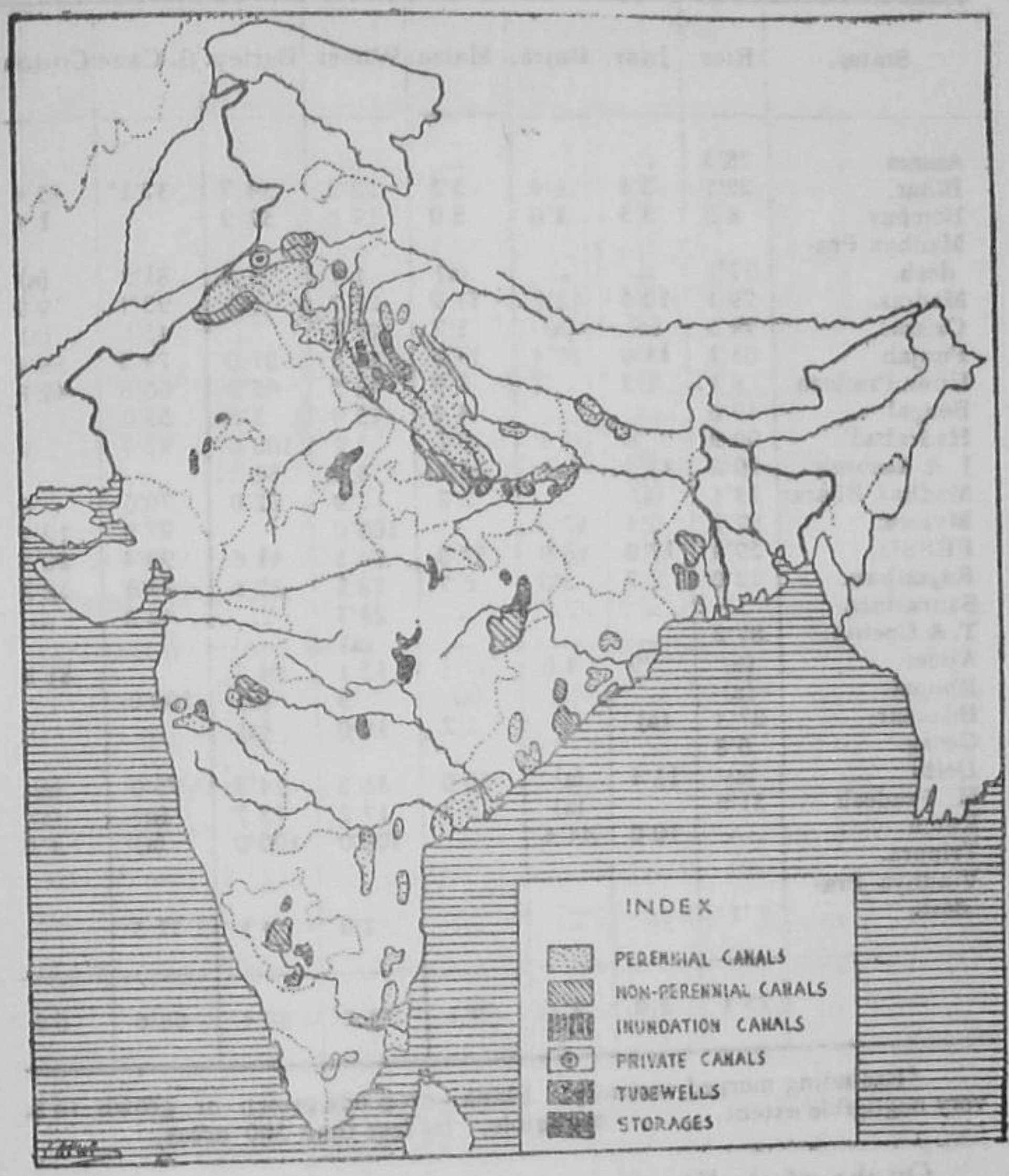
Punjab, Madras, Uttar Pradesh, Jammu and Kashmir, Travancore and Cochin, Bihar and Ajmer. It is not uniformly distributed, and over 70% of the irrigated area lies in U. P., Madras, Punjab, Bihar and PEPSU. The worst States in respect of irrigation are Tripura, Bhopal, Coorg, Saurasthra, Bombay, Madhya Pradesh, Madhya Bharat, Bilaspur and Kutch, where not even 10% of the cultivated area is irrigated. Taking humid area and the semi-arid and arid areas separately we find that in humid regions about 15% of the cropped area is irrigated, and in the alluvial part of the semi-arid and arid region the extent of irrigation is about 45%, and in the central tableland it is only 10%. The net area irrigated by different sources in different States in 1948-49 was as follows: (thousands of acres.)

States	Canals. Govt.	Canals. Private	Tanks.	Wells	Others	Total
Assam	141	727	(b)	(b)	277	1,145
Bihar	693	761	1,536	774	1,158	4,922
Bombay	333	73	133	972	60	1,571
Madhya Pradesh	(a)	1,465	(a)	179	91	1,735
Madras	4,553	157	3,044	1,784	298	9,816
Orissa	374	60	484	36	730	1,684
Punjab	2,605	318	7	1,654	26	4,610
Utta Pradesh	4,110	72	12	4,935	2,076	11,205
Bengal	281	241	880	38	469	1,909
Hydrabad	155	11	704	410	47	1,327
J. & Kashmir	173	447	5	6	29	660
Madhya Bharat	96	1	30	252	15	394
Mysore	265	5	582	92	208	1,152
PEPSU	1,297	24	...	618	20	1,958
Rajasthan	632	10	118	602	141	1,503
Saurasthra	...	...	6	48	...	54
T. & Cochin	320	68	112	27	413	940
Ajmer	...		13	90	1	104
Bhopal	2	...	1	12	3	18
Bilaspur	...	...	...	...	9	9
Coorg	4	(b)	2	...	(b)	6
Delhi	34	...	3	25	...	62
H. Pradesh	...	72	...	(b)	42	114
Kutch	1	...	...	41	...	42
Tripura	...	...	...	...	...	...
Vindhya Pradesh	1	11	2	56	(b)	70
Total	16,050	4,523	7,674	12,651	6,113	47,011
%	34.14	9·62	16·33	26·91	13·00	100·00

(a) Included under private canals. (b) Below 500 acres.



Of the total irrigated area about 44% is irrigated by canals (34% by government and about 10% by private canals) which are the most important source of irrigation at present, 16% by banks, about 27% by wells including tube-wells, and 13% by other sources Irrigation by canals is done more in Madras, Utter Pradesh, Punjab, PEPSU, Bihar and Rajasthan. Private canals are mostly found in Madhya Pradesh, Bihar, Assam, Jammu and Kashmir and Punjab. Tank irrigation is most common in Madras which has about 35,000 of them and then come Bihar, Bengal, Hydra-bad, Mysore and Orissa. Unlike wells which are mostly privately owned, tanks are almost always administered by the State. Wells are most common in northen India specially Utter Pradesh, Punjab, Rajasthan PEPSU and Bihar. In the Central and Southern India, they are less in number and the area commanded by each well is also less. In the South they are most common in Bombay. There are more than 2½ mill. wells. They are mostly private works, but their cons-truction is helped by the government by advancing 'tacavi' loans. A large number is recently sunk during the Grow More Food Compaign. This sort of development in different



parts of India has largely been governed by physical factors specially the topography, the river system, the soil profile, and the depth of water table, etc.

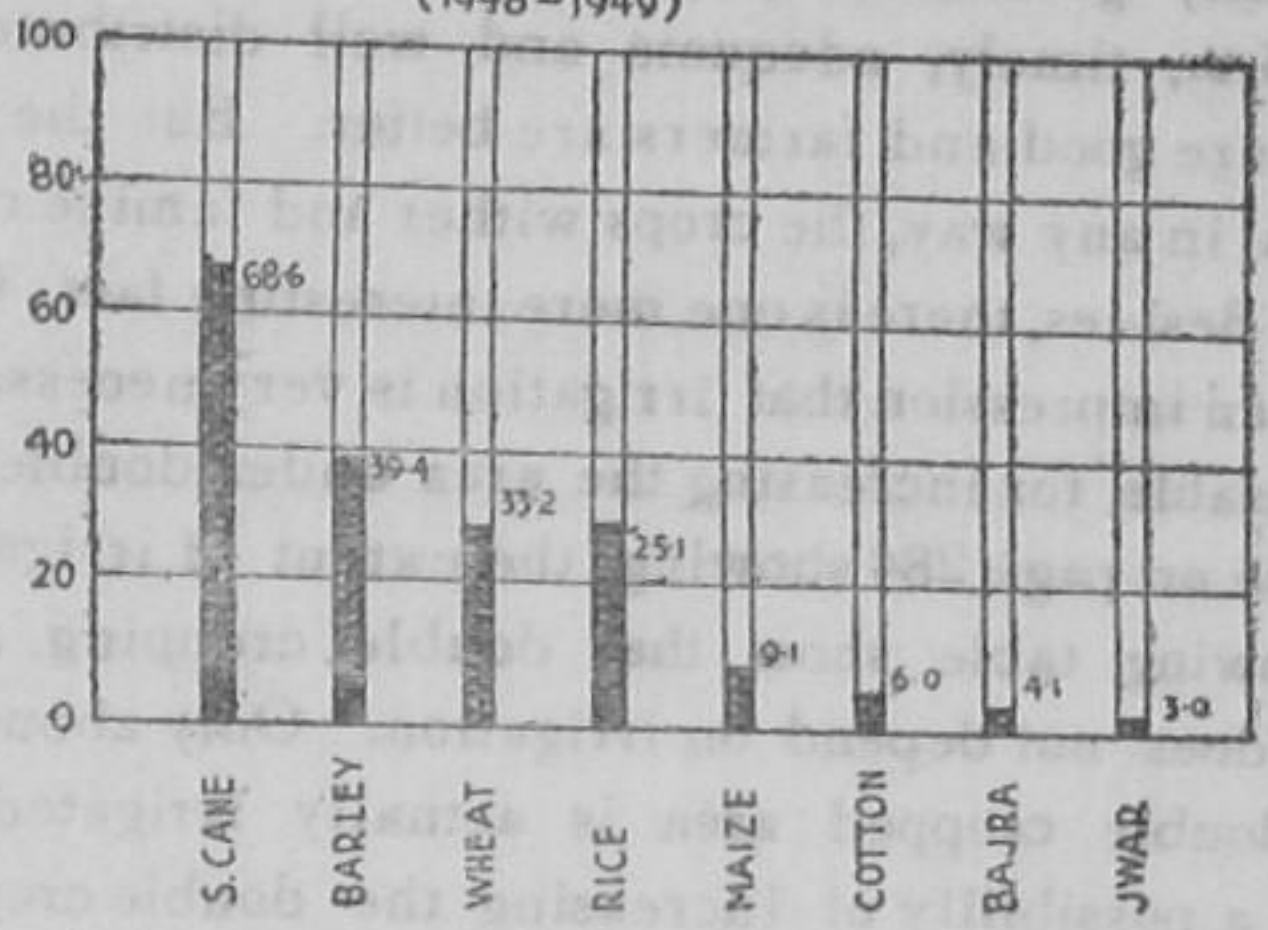
The extent of irrigation under different crops also varies considerably. The % of irrigated area to total area under some important crops in 1948 was as follows :—

States.	Rice.	Jwar.	Bajra.	Maize.	Wheat.	Barley.	S. Cane	Cotton.
Assam.	28·3			...	...		...	...
Bihar.	22·1	5·1	1·4	5·5	22 2	34 7	37·1*	45·4
Bombay.	8 5	3·3	1·6	8 0	17 6	57 9		1·4
Madhya Pradesh.	17·1	...	...	(a)	1·4	3·8	81·3	(a)
Madras.	79·1	10·5	12·7	11 9	27·7	(a)	95·4	9·9
Orissa.	14·3	(a)	(a)	1·7	27·3	...	45·1	(a)
Punjab.	63·1	14·6	10·4	34 5	53·3	27·0	74·5	88·1
Uttar Pradesh.	8 1	1 3	·2	3 0	48·5	45 2	66·8	42·8
Bengal.	19·6	...	...	4 4	15·9	3·5	55·0	
Hydrabad	90 9	·6	1·1	9·7	7·9	100 0	92 7	·2
J & Kashmir.	79·2	12·5	(a)	6·4	5·5	52·3		
Madhya Bharat	13·1	(a)	...	1·2	7·9	22·0	76·6	·6
Mysore.	97 7	5·3	17·9		100·0		97 9	10·9
PEPSU.	59·4	17·0	18·9	57 2	74·5	41 6	90·4	82·3
Rajasthan.	12·0	2·7	2·0	6·7	28·5	37·6	74·3	32·3
Saurasthra.	...	...	...	...	23·3	...	42·8	...
T. & Cochin.	87·2	...	...	...	(a)			
Ajmer.	(a)	·9	4 0	47·1	32·1	94 2	...	81·8
Bhopal.	(a)	..	...	(a)	·3	(a)	100·0	...
Bilaspur-	27·3	(a)		2·2	10·0	(a)	...	
Coorg.	6·8	...					...	
Delhi.	(a)	11·4	(a)	50 0	56·2	14·3	75·0	(a)
H. Pradesh.	51·6		(a)	5·3	17·2	13 7	(a)	(a)
Kutch	...	10 0	44·4		100·0	100·0	(a)	4·1
Tripura.	...						...	...
Vindhya Pradesh.	·1	...	...	...	2·9	4·1	37·5	...
	25·1	3.0	4 1	9·1	33·2	39·4	68·6	6 0

*Excluding merged territory. Blank—crop not grown or grown to a very negligible extent. .....negligible, (a) less than 500 areas,

On the whole Kharif crops depend mostly on the monsoon, and irrigation is mostly devoted to protect Rabi crops. Besides, about 80% of the food supply being from Kharif crops and only 20% from Rabi crops, these facilities are largely devoted to cash crops and very little to food crops. Millets are by far and large unirrigated, except to some extent in Punjab, PEPSU, Madras, Mysore, Delhi, Ajmer and Kutch.

EXTENT OF IRRIGATION OF DIFFERENT CROPS
% OF IRRIGATED TO TOTAL CROP AREA
(1948–1949)



About 1/4 of the rice crop is irrigated. It is essentially an irrigated crop in Madras, Mysore, Hydrabad, Jammu and Kashmir, Travancore and Cochin, PEPSU and Nearly 1/3 of the wheat and barley areas are irrigated, and irrigation is more uniform in the case of wheat than in the case barley so far as the different States are concerned. These crops are irrigated to a relatively greater extent in Punjab, Uttar Pradesh, PEPSU, Rajasthan, Ajmer, Kutch, Delhi and Bihar. Cotton on the whole mostly depends on the monsoon but is mainly an irrigated crop in Punjab, PEPSU and Ajmer, and considerably irrigated in Bihar, Uttar Pradesh and Rajasthan. Sugarcane depends by far and large on irrigation except (amongst the important sugarcane areas) in Bihar where about 1/3 of the crop is irrigated.

Inspite of such a vast development hardly 20% of the net cultivated area is protected by artificial irrigation and the remaining 80% depends on the vagaries of the monsoon. Both the percentage of area irrigated and the quantity of water used are comparatively very small. And, therefore, agriculture is said to be a gamble in the monsoon. The

consequences are that crop conditions and farm prosperity are directly governed by the monsoon. The year it is normal *i. e.*, timely, adequate and well distributed, crops Punjab. are good and farmers are better. But the year it is abnormal in any way, the crops wither and famine conditions prevail. Besides, there is one more interesting fact. Generally there is an impression that irrigation is very necessary, if not indispensable, for increasing the area under double cropping. The table on page 284 showing the extent of irrigation, and the following table show that double cropping, at least at present, does not depend on irrigation. Only about 10—12% of the double cropped area is actually irrigated. Hence there is a possibility of increasing the double cropped area (or intensification of cultivation) even under the existing circumstances, and irrigation is not the most important factor standing in its way.

Years.	Net area irrigated. (Mil Acres)	Total area irrigated. (Mil Acres)	Double cropped area irrigated (Mil. Acres)	% of net irrigated area to net cultivated area.	% of total irrigated area to total cultivated area.	% of irrigation under double-cropping
36-37 to						
38—39	44 3	48·7	18·6	18 8	4·4	14·6
39—40	46·5	51·2	19·6	19·1	4·7	15·4
40—41	47 5	52·2	19·5	19·1	4·7	15·6
41—42	47·2	51·6	19·7	19·7	4·4	16·1
42—43	45·8	50·1	18·9	20·6	4·3	13·3
43—44	46·8	51·6	19·0	18·4	4·8	14·4
44—45	47·1	51·7	19 1	18·5	4·6	13·5
45—46	48·1	52·1	19 8	18 8	4·0	11·6
46—47	48·5	52·6	19·9	19·0	4·1	12·1
47—48	46·6	50·1	18·9	18·0	3·5	10·7
48—49	47·0	49 7	19·2	18·0	2·9	8·9

Irrigation Methods and Practices. The term method of irrigation implies the way in which water is applied to land. Ordinarily speaking there are four methods of doing it.

(*i*) ***flooding.*** It is practised where irrigation water is abundent and inexpensive. There are several methods

of flooding : (*a*) ***from field ditches***, i. e., without levees to guide its flow or restrict its movement. This is popularly termed as flooding ; (*b*) ***border-strip flooding***, when field is divided into a number of strips, sufficiently wide and long, and water is made to flow towards the lower end ; (*c*) ***flooding by pipe*** ; (*d*) ***check flooding***, when a number of large streams are made to flow into relatively level plots surrounded by levees, suited specially to permeable soils which should be quickly covered with water to prevent losses through deep percolation, and also in heavy soils into which water percolates so slowly that they are not sufficiently moistened during the time a sheet of water flows over them, and (*e*) ***basin flooding***, which is essentially the check method adopted in irrigating orchards.

(*ii*) *By furrows*. Sometimes the furrows are deep as for the crops like potatoes or for orchards, and sometimes they are shallows as for beat.

(*iii*) *Sub-irrigation*. In which land surface is wetted a bit, if any. It is done in two ways : (*a*) controlled by lateral supply ditches, and (*b*) uncontrolled by excess application of water to higher lands.

(*iv*) *Spraying or sprinkling*. Only a limited quantity of water can be supplied in this way, and it is generally done in the case of pot cultivation.

The term 'method of irrigation', which means the way in which water is applied to land, should not be confused with the term 'sources of irrigation', which refers to the forms of irrigation works such as canals, wells and tanks, etc., through which water is drawn from its natural position.

It is interesting to enquire as to what determines the selection of the method of irrigation. The method depends largely, though not wholly, on the crops produced. And in the selection of the sub-irrigation method the most important consideration is given to the soil conditions.

There are many factors influencing the amount of water used in irrigation. They can be put under three broad classes each of which includes many specific factors (i) *Biological and chemical*, including readily available soluble plant food nutrients in the soil, chemical composition of irrigation water and the kinds and the amount of alkali salts in the soils etc. (ii) *Physical*, including climatic, such as rain, wind, heat, length of season, soil properties such as texture, depth and permeability, and land preparation such as conveyance and delivery, etc. (iii) *Administrative*, regulating the delivery of water, whether in continuous flow or in rotational or turn method or delivery on demand,

Another way of classifying the methods of irrigation is to put them under two broad heads: (*i* ***flow irrigation***, when water flows from its source in rivers, reservoirs, or lakes to land in response to the force of gravity, and (*ii*) ***lift irrigation***, when the location and topography with respect to water supply is such that it cannot flow over the land by gravity, and has to be raised by some mechanical device from its natural source.

The term 'irrigation practices' refers to such things as the size of stream, area covered under a stream, frequency of irrigation and the amount of water applied in single irrigation, etc. They are determined mostly by three conditions: (i) Soils under cultivation, (ii) climate of the locality, and (iii) the crops grown.

Classification of Irrigation Works. Irrigation works are commonly classified into four kinds, the first three of which are the main, while the forth is not commonly found, and is not very important so far as the total irrigation is concerned. They are :

(i) Canals. They are of three kinds : (*a*) ***Perennial Canals.*** They are constructed by putting some barrage across rivers which flow throughout the year. The canals are, therefore, independent of the natural water level in the river, and have an assured water supply all the year round. The gigantic canal systems of U. P. and Punjab are of this kind. (*b*) ***Inundation Canals.*** They are drawn from rivers without any barrage. They get water only when the river is flooded and water reaches a certain level. The water supply in the canal fluctuates with the natural flood level in the river, and becomes scanty when the level is low. Irrigation by these canals is mostly confined to a period from June to September. Sind canals before the construction of the Sukkur Barrage, some Punjab canals even at present are of

this type. (c) *Storage Works Canals.* They are canals drawing water from storage which is constructed by building a dam across a valley to store rain water during the monsoon period. Such works have been in existence in India from very old times specially in the Deccan, Madhya Pradesh and Bundelkhand.

(ii) Wells, including both the surface and the tube-well.

(iii) Tanks, of all sizes ranging from huge lakes, formed by constructing dams across the beds of irregularly flowing rivers, to small village ponds in which a small quantity of rain water is collected.

(iv) Other Works, generally of lift irrigation from rivers and temporary dams holding flood water.

The classification of government irrigation works is, however, made in a different way. Upto 1921, for the purpose of indicating the source from which the funds for the construction of these works were drawn, they were classified as :

(*i*) *Productive Works.* They were expected to yield within 10 years of their completion a net revenue sufficient to cover the annual interest charges on the capital investment. They were mostly found in northern India and Madras, and were financed by loans.

(*ii*) *Protective Works.* They were intended to serve as insurance against famine, and were not expected to be directly remunerative. They diminished the necessity of periodical expenditure on famine relief. The cost was charged on the current revenue of the government and was generally met from the annual grant set aside for famine relief and insurance. They were constructed in the precarious tracts specially in the Deccan.

(iii) Minor Works. This was a miscellaneous class including works (specially tanks) which the British Government inherited from early rulers, and also a few which they

constructed. They were all financed from current revenues, and loans were permitted only in case of productive ones. These minor works were further classified into two: those for which capital and revenue accounts were kept and those for which they were not kept.

After 1921 the old classification has been changed, and now it is possible to finance any work of public utility from loans irrespective of its remunerative character or otherwise. The last two categories in the old classification (protective and minor works) have been abolished,* and now the classification is:

(i) Works for which capital accounts are kept. They are classified into two: (*i*) ***Productive***, and (*ii*) ***Unproductive***. No reference is made to the source from which funds for construction are drawn.

(ii) ***Non-Capital Works***, for which no capital accounts are kept.

The Water Potential. The mean annual rainfall amounts to 2750 mill. ac. ft. Of this 51% or about 1400 mill. ac. ft. is lost through evaporation and transpiration, and is absorbed by the soil. The remaining 49% or about 1350 mill. ac. ft. forms the annual surface run-off drained by our mighty rivers, the peak discharge in the lower reaches of a number of which exceeds two million cusecs. Converted into a regulated discharge, the rivers carry 1·87 mill. cusecs all the

*We, however, come across the words 'minor' and 'major' irrigation works in the irrigation plans carried out or suggested under the Grow More Food Compaign, and the Five Year Plan. The word 'minor' here has no reference to the old classification. The distinction between major and minor is mostly made in respect of costs involved, time taken in the completion, and by implication it amounts to signify works mostly constructed by the government and those constructed by private individuals, with the help of the government. Major works in this context refer to dams, canals and multi-purpose projects, and minor ones refer to construction and repair of wells, tanks, digging of new channels, repairing or clearing old ones, and small lift irrigation schemes from rivers, etc.

year round, and this water spread over the culturable area will cover it to a depth of about $3\frac{1}{2}$ feet.* The idea of the magnitude of our water potential can be formed in another way also. Though the exact proportion of water which seeps into the ground to form the underground reservoir has not been assessed, it is a huge quantity, and roughly speaking not less than 30-35% of the annual rainfall. Regarding the surplus flow it is said that in approximately the time taken by a man to shut his eyes and open them again rivers discharge 1·87 mill. cubic ft. of water into sea. The quantity is enough to fill a circular tank of 40 ft. diameter to a height of about 1400 ft., 6 times the height of the Qutab Minar. Considered as a whole the water potential is an enormous volume, and the CWINC rightly believe that 'India is fortunate in possessing these resources in abundance and having them strategically distributed.' The most complacent feature about the water resources is that they are renewable annually, ano are a perennial asset. So long as there is snow on the mountains to feed rivers and the monsoon brings fresh quantities annually to continue the hydrological cycle the flow of rivers and the sub-soil supply will continue to be replenished; and the result is that the development based on this asset must be of a permanent nature.

Possibilities of Extension. At present roughly speaking 76 mill. ac. ft. of water is being used in irrigation. This is hardly

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*CWINC : Quinquennial Report April 1945 to March 1950, 1950, p. 3. The Irrigation Commission, 1901, approximated the surface flow from an area of 1,434,000 sq. miles (excluding the catchment basin of the Brahamputra and that part of India which lies west ward of the Indus watershed) to 51 billion cubic feet, on the basis of the computation from the rainfall. The Sub-Committee on River Training and Irrigation of the N.P.C. 1947, thought that in view of the fresh data being available in regard to the proportion of rainfall running off that calculation was optimistic. (N.P.C. River Training and Irrigation, 1947, p. 32.)

3% of the total potential and 5·6% of the total surface run-off. The area irrigated and the quantity of water used are comparatively very small, and in view of the potential quantum there seem to be vast possibilities of the extension of irrigation. But it should be noted that, though the primary factor in question of water supply is the amount of precipitation (in the form of rain, dew and snow) which reaches the earth, the whole of it being not available for irrigation, we have to take into account only the utilizable quantity. And on the other hand, we have to be mindful of the economic and engineering limitations.

In respect of the surface flow, the Irrigation Commission, the NPC and the CWINC all agree that a large part of it cannot be made available for utilization in certain tracts. Where the rainfull is high there is little use of water, and there may be conditions not favourable for storage. The NPC thought that the surface flow of our rivers amounted to 50 billion cubic feet, and though most of it could be used for generating power, only a fraction was employable for irrigation. 'The utilizable quantity is probably about 15 (with a maximum of 17) billion cubic feet, and of this, it was estimated that, 6·75 billion cubic feet or 45% were being utilized.'[1] In respect of the quantity percolating into the ground it is said that not even 2% of it is drawn by wells for irrigation.[2] Though the total underground supply is a huge quantity, it is not a measure of the potentialities of draft from wells, since extremely slow percolation (usually not

1. NPC. River Training and Irrigation, 1947, p, 32,

2, The Irrigation Commission, 1901, estimating the volume of water expended on irrigation from wells at about 1 billion cubic feet, have recorded that this is not more than 1½% of that portion of rainfall which penetrates the soil. The Sub-Committee on River Training and Irrigation (of the NPC) considered it to be a 'careless statement, since total rainfall minus run-off does not mean ground-water,' Even after making an allowance for evaporation and transpiration, the sub-soil supply is enormous, and a very small portion of it is being tapped at present.

more than a few feet a day) leads to a slow rate of delivery, and hence the amount available at any specific point is small.[1] Besides, even in the old controversy regarding the inexhaustibility or otherwise of the 'under-flow', the majority of the opinion now favours the view that the sub-soil supply is by no means inexhaustible.[2]

The broad conclusions which can be drawn from this are : first, inspite of a vast irrigational development which gives India a leading place in the word in this respect, still greater pssibilities exist for further extension. Secondly, though the potential quantum is not a measure of extension, and the utilizable quantity is only a small fraction of it, the latter is a tremenous quantity, and only a minor portion of it being actually used so far, quantitatively speaking our resources are not inadequate, and provide a hope for vast extension. But a few considerations are to be kept in mind : (*a*) The geographical distribution of these resources imposes two kinds of limitations : engineering, pertaining to the physical obstacles, and socio economic pertaining to the character of the land irrigated and the socio-economic needs to be satisfied. (*b*) The modern technological developments specially the hydraulic engineering and the improvements in the methods and the technique of water conservation, are making practicable what formerly was considered to be impossible and impracticable, and are thus adding to our water resources. (*c*) Development of irrigation is said to be essentially a community enterprise or a public responsi-

1. A fair proportion of water that percolates into the ground, utlimately reaches the streams and rivers through discharge by springs and seepage. Thus the ground-water reservoir is nature's apparatus to regulate the perennial flow of rivers, (NPC, River Training and Irrigation 1917, p. 31).

2. For a detailed study one may refer to Stamp, Auden, Brienic and others, and the NPC. The experience of the tube-well scheme of the western U. P. also proves that underground supply is not inexhaustible.

bility. It seems correct so for as the major works are concerned because financially, administratively and technologically they are beyond the individual and cooperative effort. But so far as most of the minor works are concerned, specially wells, they must be developed essentially through private efforts.[1]

Talking in terms of the acreage which can be irrigated, it is impossible to forecast with any degree of reliability the ultimate limit, becuse it will depend upon the technological developments and the other socio-economic factors which cannot be predicted over a distant future. The NPC have, however, hazarded a guess regarding the possibilities of irrigating an area of 116 million acres : 50 from government canals and reservoirs, 60 from other sources utilizing surface flow and 6 from wells drawing the underground supply.[2] Such a forecast can be treated hardly anything more than a vague hope. A better course, however, is to assume a limited period. The Irrigation Commission, 1901, outlined a constructive programme for the then Br. India for the extension of about 6 million acres in 20 years under government canals and reservoirs, and further suggested an increase of 16 million acres under wells. The Advisory Planning Board, 1947, mentioned that the irrigation projects already under construction or in contemplation are ex-

1. There is a view that irrigation mostly concerns groups of society, and must be solved through group action. Individual efforts cannot go a long way.

There is also an opposite view that development of irrigation from private works is at least equal in importance to that from works constructed by government. (Woodhead Commission, 1945, p, 134.)

2. Their conjecture in regard to expansion under 'minor class' of works is 13 mill, acres ; 5 under wells, 3 under tanks and 5 under other sources. Further out of the total surface flow, taking 17 billion cubic feet as the maximum utilizable amount, they thought that 110 mill, acres could be irrigated. In the former category the last two forms depend mostly on surface flow. The total, therefore, comes to about 115 million acres for the next two decades ; however, they looked forward for an addition of 16 mill acres only.

pected to bring 20 million acres under irrigation in 10-12 years.[1] A more accurate and reliable data has been furnished recently. In the beginning of 1951 there were 135 schemes under construction in different parts of the country. They were expected to be completed within 6 to 10 years, and were to take a few years more for irrigation to be developed fully. The additional irrigation was expected to be 5·5 mill. acres in 1955–56, 9·2 mill. acres in 1959–60 and 12·9 mill. acres ultimately. In addition to these schemes which were in progress there were 122 other projects which were under various stages of investigation. The completion of these together with those under execution was to provide irrigrtion to an additional area of 42 mill. acres *i.e.*, for a total area of 90 to 100 mill acres.[2] The Planning Commission later on estimated that the irrigation and power projects included in the first part of the Plan will irrigate an additional area of 8·8 million acres in 1955–56 and 16·5 mill. acres ultimately.[3] The actual Plan, however, has increased these targets, and by 1955–56 aims at an additional acreage of 8·5 million acres under Major Irrigation Works and 11·2 mill. acres under Minor Irrigation Works, and thus to bring the total irrigated area to about 70 mill. acres by the end of the First Five Year Plan.[4]

The rate of extension is also an important consideration in this study. The past history shows that this rate has not been commensurate with needs, and even if the targets under the Five Year Plan are achieved the increasing population and the growing demands for agricultural production

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1. Report of the Advisory Planning Board, 1947, p, 10,
2. The Hindustan Times Engineering Supplement, January 6. 1951, p, III,
3. A Draft Outline of the First Five Year Plan, 1951, p, 123.
4. The Hindustan Times, December 9, 1952, p. 13,

will put fresh demands. The NPC wished it to be increased to 3 times. But it should be noted that it depends on the general economic progress of the country, and in the near future it cannot be very rapid howsoever urgent the needs may be.

The choice of systems. In view of the pressing needs for enhancing agricultural production, and secondly, in view of the fact that agriculture is mostly a gamble in the monsoon, utmost expansion of irrigation is needed. But the systems of irrigation to be developed in different tracts will be governed by local meteorological, geological and other physical conditions. In the choice of system, therefore, there cannot be any uniformity in different regions. Besides, there is no question of choosing between different systems on the basis of their comparative merits and demerits. They are supplementary and complementary rather than competitive. The Woodhead Commission rightly observed that 'the problem of water supply will not be solved by mere extended application of one particular method of irrigation but by the use of all methods.'* Hence every possibility of irrigational expansion has to be explored, and the development of different system will depend on their suitability for different tracts or regions.

In humid regions the State works are said to have not been generally successful, because rainfall being high, the demand for irrigation-water is not constant and sustained. Drainage is an important problem in this region which has to be tackled before irrigation can be developed to any considerable extent. The alluvial plains on the other hand offer great facilities for wells and canals, and they have been taken advantage of considerably. Irrigation in the Central Tableland is poorly developed, and the most common

*Final Report of the Famine Enquiry Commission, 1945, p, 129,

system is of tanks which utilize only local rainfall, which in that region is neither copious nor certain. There is a great scope for the development of canals[1] through the provision of storage, since the higher slopes of the elevated plateaux have a humid climate and there are many rivers which start from there and run through this region. Besides, in areas where flow irrigation is not possible either due to unfavourable topography or due to insufficient water supply, but ample quantity of underground water exists, lift irrigation should be developed, though it is an expensive form. The actual method will, however, depend on the quantity of available water.

Considering the different systems separately, private canals do not seems to have great scope, and with the development of more efficient means the old private ones are gradually going out of use as in Bengal, Bihar and Madras. Tanks are found most extensively in areas of low rainfall. As storages they are also useful where the rainfall is ill-distributed. But they are expensive in construction and upkeep, and liable to fail when most wanted, since in the years of less rainfall water supply in tanks is also less. The NPC believe that most of the suitable sites being utilized, the scope for further extension is limited. On the other hand the CWINC seem to be very hopeful about it.[2] By entrusting the construction, repair and upkeep to village communities, however, some development is possible specially through small units.[3]

1. One advantage in developing canal irrigation in this region will be a rise in the spring level. It will increase the efficiency of wells.

2. Schemes aimed at impounding water during the monsoon season, when large quantities are available, for use during drier parts of the year when insufficient quantities flow in the rivers have to be designed. (CWINC : Quinquennial Report April 1945 to March 1950, 1950 p 3).

3. Large tanks need considerable finances and technical assistance to make them reasonably safe against breeches Government alone can construct and maintain them. In case of small units the repairs may be as difficult as maintaining village huts in repair. Besides, irrigation engineers believe that it is less costly in the long run to allow these works to breech every 15 years or so, then to incur expenditure on preventing breakdowns under abnormal conditions. (NPC : River Training and Irrigation, 1947, p. 39).

In areas of high rainfall and sub-montane tract small storage can be extended considerably. They will be more useful specially to rice crop during breaks in the rainfall. Again storage is not necessarily confined to open reservoirs only. Underground storage is equally important, but the field for its utilization is limited.

Wells are a very suitable and efficient form of irrigation specially where underground water is at an economic depth, and (as is frequently the case) the quality is not unsuitable. The scope for their development is very vast. The Irrigation Commission, 1901, was certain that there is no single province in which this form of irrigation might not be very largely extended with advantage. There is a large scope for expansion specially in the sub-montane tract, in which water generally lies so close to the surface that canals will not be successful, but on the other hand harmful. In the areas served by canals specially the alluvial plains they will add materially to the utility of canals as their adjuncts. In certain tracts of Central and South India, where droughts are frequent and severe, it is not possible to construct canals except at prohibitive costs, and to assure them of water-supply when most needed, hence wells are the only form of irrigation. Considerable expansion is possible through private efforts, though aided by the government.*

*It will not suffice to extend irrigation through projects constructed by governments, private irrigation works must also be greatly expanded..... If the area under irrigation is to be expanded to the fullest extent, a large increase in the number of private wells is imparative (Woodhead Commission : Final Report, 1945, p. 135).

There are many ways in which State can encourage the development of private wells : (i) further research into sub-soil water-supply, specially where such information is inadequate, (b) technical advice and assistance by special staff in areas where such information is available, (c) employment of better and more efficient means of lifting water, specially in the regions where water table is deep and electric power is likely to be made available, (mechanical devices operated either by animal power or any other power, and increasing the yield of open wells by tapping additional strata) and (d) financial assistance by way of loans and grants. (The Irrigation

crop security,* have an advantage that unlike rainfall and surface water underground supply does not vary greatly between wet and dry years, and they are easy to develop because of being within the limits of individual efforts. But it should be noted that the sub-soil supply is not inexhaustible as is frequently believed, and the problems of utilizing it for irrigation are more complex than those of using surface supplies. The solution involves intensive research and investigation for determining the extent of supply being

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Commission thought that the best way was a liberal advance of tacavi loans under the Land Improvement Loans Act, 1883. The Woodhead Commission took the same view. Under the G. M. F. Compaign the government advanced both loans and grants. There can be another way of advancing through Land Mortgage Banks).

*A comparative study of agricultural economy under well irrigation and canal irrigation, specially with reference to the effects is quite interesting. In comparision to canals, wells are said to have an advantage as they offer greater security against drought ; water is available when needed and therefore no uncertainty ; there is no waste of water ; it encourages highly intensive cultivation (makes 3 crops possible) and makes man more industrious ; does not disturb the balance in water resources as canal do ; and crop yields are also said to be higher in comparision to those under canals. Canal irrigation, on the other hand, suffers from many drawbacks : there is considerable waste of water (30—50% excess water used in N. India) ; uncertainty of supply and its failure at the time of need ; excessive application of water due to lack of incentive for economising and uncertainty (Agr. Commission) ; as a result of excessive use considerable losses are caused through water-logging and alkali formation (Usar and Reh Reclamation Committee, U. P.) ; inferior and irregular crop qualities (Howard), and diseases, specially wheat rust when there is rain in the Spring (Mukerjee), accessive water is used as a substitute for good cultivation (weeding neglected, surface crust left unbroken, less aeration, crops are forced to develop surface roots, and an attempt for early ripening by abundant water) ; it discourages high cultivation (water is not sufficient for more than 2 crops. Only in areas of precarious rainfall canals aid materially, and in plains during drought, but lead to agricultural decline in zones of heavy rainfall) ; and unscientific canal system has led to decline of water ways affecting natural drainage, silting of rivers and formation of malarial swamps and alkali lands.

But it should be noted that many of these defects are not inherent in the canal system as such but have come into being as a result of the neglect of some scientific principles, and are of administrative nature. They can be avoided in future.

For a detailed study a reference may be made to Mukerjee : Agricultural Economy of India ; Baljit Singh : Land of the Two Rivers ; and Lavania : Well Irrigationin Western U. P. (unpublished thesis Dept. of Agr. Eco., B. R. College, Agra).

available, the relation between use and depletion, and the best methods and equipment for drawing water.

Considerable expansion can be made under tube-wells and river-puming, former in the areas where water-table is not deep, and sufficient quantity of water supply is available, and the latter in areas which cannot be served by gravity canals. But their development is linked with the development of power[1].

Taking the 'minor works' as a whole they are mostly a private enterprise. Progress under them is likely to be slow, since their extension depends on the strength of the resources of the people. Further, the NPC thought that an 'excessive draft of underground water will lead to dessication of water-table. It is the surface flow which holds out prospects of extensive use of water for purposes of irrigation. As far as we can see ahead, over 80% of our irrigation is likely to obtain its water supply by gravity from surface flow.'[2] We have, therefore, to look to government canals and reservoirs. But they require a careful consideration. It is said that we are now approaching the limit in the utilization of the natural flow of our rivers. In the pioneering phase we depended on flood irrigation, which had its origin in level surface and superior commands being available in alluvial tracts. The CWINC likewise believe that the 'potential of diverting the normal flow of rivers for irrigation canals has very nearly been exhausted.'[3] These opportunities, specially the

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1. Stamp laid down 4 conditions generally essential for the success of the tube-well scheme : (i) flow of water in the sub-soil must be adequate to meet the surface demand ensuring stable water-table, (ii) the depth of water-table below the ground level must not ordinarily exceed about 50 ft , (iii) irrigation demand must prevail over a wide tract for an average period of not less than 3000 hrs. in a year, and (iv) electric power must be available over the tract at the rate not exceeding $\frac{1}{2}$ anna per unit.
2. NPC : River Training and Irrigation, 1947 p. 40.
3. CWINC : Quinquennial Report, April 1945 to March 1950, 1950, p. 3.

unfailing supplies of snow-fed rivers, have been utilized to a very great extent. Besides, a considerable improvement in regulating the supplies by replacing inundation canals by weir-controlled canals (which give better supplies and also for longer periods) has also been made. The result is that there is now not only a constant danger of scarcity of water supply at critical times, but also of supply being insufficient to meet the growing needs. We cannot expect any spectacular expansion of such works.

One important thing in connection with the expansion of irrigation and adopting a suitable system has to be remembered. The largest areas which can be irrigated and the greatest apportunities for it[1] lie along larger rivers in the arid regions. In this region there is a need of a fairly uniform flow of water specially at right place and time. Flood irrigation not being possible in this tract, storage of high water flow of rivers in large scale reservoirs and its distribution through canals is the best solution.[2] Unlike irrigation of low alluvial tracts, this

1, These areas have a warmer climate, good facilities for drainage, and soils richer in mineral plant food, These things make them very suitable for diversified farming and high-priced agriculture. Irrigation in this region will give best results.

2, In view of the (inadequate) experience of such large scale reservoirs The Irrigation Commission, 1901, thought that the term storage was 'as suggestive of the limitations as of the possibilities of irrigation as a means of protection,' because of 'great costs and uncertain operations.' These limitations arise on account of two things : (a) hydrographic, (all the flowing water cannot be stored), and (b) topographical, (construction of reservoirs is not always possible due to physical and economic reasons). Even after having a due consideration for both these things we find that our water resources are adequate and there are ample opportunities for storage, because our mountains receive heavy and unfailing rainfall and also furnish facilities for storage. Secondly, the view of 'uncertainity of operations' seems to be based on two ideas : inadequate water-supply being available, and loss of water in long time storage (holding water during favourable years and using it in years of drought). In this regard it should be noted that the technological development in river engineering show that ample water supply is available even when river is low. And water resources being renewable from year to year, it is not a question of preserving it for a long time; and henec holding water for drought years is not the normal

system of irrigation (construction of reservoirs and delivery of water through canals in an undulating tract) is bound to be costly in the arid uplands But there is a possibility of superior agriculture ; and water being put to other uses also the total cost of storage should not be charged against irrigation only. Besides, it will lead to economic prosperity in other forms also and is, therefore, a promising field for public investment.

Problems in Extending Irrigation. Before any considerable expansion in irrigation is possible, several difficulties have to be overcome. Some of the important problems relate to :

(*i*) ***Research and Investigation.*** Irrigation involves a variety of questions which need considerable study, investigation and research particularly land survey, survey of river courses, drainage survey and hydrological research, etc.

(*ii*) ***Storage and Transmission.*** The supply of water is not a local question but of the whole river valley. Transmission of water* involves many problems. A favourable site for a reservoir may not necessarily be suitable as a off-take for the alignment of the canal. Sometimes the are a

function of reservoir irrigation. Besides, on the basis of the experience of storage works situated not in the regions of unfailing rainfall, the Irrigation Commission themselves reported that 'failure occurs less often than might be supposed.' Therefore, these fears should no longer influence the irrigation plans specially of the big reservoirs and multi-purpose projects,

*In the Central Table-land river beds can be utilized as a means of conveying water because of rivers flowing in the lowest parts of the valleys and the beds being rocky. The only loss of water in transmission will be by evaporation. We are fortunate in this respect but the canals should not be too long otherwise transmission will tell upon water too heavily, The Upper Ganges canal in the North and the Tungabhadra project in the South are examples of it, The defect in conveying water to 350 miles in the Upper Ganges canal was rectified by constructing the Lower Ganges Canal which relieved the upper work from irrigation of 128 miles of the Kanpure branch and 130 miles of the Etawah branch. The main canal from the Tungabhadra Reservoir had to be designed to draw of $2\frac{2}{3}$ m, c, ft, for everyone m, c, ft, of water which could find its way to the Nellore irrigation system, (NPC).

under a canal may be of a type that plenty of water may be harmful to it.

(*iii*) ***Detailed Land Classification.*** The existing land records include in the culturable area some land of very poor quality which cannot be irrigated with advantage. A detailed land classification is required to find out lands worth the water to be applied, since after all water resources should not be used so as to be out of balance with areas to be irrigated.

(*iv*) ***Finding different uses of water.*** Possibilities of multiple use should be explored, *e. g.* combining irrigation with other purposes like power, navigation, domestic use, flood control, sanitation and recreational use, etc. Some of them specially power, which is a great income producing factor, should share the cost of storage, which should not be wholly charged to irrigation. Secondly, the financial considerations refering to costs should be decided by the maximum benefit to the community.*

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*Till recently the government judged the financial soundress of a major irrigation work by estimating the net annual revenue directly attributable to it (i, e, gross receipts from water rates, land revenue, interest on capital receipts from the sale of crown lands, etc.. minus working expenses). The work was not undertaken unless the estimated net annual revenue was sufficient, at the end of the period prescribed for the development, to cover annual loan charges. In the case of protective works account was also taken of the saving in relief expenditure. (Both direct relief to the distressed and revenue remissions). The Woodhead Commission, 1945, thought that it was difficult to find schemes calculated to yield on that basis of computation, Hence they suggested a change in the financial criteria of the government in respect of irrigation, In the first place they suggested an allowance for the indirect additional revenue to the government as a result of the increase in wealth of the people, (increased receipts from sales tax, stamps, income tax, agricultural income tax, etc) Secondly, the improvement of the general well being and standard of living of the population being direct concerns of the government, and irrigation promoting these ends, they cannot satisfactorily be reduced to calculations of hard cash and revenue. In view of their importance the Commission suggested that general revenue should contribute towards loan charges of irrigation schemes, and that well considered schemes may be under taken even when in their financial aspects they do not fully conform with the criteria hitherto adopted. (Final Report of the Worldhead Commission, 1945, 132–33).

(v) ***Territorial difficulties of divided control.*** The human community is divided into several political jurisdictions, which create conflicts in water rights. Workable regulations and laws concerning division of water are rendered difficult, and there are administrative and financial difficulties in developing river valley projects. In regard to this question the whole river basin should be regarded as an economic unit for the benefit of all the people it serves, and the question should be taken on a regional basis by all powerful regional bodies.

(vi) ***Management of irrigation.*** The excessive application of canal water has been a general complaint against cultivators who are said to drown rather than irrigate the land. The problem is not only of making the water reach the land but of its most appropriate use, because surplus water is injurious to both crops and lands. Management of irrigation involves many problems such as controlled application of water, regulation of water rates and maintaining proper relations between water users.

(vii) Surface and under-ground drainage. In case of excessive water supply (more than the soil can hold), as has been the case in some of the canal irrigated areas, seepage and percolation intercept the natural drainage, causing water-logging and salt effervescence, turning fertile lands

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The NCP was more scientific in their attitude while suggesting combination of irrigation with other uses of water. They divided the use of water under two heads : (a) Use of its inert corpus, and (b) the use of its energy. The problem of maximum benefit to the community demands reduction of consumptive use in the head-water region of rivers to lowest quantity, as the charges here must be high to compensate for the loss of power. The use of the energy of water is becoming important, and is helping materially in reducing cost of storage otherwise chargeable to irrigation.....The use of water for power is not inconsistent with its economical employment in irrigation, while irrigation effords large outlets for the use of excess power. For a detailed consideration of the point of costs and the rate of interest one may refer to the NPC : River Training and Irrigation, 1947,

into malarial swamps and alkali soils. Reclamation by surface and underground drianage has, therefore, become an important issue, specially refering to lowering of seepage and reducing alkali formation particularly where the heavy and underground drainage is poor.

Irrigation in the Five Year Plan. The Planning Commission have started with the view that it is only by utilizing water recources for irrigation and generation of power, and by the adoption of intensive measures for improving the standards of agricultural practices, and the promotion of cottage, small-scale and large-scale industries with the help of cheap electric power, that an appreciable rise in the standard of living of the people can be achieved. They rightly think that there are large possibilities for the development of the country's water resources, specially in view of the improvements that have taken place in the technique of dam construction, and that agriculturist's greatest need is an assured water supply. In addition to irrigation these projects offer possibilities for generation of power and also in some cases for flood control and navigation. Some of these schemes, therefore, are purely for irrigation, some only for hydro-electric power and others are multi-purpose in nature.

In the Plan irrigation has been given the first priority. In the Draft Outline the total estimated cost of all the irrigation and power projects included in the first part of the Plan was Rs. 734 crores. Of this Rs. 144 crore were spent by March 1951, during next five years covered by the Plan Rs. 450 crores were to be spent, and Rs. 140 crores after

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Water is a prime necessity to life but it becomes a menace when it is not properly used, It is said that civilizations in the past developed in areas where water was easily available. It is also a fact that they crumbled there. Man's crime against rivers had its Nemesis. For a detailed study of the effects of the abuse of water one may look to R. K. Mukerjee: Rural Economy of India.

that period. These projects are calculated to irrigate an additional area of 8·8 million acres in 1955 56 and to generate 1·1 mill. kilowatts of additional power. After the completion and full development the total additional irrigated area was estimated to be 16·5 mill. acres and 1·93 mill. kilowatts of power. In addition to these projects which were included in the Plan there were other irrigation and power projects under consideration at that time. The aggregate cost of all these projects was expected to be Rs. 1400 crores. In the actual Plan now presented some additional projects are included for execution, and the total allotment for power and irrigation is Rs. 561·41 crores out of a total expenditure of Rs. 2068·78 crores. The additional irrigation is estimated to be 8·5 million acres through major and 11·2 million acres through minor works, bringing

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When the quantity is more than the soil can hold, natural drainages are intercepted, by seepage and percolation, pores of the soil are not allowed to remain open so as to keep it warm and purified by aeration and there is a rise in the sub-soil water level. The result is that where the soil gets so firmly compact that water cannot move freely, there is water-logging and malarial swamps are created, and where there are dissolved salts there is alkali formation, and the land is turned into a barren *usar*, as has been the case in Nira, Pravara and Godavari canals in Bombay, Upper Chenab and Upper Jhelum, and canals of Punjab (now in Pakisthan). It occurs in two forms: (*i*) soil saturation (the first stage is called *sem*, and in its worst form *jheels*, *i e.*, collection of water on the surface), and (*ii*) concentration of salt in upper layers called *thur*. This happens in several stages, and there are distinct signs of the coming danger at each stage, (*barani* crops being successful for a few years, *kallar* patches appearing in the fields, and no germination in these patches, reduction in crop yields, depressions beside the canals remaining full of rustly coloured water, spring level coming close to the surface, drinking water tasting raw, obnoxious odour coming from mud walls and their crumbling).

This necessitates reclamation by drainage, which means total absence of free water in the soil to a depth sufficiently below that of root penetration so that there may be circulation of air. The remedies should be both curative and preventive. Surface and sub-soil drainage should be improved, and further seepage must be reduced as far as possible. Some specific measures which have often been suggested are : Proofing of canal beds by concrete, pumping out water by tube-wells, opening out of obstructed drainage, checking over irrigation through a regulation of water rates and replacing canal irrigation by well irrigation, etc. But these suggestions should be considered in the light of their own limitations,

MAP OF INDIA
SHOWING
MAJOR RIVER VALLEY PROJECTS

INDUS
HARIKE BARRAGE
BHAKRA & NANGAL DAMS
DOCHI DAM
KISHAU DAM
SUTLEJ
YAMUNA HYDEL
SARDA POWER-HOUSE
YAMUNA
GANGES
GOGRA
KOSI DAM
KOSI BARRAGE
KOSI
BRAMPUTRA
CHAMBAL
CHAMBAL DAMS
SON
PIPRI DAM
GANGA BARRAGE
MOR DAM
DAMODAR
DAMODAR VALLEY DAM
BROACH DAM
PUNASA DAM
NARMADA
TAPTI
KAKARAPARA DAM
WAINGANGA
HIRAKUD DAM
MAHANADI
WAINGANGA DAM
GODAVARI
MACHKUND HYDEL
KOYNA HYDEL
KISTNA
RAMAPADA SAGAR DAM
GHATAPRABHA DAM
TANGABHDRA DAM
MAHATMA GANDHI HYDEL
LAKKAVALLI DAM
CAUVERY
LOWER BHAVANI DAM

▲ UNDER CONSTRUCTION
● IN ADVANCED STAGE OF INVESTIGATION
○ IN PRELIMINARY STAGE OF INVESTIGATION



the total irrigated area to nearly 70 million acres by the end of the period of the Plan.

In the preparation of this Plan, projects likely to yield additional food at an early date have been given preference over others and the large multi-purpose projects have been phased with a view to the early completion of their irrigation aspects; the power generation is carefully regulated and taken up in stages as the demand arises. Of the projects commenced and under execution, some are financed wholly from loans advanced by the Central Government, and others by State Governments, with the help, in regard to individual projects, of Central loans. Regarding the financial arrangements the Commission in October 1950, made a few suggestions to State Governments. The most important was a levy of betterment fee with the object of securing for the States a share from the 'unearned increment'—from the increase in land values that occurs as a result of the provisions of irrigation facilities. There was a large measure of agreement on the principle of this levy. The Commission further suggested to the State Governments to consider an upward revision of water rates in view of high cost of new works, increased cost of maintenance and the rise in agricultural prices, the levy of agricultural income tax (which has already been introduced in some States), and the creation of a non-lapsable irrigation and power development ways and means fund. In the end they very emphatically stated that these projects cannot be implemented successfully unless the States can arouse mass-enthusiasm and secure public support* for these projects on a nation-widle scale.

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*While suggesting the ways in which public cooperation can be obtained and the forms it should take, the Planning Commission referred to the levy of betterment contribution in the form of land from larger holdings, and to adopt a scale of wages (in preparing estimates for work in which

It should, however, be noted that these multi-purpose projects are the basic feature for our economic progress in general and agricultural development in particular; and they are the best and the lasting solution of the food problem.

An abstract of the actual schemes of irrigation included in the First Part of the Five Year Plan in the Draft Outline is as follows;* and for a detailed study one can look to the Draft Outline of the Five Year Plan, pages 268-295.

States	Projects	Proposed exp, 5 yrs, 51-52 55-56	Total cost (Rs. lakhs)	Additional irrg. 1,000 acres.	
				55-56	On completion.
Central Govt	Bhakra-Nangal	77,50	132,90	1,360	3,915
	Harike	10,62	13,80	...	...
	Damodar Valley Projects	41,70	74,89	600	1,325
	Hirakud Dam	44,00	62,59	273	1,095
	(Investigations)	2,08	2,83	...	...
Total		**175,90**	**287,10**	**2,233**	**6,335**

unskilled labour was employed) on the basis that work should be done by the villagers on the canals in their villages and not on the basis of work being entrusted to contractors. In each village or villages the villagers should be organized into cooperatives for taking up the work in their own area. (Draft Outline of the Five Year Plan, 1951, pp. 128-9,) Sentimentalism rather than the considerations of practicability seem to have influenced the Commission's mind so far as this point is concerned. These things do not appear to us practicable and workable propositions.

*A Draft Outline of the Five Year Plan, 1951, annexure II.

States	Projects	Proposed exp. 5 yrs 51-52 55-56	Total cost (Rs, lakhs.)	Additional irrig. 1,000 acres	
				55-56	On completion.
Part 'A' States,					
Assam.	Navigation, Embankment and Drainage Projects,	60	60	...	...
Bihar.	Tube-wells in North, South and Sugar factory areas; drainage of chaurs; Sakri Upper and Lower Valley Schemes; Tribeni canal extension schemes; Emergency pumping schemes and Dams and weirs in hilly districts.	9,73	11,40	719	823
Bombay.	Gangapur storage project; Wardala Dam project; Ghataprabha Left Bank Canal; Mahi Right Bank Canal; Ranand Tank; Kolchi weir; Kakarapara Project.	22,69	25,72	491	876
Madhya Pradesh.	Construction of Tanks in Chindwara, Dokerli, Bargoor, Gondli, Dudhwa, Sampra and Dukrikhera.	3,26	3,55	159	179
Madras.	Lower Bhawani, Malampuzha Reservoir; Mettur Canal Scheme; Rallapad 2nd Stage; Romperu Drain; Cauveri delta drainage improvement; Manimuthar Project; Upper Pennar Project; Bhiravanitippa Project; Araniar scheme; Margalam Reservoir; New G,M,F, scheme; Walyar Scheme & Tungabhadra.	30,16	44,24	459	615
	Minor Works,	3,00	4,02	255	261
Orissa					
Punjab.	Dera Babananak Tubewell Scheme; Aliwala T,W, Scheme; Extension in arid areas; new distributary to Kasur Branch; Kiran Nallah; Raising banks of channels; Jagadhari T.W, Scheme.		4,11	619	676

States	Projects	Pro-pose exp. 5 yrs. 51-52 55-56	Total cost (Rs. lakhs.)	additional irrig. 1,000 acres	
				55-56	On com-pletion
Uttar Pradesh.	Tube-well and extension of pacca lines ; Extension of Sarda Canal ; Pratapgarh Branch ; Trans-Kalyani project ; Saprar Dam: Belan canal Project ; Kabrai Lake ; Linning of channels and canals ; Reservoirs and Bundhis and small channals in hill districts.	15,19	47,47	1,681	3,474
West Bengal.	Mayurakshi Reservoir ; Suranker Daura Scheme ; Sonapur - Arah-panch Scheme ; Bangjali chuni and other Schemes,	15,17	19,21	1,067	1,067
TOTAL		102,63	1,62,32	5,450	9,717
Part 'B' States, Hydrabad.	Tungabhadra ; Rajolibun-da ; Godavari 1st phase ; Koilsagar ; Salasagar ; Bendsura ; Khasapur ; Minor Irrigation.	24,63	34,10	359	680
Madhya Bharat.	Khuj Project ; Chiri Pro-ject ; Lohagarh Project ; New tanks and repair of old ; Extension of cha-nnels,	3,27	3,28	57	90
Mysore.	Reservoir near Lakkavali ; Anicut across Tunga : Re-servoirs across Nagu Ri-ver, Salur Halla ; New Tanks across Jinigehalla and Suvarnamukhi River and other scheme,	7,16	27,09	64	259
PEPSU.	Remodelling of channels and others,	34	35	1	1
Rajasthan,	Jawai projects. Parvati pro-ject ; Gudha Project ; Kali Sill and other Pro-jects,	4,56	9,89	105	596

INDIA

MAJOR IRRIGATION AND POWER PROJECTS

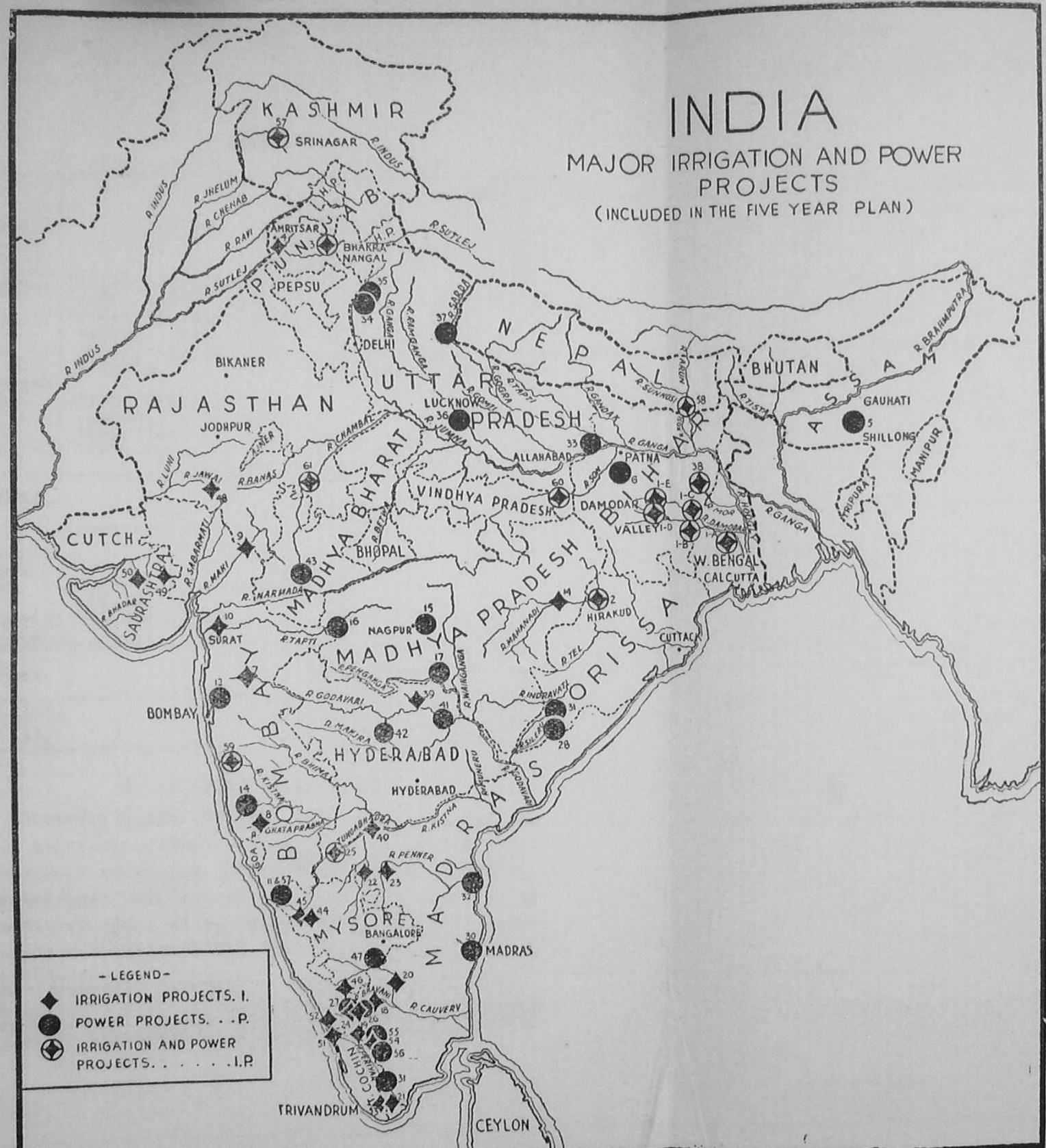
(INCLUDED IN THE FIVE YEAR PLAN)

KASHMIR
SRINAGAR
R. INDUS
R. JHELUM
R. CHENAB
R. RAVI
R. SUTLEJ
PUNJAB
H.P.
AMRITSAR
BHAKRA NANGAL
PEPSU
DELHI
R. GANGA
R. RAMGANGA
R. SARDA
NEPAL
R. KARNALI
R. GOGRA
R. TAPTI
R. GOMTI
R. SUNKOSI
R. KOSI
R. BRAHMPUTRA
BHUTAN
ASSAM
GAUHATI
SHILLONG
MANIPUR
TRIPURA
BIKANER
RAJASTHAN
JODHPUR
UTTAR PRADESH
LUCKNOW
ALLAHABAD
PATNA
R. JUMNA
R. CHAMBAL
R. LUNI
R. JAWAI
R. BANAS
R. SON
R. DAMODAR
R. HOOGHLY
R. GANGA
DAMODAR VALLEY I-D
I-E
I-C
I-B
I-F
W. BENGAL
CALCUTTA
BIHAR
VINDHYA PRADESH
CUTCH
SAURASHTRA
R. SABARMATI
R. MAHI
R. BANAS
R. BETWA
MADHYA BHARAT
BHOPAL
R. NARMADA
R. AMANAT
R. BHADAR
SURAT
NAGPUR
R. TAPTI
MADHYA PRADESH
R. PENGANGA
R. WAINGANGA
R. MAHANADI
HIRAKUD
CUTTACK
R. TEL
R. INDRAVATI
ORISSA
BOMBAY
R. GODAVARI
R. MANJRA
HYDERABAD
BOMBAY
HYDERABAD
R. BHIMA
R. KISTNA
R. PENNER
R. PUNNERU
R. GODAVARI
GHATAPRABHA
TUNGABHADRA
MYSORE
BANGALORE
MADRAS
MADRAS
R. CAUVERY
R. BANNAR
R. PALAR
COCHIN
TRIVANDRUM
CEYLON

- LEGEND -

- IRRIGATION PROJECTS. I.
- POWER PROJECTS. . . P.
- IRRIGATION AND POWER PROJECTS. . . . . I.P

C S Capur



Central Government

1. Damodar Valley Projects IP
2. Hirakud Dam IP
3. Bhakra Nangal IP
4. Harike IP

State Projects—Assam

5. Umtru Hydro-Electric Project P

Bihar

6. Thermal Power Station Scheme In North Bihar P

Bombay

7. Gangapur I
8. Ghataprabha Left Bank Canal I
9. Mahi Left Bank Canal I
10. Lower Tapti Valley (Stage I) I
11. Jog Distribution Scheme P
12. Chola Power Station P
    North Gujrat Electric Grid Scheme P
    South Gujrat Electric Grid Scheme P
13. Radhanagari Hydro-Electric Project P

Madhya Pradesh

14. Dudhwa I
    Six Medium Irrigation Schemes I
15. Central Power Station (Nagpur) P
16. Akhola Power Distribution P
17. Power Station Ballarpur P

Madras I

18. Lower Bhavani I
19. Malampuzha I
20. Mettur Canal I
21. Manimuthar I
22. Bhairavani Tippa I
23. Upper Pennar I
24. Walayar I
25. Tungabhadra IP
26. Moyar Hydro Electric Scheme P
27. Pykara I I I Stage Extension P
28. Machkund Hydel Scheme P
29. Machkund Transmission Lines and Sub-stations P
30. Madras Plant Extensions P
31. Papnasam I I Stage Extension P
    Transmission Lines and Distribution
25. Tungabhadra Hydel Scheme I Stage P
32. Nellore Thermal Scheme P
    Madras-Mettur Interconnection P

Orissa

    Daduma Transmission Scheme P
28. Daduma Hydro-Electric P
2. Hirakud Power Utilisation Scheme P

Uttar Pradesh

33. Eastern Area Power Stations P
34. Mohammadpur Station P
35. Pathri Power House P
36. Kanpur Electric Supply Administration P
37. Sarda Power House P
    Sarda Transmission Lines P

West Bengal

38. Mayurakshi Project IP
    North Calcutta Rural Electrification scheme P

Hyderabad

39. Godavari I Phase I
40. Rajoli Bunda I
25. Tungabhadra IP
41. Ramagundam Thermal P
42. Nizamsagar Hydro-Electric Scheme P

Madhya Bharat

43. Central Power House Indore P

Mysore

44. Lakkavalli Stage I (Bhadra Project
45. Tunga Anicut I
46. Negu Reservoir I
11. Mahatma Gandhi Hydro-Electric Works P
47. Shimsha Extension P
    Installation of Step-Down Station P
    Extension of Transmission Lines P
    Distribution-Power Supply to villages and Towns P

Pepsu

    Electrification of Pepsu Towns P

Rajasthan

48. Jawai Project I

Saurashtra

49. Brahmani I
50. Machhu I
    Medium Irrigation Schemes I
    Establishment of Thermal Stations (Grid Scheme) P

Travancore-Cochin

51. Chalakudy I
52. Peechi I
53. Neyyar I
54. Pallivasal I I Stage P
55. Poringalkathu Left Bank P
56. Sengulam Hydel P

Jammu & Kashmir

57. Sindh Valley Project IP

Projects to be Initiated in the Period of the Plan

58. Kosi IP
59. Koyna IP
    Krishna Valley Schemes IP
60. Rihand IP
61. Chambal IP



States	Projects	Proposed exp 5 yrs, 51-52 55-56	Total cost (Rs, lakhs,)	Additional irrg, 1,000 acres	
				55-56	on Completion
Saurashtra,	Ranghola ; Machu ; Brahmani ; Sashoi ; Ghee ; Puna ; Mo : Surajwadi ; Bhimdad ; Malan ; Aji ; Bhogvo. Ozat and lift Irrigation,	4.79	6,41	101	108
Travancore-cochin,	Peechi ; Chalakudy ; Perunchrani ; Wadakkancheri ; Vembanad ; and Neyyer Seheme.	4,78	6,10	170	170
TOTAL.		49,53	87,22	875	1,905
Part 'C' States.					
Kutch,	Majore Irrigation works and wells.	95	95	...	...
Himanchal Pradesh.	Medium Irrig. Projects.	80	80	300	300
TOTAL		1,75	1,75	300	300
GRAND TOTAL		3,29,81	5.36,39	8,840	16,511

IV. POWER RESOURCES.

Alternative Sources of Power. It is difficult to estimate to a reasonably accurate degree, the total production of energy from all sources. The NPC think that it probably does not exceed 100 units per capita per year. Of this 60 is from human labour, 15 from animal labour and 25 is from mechanical sources, of which electricity counts for only 8.

For a detailed study of the evolution of the Administrative set-up for Irrigation in the Govt. of India, of the river valley projects and of the schemes of irrigation and power included in the Five Year Plan reference may be made to : CWINC : Quinquennial Report, 1950, and the Five Year Plan.

It means that man is by far the largest source of power. However, there are numerous sources from which mechanical power, which is technically termed as power, can be produced. But the utilization of these resources depends upon a number of factors. The use of solar energy and wave power is not economical at present. Wind movements provide vast potentialities, but considerable amount of work has to be done before practical methods of utilizing this power can be devised. These resources, therefore, are not of immediate concern at present. Forests are exhaustible. Though they are replaceable, but at a very slow rate. Besides, their use as a fuel for power will soon exhaust them for the immediate successors, and will create many other problems like soil erosion and floods. Alchohol, a by-product of sugar industry can serve as an industrial fuel, but it needs considerable development in supply and other research in technology. The most important form of power, however, is electricity.

Electricity can be generated from mineral oil, coal and water. (i) Mineral oil requires geological times for accumulation. Being irreplaceable, its utilization is, so to say, living on country's capital resources. Our supply is rather scanty, being only 6% of our requirements including motor spirit and other fuel oils. Hence no major electrict power project can be constructed on the basis of oil fuel, and its use will be confined to those small power stations in areas which cannot be economically served by other major power projects planned or under consideration. The chief sources for generating electric power, therefore, are coal and water.

(*ii*) *Coal.* The Indian Coalfields Committee, 1946, estimated the total reserves of workable coal deposits in various areas to be as follows :

Bihar.	13,146	(Mill. tons.)
Bengal.	2,352	,,
Madhya Pradesh.	381	,,
Assam.	14	,,
Orissa.	7	,,
Other States (Mainly Hydrabad.)	574	,,
Total	16,474	

These may be taken as approved workable coal resources. The Geological Survey of India estimated it to be 20,000 mill. tons. The probable total reserve may be much larger, say 60,000 mill. tons. Considered in absolute terms it is a fairly large quantity, but in comparison with the reserves in some industrialized countries, it cannot be considered abundant.[1] Besides, in the study of power there are a few important considerations. First, the known coal deposits are found in fairly well defined zones, and are localized in a more or less contiguous areas in West Bengal, Bihar, Orissa, Madhya Pradesh and Hydrabad.[2] The supply to

1. Coal resources in million metric tons.

Countries.	Coals.		Brown Coal & Lignite.		Peat.
	Proved Reserves.	Probable Total Reserves.	Proved Reserves.	Probable Total Reserves.	Probable Total Reserves.
Germany.	80,445	27 ,516	28,837	,758	10,000
U. S. S. R.	295,900	998,006	12,890	202,000	72,330
U. K.	129,900	172,200	...	...	...
Canada.	43,806	65,053	12,554	24,592	...
U. S. A.	..	1,958,000	...	852,000	12,542

(World Power Conference : Statistical Year Book.)

2. Occurence of workable deposit of lignite has recently been reported in South Arcot district of Madras and in Kutch. The Geological Survey of India are carrying out detailed investigations in these areas to find out the nature, extent and the practicability of commercial working of these deposits.

distant areas involves considerable transporation costs, which influence the location of thermal power stations. It is, therefore, normally expected that in South India and Punjab which are distant from coal deposits, the development of power will not be based on coal fuel. On the other hand, large thermal power plants designed for high steam pressure would generate electric power at economic rates in colliery areas of Bengal, Bihar and Madhya Pradesh.

Secondly, the question is not of the total potential but of how long the better and the more cheaply got coals will last. The deposits of high quality coal suitable for metallurgical purposes are said to be 700 to 750 mill. tons. The bulk of it is being used for steam locomotives, and at the present rate of consumption (about 10 mill. tons per year) the metallurgical reserves will exhaust in 65 to 70 years. Recently revised estimates put this figure at 200 years. That too is not a complacent situation. The Coalfields Committee, therefore, rightly stressed the need to restrict the use of high quality coking coal to metallurgical purposes only, and so far as possible, to use the coking coals which form the bulk of our coal reserves, for raising steam for power stations, industrial uses and esteam locomotives. It is gratifying to note that, realizing the importance of the problem, the Government of India have recently taken steps to rationalize the Coal Minning Industry and to conserve the high grade metallurgical coal.

Thirdly, coal is an important raw material for synthetic chemical industries. In the light of these considerations it appears that in future the large thermal power stations designed to use low grade coal will be located at colliery

pitheads, and those thermal stations which are far distant from colliery areas will be designed to burn only low ash content fuel. The Central Water and Power Commission, however, believe that 'in the ultimate power picture of India these thermal power stations would only be of medium capacities and would be generally intended to act either as standby to or to supplement other primary sources of power in the area.'[1]

(iii) Water Power. Water seems to be the best source of power.[2] It is a perpetual mine, and in generating electricity only the gravity of water is used without consuming any substance. There is an urgent necessity of utilizing it, because when it is allowed to run without being utilized it causes destruction where it could be of service to mankind. The NPC think that 'every horse-power generated hydraulically represents an annual saving of approximately 4 tons of coal.'[3] As a matter of fact any use whatsoever of water (for power) is better than no use at all, since if it is not used, it is not stored or conserved but wasted. And from the view point of conservation its use is preferable to that of calorific energy at the same or even

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1, Central Water and Power Commission: Planning for Power Development in India, I951, p, 3,

2. In the past the use of fuel assumed great prominance, because under old conditions thermal power was supposed to be superior to hydel power. The reasons were that under the then technological developments it was cheapest to transport coal than to transmit energy above a certain distance. Therefore, a thermal power station could be located at the most favourable site, whereas the hydro-electric plant could be sited only where nature placed it. Secondly, as regards load factor the hydro-electric plant did not posses as much flexibility as the steam plant. But the conditions are now changed. Now it is cheaper to transmit electricity than to transport coal when the distance is not much larger than 100 miles Electricity is the most adaptable form of power. And now the question is not one of merely supplying a few concentrated loads in the most favourable sites, but of supplying the whole countryside.

3, NPC: River Training and Irrigation. I947, p, 73.

somewhat higher cost. Besides, according to the NPC hydro-electricity possesses the following advantages over thermal power.*

(*a*) Every horse power developed by water preserves Rs. 40 worth coal per annum, and justifies an investment of Rs. 400 in a hydel plant in excess of a steam plant.

(*b*) A hydro-electric generating unit is more dependable than a heat unit because of operating at a comparatively low speed and temperatures.

(*c*) The non-scheduled voltage "when in demand" is negligible, and hydro-plant units can be placed in operation quickly, which is important and valuable under sudden large load increases and emergencies.

(*d*) Less power is required for station service.

(*e*) The cost of developing hydro-electric scheme is no doubt large, usually greater than the erection of a thermal station, but against this there are substantial savings in running expenses.

(*f*) As the load factor rises the advantage of water power increases, and sales which fill up the hollows in the load curve without affecting the peak are profitable at whatever rate they bring in.

In the light of these considrations it is believed that 'the form of primite mover for generating power which holds out the greatest promise of social success is the gravity of water.' But any reasonably accurate assessment of the

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*It is also said to have some disadvantages, *(a)* Because of large first cost there is a corresponding risk of loss which makes capital shy to go in for these undertakings, (b) Demand must be foreseen a long time in advance, and the installation has to be made for a greater capacity than the existing needs. (*c*) There are technical difficulties also (*d*) Long-distance transmission is uneconomical.

water power polential* is not possible at present. A complete assessment will be available when the hydrological survey commenced by the Central Water and Power Commission is completed. However, at present it has been guessed to be 25 mill. kw. But it should be remembered that a large number of potential sites have not yet been investigated.

Our main sources of hydro-electric power are the snow-fed rivers rising in the Himalayas along a length of about 2000 miles from Kashmir to Assam, and the heavy rainfall on the Western Ghats. Besides, in other parts of the country many sites on the rivers flowing in the plains, where high head dams can be constructed and hydro-electric machinery can be installed, can likewise be used. But it should be noted that every water-fall cannot be used for hydro-electric installation, since its economic feasibility depends not only on the water-flow and the hydraulic head, but also on other factors like accessibility of the site for transporting heavy machinery, distance from load centres, nature of flow, cost of storage and the likely load factor.

Besides, in regard to the use of water for generating power there are a few points which require careful consideration. First, the seasonal variation of flow of our rivers has to be evened out for generating power. This necessitates the construction of dams to store water, for utilizing during the time of lean flow; and therefore, in our hydro-electric projects, unlike those of western countries, these ancillary civil works must form a substantial part of capital outlay. Secondly, the country being mainly agricultural, and irrigation

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*The first assessment of water power resources was made by J. W. Mears in 1923, which is believed to be very inaccurate. Burrow's estimate is supposed to be more accurate. He put it at 30 mill, Kilowatts. The NPC refer to a conjecture of 5.5 mill, Kilowatts, and themselves estimate it at 11 mill. Kilowatts.

depending mainly on the rivers fed by the monsoon, there is a clash of interest between the needs of irrigation and of electricity. Therefore, many of the projects have to be attempted as joint irrigation-cum-electricity measures or as multi-purpose projects; and in almost all such joint measures a certain amount of compromise, as regards the use of water has to be accepted as necessary and unavoidable. This nature of the projects, moreover, (multi-purpose character) should be the determining factor in financial considerations of construction costs, etc. Thirdly, as is likely, the power output of the hydro-electric installation will not be maintained at a uniform level over the various seasons of the year.[1] This requires inter-connecting transmission lines between adjoining large power systems so that by interchanging power the over all power output can be maintained more or less uniformly. And in smaller regions the hydro-electric stations will have to be coordinated with thermal stations.[2] In the light of these circumstances it appears that the power development in our country will be one of inter-connected hydro and thermal stations in various regions, and these regional systems will also be inter-connected through transmission lines to form a big national grid.

The Development of Electric Power. The first installation of power plant in India was made in 1897-98, and though industrial development in the west was considerably accelerated by electricity, in our country it was perhaps

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1. During rains the discharge in river may exceed the requirements of power generation, while in the dry season the available supply will be inadequate. Besides, as a measure of flood control it may be necessary to run down the reservoir to safe limits before the monsoon ; it will reduce the head and consequently the power output.

2. The thermal station will compensate the deficit of hydel power output at the time of low discharge of rivers, and during the season of maximum flow when the entire discharge will be used for power generation, the thermal station will act as standby.

considered synonymous with electric lighting. It was developed as a private enterprise, and the companies which took licences under the Indian Electricity Act 1910, being guided by the prospects of reasonable returns, operated in important cities, and due to the absence of mechanized industries power was used for lighting and general purposes. By 1914, however, most of the large cities had electric supply, but till then neither the Central nor the Provincial Governments followed any progressive policy of power development.

During the World War I the helplessness of the country, specially in the industrial field, was proved, and as a result of the recommendations of the Indian Industrial Commission, 1918, a policy of industrial and power development was contemplated. They recommended a systematic survey of hydro-electric power, and J. W. Mears was asked to carry out that survey. But beyond that survey no definite action was taken by the Government at that time. And in 1921 the subject was transferred to the Provinces. The Provincial Governments, however, launched schemes for hydro-electric development, and the progress in power development was rapid after 1925. And the Depression which enabled the governments to obtain plants at considerably reduced rates from abroad assisted the growth considerably.

The need to promote the development of electric power was further realized during the World War II when power resources proved very inadequate to meet the civil and war demands. In 1941 the office of the Electric Commissioner with the Government of India was created in order to regulate, assist and control the electric power supply with a view to promote war effort. In 1944 he initiated a programme of active assistance by Government of India for

developing country's resources. Some financial principles to guide the electric supply undertakings were prepared and circulated. Work was started on drafting the legislation (on the basis of the British Electricity Act 1926) which was intended to develop large sized economical power stations, to develop regional electricity grid system, and also to promote rural electricity supply. Provincial and State Governments and also the electric supply undertakings were encouraged to prepare in advance their post-war development plans. They were examined by the Electricity Commissioner from the view point of co-ordinating tham, and further the possibilities of securing manufacturing capacity for the plant and equipment required for the post-war development projects were investigated.

In 1945 the Central Technical Power Board was set up. In 1948 it was merged with the office of the Electricity Commissioner to form the Central Electricity Commission. It was a step to assist the provincial and state governments and other undertakings in initiating and planning the new power schemes. On the grounds of economy and efficiency a further administrative change has been made recently. The two engineering organizations of the Government of India, viz., the Central Electricity Commission and the Central Water-Power, Irrigation and Navigation Commission have been amalgamated to form a new organization called the Central Water and Power Commission. The Power Wing of this organization carries out the duties formerly performed by the Central Electricity Commission. The old Act of 1910 which governed the electricity supply industry was also replaced by the Electricity (Supply) Act, 1948, and

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For a detailed study of the functions of the new organizations and the Electricity Supply Act, 1948, reference may be made to Central Water and Power Commission : Planning for Power Development in India, 1951, pp. 7—9.

the International Engineering Exhibition and the sectional meeting of the World Power Conference held at Delhi in Jan. 1951, have considerably stimulated interest and activity in power development.

The progress or the development of electric power in the Indian Union from 1900 to 1950, classified according to the type of plants, is as follows :—

Average installed generating capacity of public utility supply installations. (kw)

Yr.	Steam Plant.	Oil/Gas Plants.	Hydro Plants.	Total.
1900	1,000	...	130	1,130
1905	3,235	...	8,515	11,750
1910	14,925	955	15,467	31,347
1915	34,281	2,264	20,741	57,286
1920	49,245	6,323	74 441	130,009
1925	145,496	19,315	162,341	327,152
1930	266,660	44 889	286,591	598,140
1935	440,514	95,519	364,369	900,402
1940	624,162	115,291	468,969	1,208,422
1945	713,951	121,346	484,019	1,319,316
1950	1,004,434	148,796	559,285	1,712,515

Of this 1·71 mill. kw ·6 or 35·6% belonged to 201 government owned power stations, ·02 or 1·2% to 19 municipal owned power stations and 1·08 or 63·2% to 258 power stations owned by private companies. It shows that major part of the development of the public utility electric supply has so far been made by the private companies. In addition to public utility power stations individual industries and Railways in many cases operate their own power plants. In March 1951 there were 587 such installations with an intalled generating capacity of ·64 mill. kW. This makes a total of about 2·4 mill. killowatts.

A significant feature in the post war years, however, is the increasing participation of State Governments in the Electric Supply Industry. In fact power development is being taken up by all State Governments, but the governments which have now entered the field considerably are Bengal, Bihar, Orissa, Madhya Pradesh and Bombay. The prevailing tendency is in favour of State ownership of public electric concerns.* Some of the private concerns are being purchased by the State Governments, *e. g.*, in 1947 the Madras Govt. acquired the Madras City Thermal Station, and the Uttar Pradesh Government purchased the steam power station establishment of Messers Martin Burn, Ltd. at Kanpur. But even at present by far the major part of the electric supply industry is the result of private enterprise.

The Present Position. The total installed capacity, including that of the stations serving individual industries and railways, at the end of March 1951, was 2·43 million kilowatts. In absolute sense the extent of electric power development seems quite significant, but if viewed in relation to the vast area, the huge population and the power needs, it fades into an insignificant feature; and further, if compared with the electric development in some industrially advanced countries, it becomes clear that we are

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*There is a general tendency all over the world to bring this public utility service under government control. The prevailing opinion is that electricity being a public utility service, this industry should not be permitted to be operated like other industries actuated purely by profit motive. Ordinarily the argument in favour of public ownership is that the expectations of return are no more than the interest on capital outlay which private investors will consider very inadequate. The argument against public ownership is the comparative inefficieney due to administrative procedure. This can be remedied The Madras and Mysore governments have overcome these difficulties. Besides, the State Electricity Boards under the Electricity Supply Act, 1948, aim at imparting efficiency and expedition in such government bodies.

still far way behind. The following table affords a comparison.

	Japan	U.S.A.	Canada	Sweden	U. K.	India
Area, (Thousand sq. miles,	142	3,620	3,690	173	94	1,220
Population, (millions)	81	149	13	7	50	362
Installed Capacity, (MW.)	10,219[2]	67,509[3]	9,950[3]	2,6000[1]	15,083	1,713[3]
Kilowatt-hours generated (mill. kWh)	30,407	329,028	50,795	14,206	55,008	5,106
Installed generating capacity per sq. mile (kW.)	72'1	18'6	2'7	15'0	160'3	1'4
Kilowatt-hours generated per capita.	376	2,207	3,905	2.029	1,100	14

(1. 1946 figures.) (2. 1947 figures.) (3. 1950 figures.)

The development of electric power is not uniform throughout the country, but is concentrated in a few regions. Again, amongst these regions also, there are considerable differences so far as the nature and extent of the power development, the ownership of schemes, and nature of loads, etc., are concerned. There seem to be 5 such zones, and a brief discussion of each may be as follows :—

(i) South India : (comprising of Mysore, Madras and Travancore and Cochin States). Due to long distance from collieries the use of coal for generating power is very costly, and, therefore, greater development of power is from water. The total generating capacity is ·3 mill. kW. of which 80% is hydel and only 20% thermal. In Mysore the hydro-electric stations are at Sivasamudram, Shimsa and Jog. These three are interconnected, and supply power to Mysore State. One of the important loads supplied by this system is in the Kolar gold fields. In Madras there are 3 hydro-electric stations at Pykara, Mettur and Papnasam. These three are inter-con-

nected and serve mostly South Madras. There is a big thermal station in Madras city which is connected with Mettur station. The capacity of the interconnected system of these stations is augmented by a steam power station at Madhurai. Besides, there are two more thermal stations at Vijaiwada and Vishakhapatam. In Travancore and Cochin there is a hydro-electric station at Pallivasal, which is said to be mostly responsible for the development of the aluminium, fertilizer and chemical industries in the State. The two distinct features of the electric development in this zone are that these schemes, specially the generating stations and main transmission lines, are State-owned, and though the aggregate capacity is not very large, they are extending power supplies to rural areas for agricultural and other purposes.

(ii) Bombay Area. The total installed capacity is ·24 million kW. of which 60% is hydel and 40% thermal. The major public utility stations are the three hydro-electric stations at Khopoli, Bhivpuri and Bhira on the slopes of the Western Ghats between Poona and Bombay, belonging to the Tata Electric Agencies, and the thermal power station at Ahmadabad, belonging to Ahmadabad Electricity Co. The Tata Electric system is inter-connected with the steam power station of G.I.P.R. at Kalyan, and serves the industrial installations in Bombay, specially the textile industry. The thermal plant at Ahmadabad supplies power to the textile mills there. Outside the industrial areas of Bombay and Ahmadabad there are two thermal stations at Surat and Sholapur, sustained mostly by industrial load. The distinct features in this region are that outside the industrial centres of Bombay and Ahmadabad there is very little electrict development, and the electric supply industry is almost exclusively in the hands of the private enterprise (only exception being the station at Bhatgar). This explains

as to why has it remained confined to industrial and urban areas only.

(*iii*) ***Bihar-Bengal Area.*** The aggregate installed capacity including both the public utility and the privately owned power stations is ·95 mill. kW. Ample supply of coal being available in Bihar and Bengal collieries electric development in this areas is based almost exclusively on steam power plants. Again the development is exclusively due to private enterprise. The largest of the power stations at present are the four steam power stations at Cossipura, New Cossipura, Southern and Mulajore, belonging to the Calcutta Electric Supply Corporation, and supply power to Calcutta industrial and residential areas. Other major public utility stations are at Gourpore Seebpore and Dishergarh in Bengal and Sijua Jheria and Patna in Bihar. Besides, there are a good number privately owned plants belonging to railways, collieries and other industries, the biggest of which are belonging to the Tata Iron and Steel Co., at Jamshedpur, the Steel Corporation of Bengal, the Rohtas Industries Ltd., Dalmianagar, and the Aluminium Corporation of India near Asansol. Except in the city of Calcutta and a few large towns where domestic and other general demands come upto about 20% the remaining power

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The economical methods of construction and operation, and the progressive policy adopted by these three Governments, have largely contributed to the industrial development of South India. Progress in South India might be pointed out as an argument in favour of bringing electricity under unified control as envisaged under the Electricity Supply Act, 1948

The Bombay Government have recently established an Electric Grid Department, which will undertake schemes of electrifying the entire State.

Towards the end of 1948, the load development in the area served by Tata G. I. P. Railway inter-connected system exceed the available capacity, which necessitated the introduction of staggering of working hours and days of the various industries, thereby making it possible to utilize the available capacity to the best advantage until adequate additional generating capacity is provided in the system. The staggering of industrial loads has enabled a reduction of about 38 thousand kW of demand.

development is due to industrial demand. And outside the industrial areas of Bihar and Bengal there is very little electric development.

(*iv*) *Uttar Pradesh and Punjab.* The aggregate installed capacity is ·31 mill. kW. The power is partly thermal but mainly hydel. The Uttar Pradesh Government has taken a lead in promoting electric development. There are 8 hydro-electric stations on the Upper Ganges canals. They are inter-connected with one another, and also with two steam stations at Chandausi and Harduaganj. A special feature of the Ganga Canal Grid scheme is the predominence of the agricultural and irrigation loads. In fact tube-well irrigation in areas not directly commanded by canals was the main objective with which this scheme was initiated. The U. P. Government has also installed a steam station at Sohwal, and has recently purchased one at Kanpur belonging to Messrs Martin Burn, Ltd. Besides, in several big towns of U. P. like Agra, Allahabad, Banaras, Lucknow and Bareilly power is supplied from steam stations belonging to Martin Burn, Ltd Supply in Delhi is obtained from the Central Generating station, Delhi, and in Punjab there is a big hydro-electric station at Jogindernagar, which serves several important centres such as Amritsar, Jullandhar, Ludhiana and Ferozpur, and also continues to serve considerable areas in West Punjab (Pakistan). The supply to Pakistan is expected to be gradually reduced. But this should not be done. On the other hand India should continue to export ele-

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The hydro-electric station at Jogindernagar was established by the old undivided Punjab Government. It is a costly project, since the river Uhl had to be diverted from its valley through a 3 miles long tunnel to a watershed on the other side of the hill. The major portion of the load connected with the system happens in the area which after partition forms part of Pakistan. A working arrangement, however, has been made between the two governments : West Punjab (Pakistan) and E. Punjab (India) in regard to the continuance of the supply. There is a fear of this Supply being gradually reduced.

ctricity and increase the supply so far as possible. This will mean not only dealing in a vital commodity but also earning foreign exchange. And there can be a possibility of a greater load supply through regulating the flow of the river or by storage, and without adding to the installed capacity of the plant.*

(*v*) *Central Region* (Comprising of Hydrabad, Madhya Pradesh and Orissa). The total installed capacity is ·15 mill. kW, and the power is almost exclusively thermal. The important public utility installations are at Nagpur, Cuttack, Khaperkheda and Hydrabad. Besides, there are several power plants belonging to private industrial concerns such as collieries, cement factories, textiles, chemicals, paper mills and ordnance factories, etc. The major part of the power generated in this region is by these plants, and therefore through private enterprise. This region has good potentiality of industrial development since it possesses rich mineral resources such as manganese, coal, bauxite, iron ore and limestone, which have not been systematically developed so far.

The total installed capacity of all these stations comes to about 2·13 mill. kW, *i. e.*, 88% of the total. The remaining amount of power is scattered in other parts. According to the present programme of planned power development the country is divided into 11 power zones in each of which a self contained power development is being

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*In this scheme no storage is provided. The result is that the output of the power station at Jogindernagar is subject to the variations in seasonal flow in the Uhl. Hence inspite of the total installed capacity of 48 thousand kW the dry weather flow in the river is adequate only for generating about 20 thousand kW. A greater output can be made possible by regulating the water supply through storage. Secondly, when the greatest output is made possible, the question may be whether to export it to Pakistan or to extend it in the E, Punjab itself. With reference to the position of our foreign trade it may be advisable to export electricity to Pakistan.

attempted. The present capacity of power plants in these zones is as follows:—

Zone No.	Areas covered.	Installed capacity (kW)	% to Total.
1.	Jammu and Kashmir State.	6,000	·2
2.	Punjab, Delhi and parts of Rajasthan.	148,000	6·1
3.	Parts of Madhya Pradesh and Rajasthan.	149,000	6·2
4.	Bombay State and parts of Hydrabad.	528,000	21·7
5.	S. India excluding coastal Andhara Desh.	317,000	13·0
6.	Coastal Andhra Desh and parts of Hydrabad, Madhya Pradesh and Orissa.	67,000	2·8
7.	Area under Mahanadi Valley Development.	13,000	·5
8.	Area under Rihand Project and Central regions of U. P.	175,000	7·5
9.	Western Districts of U. P.	74,000	3·1
10.	Calcutta and Damodar Valley.	948,000	38·9
11.	Assam.	8,000	·3
	Total.	2,433,000	100·0

The development of electric power is mostly confined to the industrial areas of Culcutta and Bombay which together form 60% of the load. In other regions also there is, however, now a planned programme for development. In several of these power zones regional grid systems are being developed. Besides, electric power is now a concurrent subject coming under the perview of the Union and State Governments. The Union Government lays down the

general policy and legislates to guide the working of the electric industry, and the day to day administration is the responsibility of the State Governments. The Electric Supply Act, 1948, provides the machinery for promoting a rapid and coordinated power development in all the regions.

The Future Development. At present cheap power is the vital force behind industrial development. As a matter of fact power can be taken as a measure of ascertaining the level of production and the trend of technological development. Amongst the different forms of power electricity is said to have many advantages over others.[1] Really speaking electric power plays such an important role in modern economic life that the present period may be called the 'Age of Electricity,' and the extent of electric power development in a country may be taken as the pointer to the stage of economic development of the country and an index of the standard of living of the people.

In the post-war period all State Governments and the private electricity undertakings began very enthusiastically their plans. According to these original plans it was expected that in 5 years ending 1951 about 1·23 mill. kW of new generating capacity will be installed, and in the subsequent period of 5 years ending 1956 there will be an addition of 3·12 mill. kW. But as the result showed the first target could not be achieved. The NPC proposed an addition of 4 mill. kW in 20 years.[2] The Central Water and Power Commission drew up a planned programme of power development in different zones as follows :

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1. It can be transmitted with facility from where it is generated to where it is used ; it lends itself to easy and effective control ; and it is extremely adaptable for multifarious purposes.

The advantage of hydro-electric power increases with a sustained load, and it is more economical to transmit power at a high load factor than at a low one.

2, River Training aud Irrigation, 1947, p. 85.

Zone No.	Area covered.	Anticipated capacity (000 kW)[1]	
		1954	1959
1.	Jammu & Kashmir State.	12	15
2.	Punjab, Delhi and part of Rajasthan.	262	470
3.	Part of Madhya Pradesh and Rajasthan.	231	326
4.	Bombay State and part of Hydrabad.	699	1,044
5.	South India excluding coastal Andhra Desh.	578	757
6.	Coast Andhra Desh and parts of Hydrabad.	178	235
7.	Area under Mahanadi Valley Development.	66	141
8.	Area under Rihand Project and Central regions of U. P.	196	296
9.	Western Districts of Uttar Pradesh.	143	194
10.	Calcutta and Damodar Valley.	1,215	1,538
11.	Assam.	8	17
	TOTAL	3,588	5,029

The Planning Commission in their Draft Outline of the First Five Year Plan alloted Rs. 734 crores for irrigation and power projects. Of this Rs. 144 crores were spent by March 1951, Rs. 450 crores were to be spent during next 5 years and Rs. 140 crores thereafter. The additional power expected was 1·1 mill. kW at the end of 5 years and 1·93 mill. kW after completion and full development. The expectation for the period of 5 yrs. was as follows :[2]

1951—52	·144	mill. kW
1952—53	·373	,,
1953—54	·889	,,
1954—55	1·000	,,
1955—56	1·124	,,
Ultimate	1·935	,,

The mul-tipurpose projects have been phased with a view to the early completion of their irrigation aspect ; the power generation is carefully regulated and taken up in stages as the demand arises. The schemes in the Draft Outline are :—

1, Planning for Power Development in India, 1951, p, 38,
2, Draft Outline of the First Five Year Plan, 1951, p, 123,

POWER MAP OF INDIA

SHOWING POWER STATIONS OF 1000 K W & ABOVE, MAIN TRANSMISSION LINES AND POWER ZONES AND INSTALLED CAPACITY

A 127 000 K.W.
B 269 000 K.W.
C. 533 000 K.W.

A 61.000 K W.
B 138.000 K W.
C 215.000 K W.

A. 119,000 K W
B 154.000 K W.
C. 384.000 K W

A 108 000 K.W
B. 211.000 K W
C 293.000 K.W.

A 749.000 K W
B 1,246.000 K W
C 1.538.000 K W

A. 447.000 K W
B. 565.000 K W
C. 730.000 K W

A 32.000 K W
B 72.000 K.W
C 195.000 K W

A. 270.000 K W
B. 587.000 K W.
C. 692.000 K W

A. 61,000 K W
B. 194.000 K.W
C. 245.000 K.W

- EXISTING THERMAL POWER STATIONS
- O THERMAL POWER STATIONS UNDERCONSTRUCTION OR UNDER ACTIVE CONSIDERATION
- ■ EXISTING HYDRO POWER STATIONS
- □ HYDRO POWER STATIONS UNDER CONSTRUCTION OR UNDER ACTIVE CONSIDERATION
- ——— EXISTING MAIN TRANSMISSION LINES
- ···· MAIN TRANSMISSION LINES UNDER CONSTRUCTION OR UNDER ACTIVE CONSIDERATION
- ═══ POWER ZONE BOUNDARY

A INSTALLED CAPACITY BY END OF 1948 - 2004.000 KW
B " " " " - 1953 - 3.451.000 "
C. " " " " 1958 - 4.849,000 "

MOHORA
GANDARBAL
JAMMU
MIRAN SAHIB
JOGINDRANAGAR
BHAKRA
NANGAL
CHABA
SIMLA
MUSSOORIE
BHUPENDRA
SRIGOPAL
PATIALA
YAMUNA
DEHRADUN
PM JAGADRI
PATHI
RAKADEABAD
STAR PM
NAYAR
MOHAMMEDPUR
MORGAJNI
PANIPAT
CHITAURA
SALAWA
SARDA
BIRLA C.W.M.
BHOLA
RAMPUR
DELHI
CHANDAUSI
DGG DADRI
DELHI CES
GURGAON
PALHA
SUMERA
BAREILLY
HARDUAGANJ
BIKANER
BALRAMPUR
DARJEELING
KOSI
GAUHATI
JAIPUR
AGRA
E I RLY
SONWAL
LUCKNOW
GORAKHPUR
AJMER
ORDNANCE FACY.
U I COOPER P M
SAHDARNAGAR
SARAYA S.M
JODHPUR
BBCI
GWALIOR
BANMORE A C C
JIVAJIRAO C M
ALLAHABAD
BANARAS
MOGHAL SARAI
PATNA
JAMALPUR
BHAGALPUR
LAKHERI
ERINPURA
KOTAN
DUKNWAN
JHANSI
DALMIANAGAR
BANJARI K E
S V P C C
TILAIYA
BALPAHARI
MAITHON
MOHAR
BOKAR
MOR
MENGAON A C C
KYMORE A C C
RIHAND
BURKAN
DAYER
SP ESPUR
KATNI A C C
KATNI
RAMGARH
SINDRI
JARAYNAGAR
KHALARI
PANCHET M
KANCHRAPARA
MULAJORI
GOUREPORE
AHMEDABAD
UJJAIN
BHOPAL
G C F
JUBULPUR
JAMSHEDPORE
GOSSIPORE
BALASINOR
MALWA
BHOPAL TEXTILE
GNATSILA
SOUTHERN
OKHA
JAMNAGAR
DOMAD
INDORE
BARGI
CHAIBASA A C C
SEEKA
KORBA ALUM F Y
DWARKA A C C
BARODA
BARKUMI
BRAJARAJNAGAR
PORBANDER
CHANDNI
HIRAKUD
BHAVNAGAR
MODEL MILLS
EMPRESS MILLS
SURAT
NAGPUR
KHAPARKHEDA
RAIPUR
TALCHERA
BILIMORA
BHUSAWAL
OCUTTACK
BHARAT V. PROD. PACHORA
WAINGANGA
NASIK
BHANDARDARA
KALYAN
RANDHA
SIRPUR P.M.
NANDER
TONDUR COLLIERY
BOMBAY
SHIVPURI
KHOPOLI
BELAMPALI
MACHKUND
BHIRA
NIZAMSAGAR
RAMAGUNDAM
BHATGAR
NARSINGGIRJI M F G Co.
AZAMJAHI MILLS
SHOLAPUR
VIZAGAPATAM
HYDERABAD
KOTTAGUDEM
MAHABUBNAGAR MILLS
SHAHABAD
KOYNA
A.C.C KISTNA
RAJAHMUNDRY
KOLHAPUR
BEZWADA
RADHANAGRI
GOKAK T.M.
HUBLI
TUNGABHADRA
CANAL P.H.
ELLORE
JOG
BHADRAVATI
LAKKAVLI
MADRAS
BUCKINGHAM E'
CARNATIC MILLS
SHIMSAPURA
SIVASUMADR
MEKADATU
MOYAR
METTUR
PAHRUTI
NELLIKKUPPAM
PYKARA
KARTERI
TIRICHNOPOLY
PORINGALKUTHU
TIRICHUR
MUNHAR
GOLDEN ROCK
PALLIVASAL
ERNAKULAM
SENGULAM
MADURA
PERIYAR
TRIVANDRUM
PAPANASAM



States	Projects	Exp. (Lakhs Rs,)		Additional power (000 kW)	
		FiveYrs.	Total cost	55-56	on completion
Union Govt.	Bhakra-Nangal	77,50	1,32,90	96	400
	Harike	10,62	13.80	...	...
	Damodar Valley Project	41.70	74,98	150	274
	Hirakund Dam	44,00	62,59	85	259
	(Investigations)	2,08	2,83	...	...
		1,75,60	2,87,10	331	933
Part 'A' States					
Assam	Umtru-Hydro-Electric Project	85	85	...	...
Bihar	Emergency Tube-well, north Bihar and Buxur Tube-well electrification schemes; Dehri-Sasram electrification Gaya and Hazaribagh electric supply schemes; Mica mine and coal mine electric scheme ; Girdih electric supply scheme ; Girdih-Madhopur-Jasidih electric supply and thermal Station in N, Bihar.	5,50	8.47	2	4
Bombay	Radhanagri Hydel Project; Kolhapur scheme; Jogdistribuion scheme; Chola power station; North Gujrat electric grid-scheme; S, Gujrat electric scheme, electrification of towns and villages	10,43	14,12	141	141
Madhya Pradesh	Nagpur thermal station ; Akhola Power distribution; Gordia extension; Jabbalpur-Katni grid; Raipur station; Billaspur Power Station.	6,01	13,69	55	55
Madras	Moyar hydro-elect. scheme; Pykara III stage extension; Lapnasam II Stage extension ; Machkund hydel scheme; Madras plant extension ;				

States	projects	Exp. (Lakhs Rs. FiveYrs.	Exp. (Lakhs Rs. Total cost	Additional power (000 kW) 55-56	Additional power (000 kW) on completion
	Nellore thermal scheme ; Madras-Mettur inter connection ; Tungabhadra hydel scheme; etc.,	50,24	77,73	192	310
Orissa	Duduma transmision scheme ; Rural electrification scheme ;	1,07	3,25	5	6
Punjab	Nangal load development ; and other things.	50	71	...	...
Uttar Pradesh	Mohammadpur Station; Sarda power house; Paltin power house ; Gorakhpur power house ; Ganga and Sarda transmission lines;				
West Benga!	Easternarea power station, small hydel schemes,	13,58	27,28	54	137
	North Calcutta electrification scheme; other scheme:	78	1,36	4	4
	Total of Part 'A' States	88,96	1,47,46	453	657
Part 'B' State Hydrabad	Nizamsagar hydel project ; Tungdhadra hydel I phase; Ramgundam thermal				
Madhya Bharat	Hyderabad thermal: Indore power house; reconditioning of plants at Indore and Ujjain; extensions at Gwalior Rural electrification.	2,34	5,33	60	60
Mysore	Mahatma Gandhi hydel works; shimsa extension; Frequency conversion; extensions of transmission lines; Distribution; power supply to pumping sets etc,	14	18	15	15
PEPSU	Electriflcation of towns.	12,68 31	19,24 2.00	171 ...	171 ...
Rajasthan	Power project.	38	38	...	...
Saurasthra	Thermal Stations.	2,62	2,62	12	12

States	projects	Exp. (Lakhs Rs.)		Additional power (000 kW)	
		Five yrs.	Total cost	55-56	on completion
Travancore Cochin	Pallivasal II Stage; Sengulam hydel; Poringalkuthu Left Bank; Transmission and Distribution.	9,85	17.20	81	81
	Total of part 'B' States	28,32	46,95	339	339
part 'C' States					
Bhopal	Bhopal electric power extension ;	5	5	...	...
Coorg	Bulk purchase of power from Mysore	15	15	...	...
Kutch	Acquisition of electricity under-takings and rural electrification.	23	23	...	...
Tripura	Nationalization of electric supply Co.. Agartala.	7	7	...	...
Vindhya Pradesh	Power project.	50	50	...	...
Himanchal Pradesh	Hydel plants in Mandi, Chumba, and Mahasu and extension from Mandi to Sundernagar.	9	9	1	1
	Total of part 'C' States	1,09	1,09	1	1
G. Total	Indian Union	2,94,27	4,82,60	1,124	1,930

In the actual Plan now presented these estimates are revised. Irrigation and power is now alloted Rs. 561·41 crores out of Rs. 2068·78 crores.

The Union and State Governments seem to be fully alive to the importance and the urgency of developing electric power. As the Plan shows, they are actively engaged in planning and execution of many large schemes throughout

the country. The plans appear to be modest specially in view of the needs of the country. But it should be noted that our capacity is limited by financial resources, the technical know-how, and the local water resources in some cases. Under such circumstances very rapid progress should not be expected, and the development in some of the States is bound to remain slow.

Besides, in the development of our water power resources a few points must be carefully considered. First, the large sources of water power lie in the Himalayan ranges extending from Kashmir to Assam. This potential power can be utilized only when it is transmitted to distant consuming centres in Rajasthan, Punjab, Uttar Pradesh, Bihar, West Bengal and Assam. Recent developments in high voltage power transmission make the hydro-electric power sites accessible to distant consuming centres, and thus has increased the availability of water power. These potential sites and large scale power projects should now benefit many States. Hence narrow parochial interests should not be allowed to check the progress of water power which should be conceived from an overall regional or national point of view. Secondly, in order to get the full advantage of water power potentialities the development programme should be carried over a long period in such a manner that the new power units may be brought into service progressively when required. Since the power resources are not distributed uniformly throughout the country, some scheme to transmit power from surplus to distant deficit regions crossing State boundaries will have to be undertaken. This will require cooperation of several States in particular projects and establishment of 'regional authorities.' Besides, the principle of unified development of natural resources recently applied to river valley projects (TVA and DVC),

having further proved the utility and practicability of it, a new approach to resource utilization has been made possible. They should start by taking in view the maximum overall economic and social benefit, and should tackle the problem on a regional basis through regional authorities. Thirdly, the development of inter-connected power system (grid system) leads to considerable economy.* The transmision makes it possible to combine the water powers situated in different localities. Further, since power-generation has to conform to load and water conditions, there is an immense advantage in linking up the different water-sheds, since the inherent disadvantage of the unsteadiness of water supply is overcome by linking up. Though in the initial stages each region has to be developed with local resources as far as possible, when the economic limits of the local sources are reached the possibilities of importing power from adjoining regions have to be explored. However, when the regional developments are implemented there will be a need of tie lines between different regions. The Central Water and Power Commission aims at the possibilities of having an All-India Grid as the ultimate objective. Lastly, the development of power is ultimately determined by the demand for it or the load factor. Hence it is not only a question of scientific and engineering development, but also of economic development as such. It implies a coordination between the development of load factor (schemes of power

*The old method in which each power station used to feed its own transmission and distribution system, has now (with the development of high voltage power transmission) changed into an inter-connected power system, commonly known as the grid development, by which the surplus power from one station can be transmitted to make good the output of another station. In the past security and reliability of power supply necessitated the provision of adequate capacity of spare and standby plant in each power station. Now due to the inter-connection of several power stations by transmission lines the powerful system can serve a very large area, and a very substantial reduction in the amount of standby plant has been made possible.

utilization) and the production of power. There is, however, a question whether planning for load should precede the construction of generation and transmission facilities, or whether power development in an area should be held up till the possibilities of load are definitely known.* Ordinarily speaking the availability of power in an area attracts industries and the experience in the growth of load factor in Madras, Mysore and Travancore and Cochin confirms this view. But the scheme should pay within reasonable time after installation, and unless there is an assured minimum load it is not prudent to embark on large power projects. In our case, however, in view of the known shortage of power in almost all regions there seems to be no difficulty of the additional power, likely to be created by the projects under the Five Year Plan, being utilized within reasonable time. But in the subsequent years the chances of additional power being utilized as quickly are limited unless planned efforts for industrialization are made in all regions.

Rural Electrification. The development of electric supply has mostly been confined to urban industrial centres. It is

*There are opposite views on this point, One view is that unless there is an assured minimum load the large power schemes should not be launched. The opposite view is that power is a primary requisite for industrialization, and the availability of power in a region attracts industries, e.g,, the development of textiles near Coimbatore, irrigation pumping and other industries in Mysore and Aluminium, Fertilizers and Rayon manufacture in Travancore and Cochin, are due to the availability of hydro-electric power in these areas; and the growth of load is said to be far beyond expectations. The answer to this question cannot be one sided. We are, however, inclined to suggest a moderate policy. It is hazardous to assume that in every region there is an unlimited scope for utilizing electricity, The question is how soon can a given load be developed in a particular area. If for any reason the development of industries or the creation of load factor takes very long it is not prudent to embark on large power projects too much in advance. It is said that ordinarily small and medium sized power schemes can depend on miscellaneous load growth, But large power projects which are very costly should not be undertaken in regions which are too much under-developed unless there are reasonable prospects of the energy being utilized within reasonable time.

clear from the following tables.

% of towns and villages electrified

Towns & Villages having population range.	% of towns & villages electrified
over 100,000	100·00
50,000—100,000	100·00
20,000— 50,000	86·64
10,000— 20,000	42·83
5,000— 10,000	10·86
Below 5 000	·49
Total	·64

Installed capacity and the power generated by public utilities alone in some urban and highly industrialized areas.

Name of the Area	% of the total in the country	
	Installed capacity	Energy generated
Calcutta	28·29	18·76
Bombay	16·98	25·60
Ahmadabad	4·83	4·36
Kanpur	3·77	3·42
Madras	2·81	2·28
Delhi	2·19	2·39
Total	58·87	56·82

About 60% of the electric supply is confined to only half a dozen big cities and highly industrialized areas. Besides, other cities and lesser industrialized areas occupy most of

the remaining supply, with the result that electrification in rural areas is conspicuous by absence.

The need of electrifying rural areas is quite obvious. In fact if electricity is to serve the purpose of raising the general standard of living its main field of application must be in rural areas. There it can increase the production of food and raw materials specially by increasing irrigation facilities. It can help in the reclamation of water-logged areas and in the prevention of water-logging in low-lying areas. It can increase rural occupations by attracting small scale industries and thus reduce the pressure on land. In the beginning rice hulling, flour milling and sawing, etc. can be taken up, and in the second stage the processing of raw materials can be developed. It can further help in the selling of the finished products by helping in the development of transport. Further it enables the decentralization of industries. As a matter of fact in our agriculture by far the major portion of the cost of production is power (human and animal labour) efficient power will bring about considerable savings, and there is a vast scope for its application.

In recent years some State Governments have shown codsiderable interest and activities in rural electrification. In Madras in 1949 the number of electrified villages was 1600, the connected load in rural areas was 92 thousand kW, the energy consumption was 76 mill. kWh, and the capital outlay was Rs. 374 lakhs. The planning for the year 1954 is to electrify 3000 villages, with a connecting load of 203 thousand kW and an energy consumption of 167 million kWh. The government of Madras have launhced an intensive economic development of 24 firkas (sub-division of a taluka) each comprising of 50 to 60 villages and 7 khadi centres. A significant feature of rural electrification in Madras is the integrated development of both rural

and urban areas, which amounts to the surplus revenues in urban areas being utilized for the benefit of rural schemes. There are over 13,500 lift irrigation pumps; and 1500 rural industries are operated by electricity. The general pattern for rural loads is : 52% of the total connected loads is in irrigation pumping, 25% in rural industries, 21% is domestic load, 1% in street lighting and 1% miscellaneous. The demand for power is so insistent that the extenstions are restricted only by the availability of line materials and other equipment. In Mysore at the end of 1949, 288 villages were electrified. The pattern of rural load is almost the same as in Madras. As a result of the power supply cottage industries specially weaving and toy making have made sufficient advancement. In the next 5 years the government is aiming at electrifying all villages having a population of over 1000. In Travancore-Cochin out of 153 revenue divisions (in Travancore part) 70 have been electrified. Rural electrification in this State is more expensive since in rural areas of this part people live in farm houses (and not in villages) widely separated from each other, where length of distribution lines adds to the cost. Water is mostly pumped from rivers and canals and there is not much lifting from wells. Power is also utilized for reclamation of water-logged area in Kutanad in north Travancore, and at present about 26,000 acres of water-logged land is brought under cultivation. Besides, several small scale rural industries are also in operation. In the next 5 years 800 villages with a population of more than 5000 each are to be electrified, and within next 5 years 1200 more. In Uttar Pradesh the most significant development in rural electrifiaction is in regard to tube-wells. In fact the Ganga Canal Hydro Electric Scheme was mainly conceived to supply power to tube-wells for irrigating areas which were not

commanded by gravitation canals. There are over 2500 tube-wells constructed and operated by government in the Ganga Canal area. Besides, there are a large number of privately owned tube-wells for which power is supplied by the goverment.* The new programme of rural electrifi-tion is to electrify 500 villages in the Ganga canal grid area, 130 villages in Sarda scheme, 4 villages and 100 tube-wells in Gorakhpur scheme and 60 tube-wells in Faizabad. The Bihar government are operating small rural schemes near Patna and Dehri-Sassaram. Further extensions of these schemes are being implemented. Bombay is now giving special attention to rural electrification. About 250 villages and townships will be electrified. Irrigation pumping either from open wells or tube-wells will form a significant position of the anticipated loads. In Madhya Pradesh and Assam there have been two successful projects for rural electrification. In the former a State Electricity Board is formed, and the rural areas within the economic reach of the grid sub-stations will be electrified. In the Punjab it is expected that with the commencement of power supply from Nangal power stations it will be possible to extend electricity throughout the State both in rural and urban areas. The north Calcutta Electrification scheme in W. Bengal is said to have the supply of power in the mofussil

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*A peculiar feature of rúral electrification in these areas was that the State paid special attention to build up tube-well load, and the development of other load was left in the hands of private licensees. Licenses for distributing electricity for industrial and general purposes were granted in all areas coming whithin the Ganga Canal Scheme. They confined mainly to urban areas and therefore the supply in rural areas made very little progress. Though the government had constructed a large net-work lines it could be utilized for general purposes. It was done, but the progress was slow ; it could be rapid had it not been for an agreement of the U. P. government with the licensees that in virtue of the latter holding distributing licenses in particular area, the government would pay them a royalty of 10% of the gross revenue realized from rural loads other than tube-wells,

townships and villages for industrial and agricultural developments as its objective. The Orissa government is constructing a network of lines in the area between Cuttak, Bhubaneshwar and Puri for electrifying the adjoining rural areas. One significant fact about rural electrification is that whatever success has been achieved so far is in areas developed by various government agencies, and private investment, being guided mostly by security of turnover did not undertake risky enterprise but remaimed confined to safe areas in urban industrial centres.

Rural electrification means extending the benefits of electricity to economically poor people residing in scattered villages. As such there are many engineering and economic difficulties. But on the other hand, a popular demand for cheap electricity seems to be based on a misconception that a vast hydro-electric potential in the country can be developed at a cheap cost. Really speaking there are many difficulties in electrifying rural areas. First, due to the far flung character of the load the transmission, distribution and operation costs must be high. Besides, at present the capital cost per kW of steam station is about Rs. 800 and that of hydro station Rs. 1,500—2,000. These costs are not likely to be reduced much in future. The average selling rates for electric energy in 1949 were : 2·47 annas for residential and commersial loads, ·65 anna for large industries, ·56 anna for electric traction and ·96 anna overall rate. The Central Water and Power Commission think that in future these figures will show substantial increase.[1] The chances of low rates are, therefore, limited. But on the other hand, village people are not in a position to pay high rates. Secondly, the

1. Central Water and Power Commission : Planning for Power Development in India. 1951, p, 4p.

load density in rural schemes is not always a sure factor. It is said that most of the rural electrification schemes do not become self-sufficient even at the end of 10-15 years.[1] Thirdly, these schemes involve huge financial investment. The private investor is not attracted due to low turnover and due to scheme not being self-sufficient for very long; and the government which can take a longer view does not always find it convenient to take up such big enterprises. Even in the case of subsidies there is a limit to them.

But it should be noted that electric power development is not an end in itself, it is a means towards betterment. Besides, the experience shows that once electricity takes roots people become electricity minded, and the load grows on.[2] It does not suffer depression except in the rare event of several large industries closing down. In schemes of rural electrification a long-term view must be taken. In the initial stages, in order to tide over the difficulties, subsidy should be considered necessary for a shorter period. The

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1. Central Eleciricity Commission : Rural Electrification in India, 1948, p, 3.

The experience in Canada and U.S.A, was the same, but by taking a long view of the working of the projects they spread out the financial expectations over a longer period.

2. The Sectional Meeting of the World Power Conference held at Viena suggested that experience proved that rural electrification was a more promising field than was at first believed to be so. The experience in Mysore and Madras suggests that there is at present no need to educate the peasant regarding the benefits of electricity or to make special load promotional efforts. The study of the growth of load factor in our rural electrification projects proves that the rural load has increased beyond expectations, Besides, the individual rural load may not be high but the total load in the whole area accumulates to a substantial figure. But it is significant to note that actual agricultural load is only a small part of the total load. The Survey of the Damodar Valley project shows that the rural load will be hardly 10% of the total demand in the project. The experience in Madras, Mysore and U.P. showed that actual agricultural load was hardly 3%, 12% and 13% respectively in 1948. This shows that planning for non-agricultural load has to be made in rural areas. In the first period of planing it may not be difficult for the additional power being utilized but for successive period care has to be taken in advance.

whole scheme should be taken up as an integrated one so as to subsidise rural tariffs by higher rates on other uses of electricity. So far as the agency is concerned rural schemes will not be an attractive investment for private enterprise having profit motive. It will not make much progress in spreading electricity in villages. The government has to take the responsibility. They can take a long view so far as investment is concerned, and with them the problems of costs are also minimised. Reduction in costs is also to be attempted through technological improvements and administrative conveniences. Keeping in mind the security of service, the costs of construction, transmission, operation and maintenance should be reduced. And keeping in mind our conditions the start should first be made in selected areas which are relatively prosperous, where the load prospects are good, and with rates which the traffic will bear. The low rates are said to have contributed considerably to the success of the rural electrification in the TVA experiment.*

V. NEED FOR A CO-ORDINATED POLICY OF RESOURCE UTILIZATION.

In the study of resource utilization the unity, balance and harmony of the ecological complex must be appreciated. It is the universal process of action and reaction of man and his environment, or of the human community and the regional complex, that symbolizes itself in a distinctive genus of life in a given region. This genus of life is created, consolidated and maintained through subtle, complex,

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*For a detailed study of power one can refer to : Central Water and Power Commission : Planning for Power Development in India, 1951 ; Central Electricity Commission : Rural Electrification in India, 1948; NPC : Power and Fuel and River Training and Irrigation, 1947 : CWINC : Quinquennial Report April 1945 to March 1950, 1950 ; and the Five Year Plan.

manifold and ever ramifying relationships between human community on the one hand and the organic and the inorganic nature on the other, *i.e.*, through the binding of human culture with land, water, plants, animals, insects and climate, etc. It is termed as man's reactions to environmental stimuli, or man's adaptations to geographical milieu, or importing of man's meanings, symbols, designs, values, ideals and goals, or more popularly termed as man's struggle for a more satisfying way of life. The analysis of cultural complex shows that only those traits which develop in harmony with the physical aspect of nature, survive and accumulate as heritage for coming generations; and the history of civilizations shows that they were founded on and formed by Nature. They survived and continued so long as man worked in harmony with his environmental milieu. Therefore, to achieve and continue social progress the balance between the various resource patterns must be maintained.

The price which man has paid for creating a disequilibrium is rather heavy. The most eloquent testimony is furnished by the remains of the ancient civilizations of Egypt, Babylon, Greece, Rome, India, China and several other glorious culture areas in the world. These civilizations decayed and disappeared due to inadequate, indiscreet and indiscriminate manipulation and utilization of resources.* The decline of Chinese Civilization is explained in terms of soil erosion, the decay of Greek Civilization was due to inadequate resource potential, the fall of Rome is attributed to the declining rainfall and indiscreet resource manipulation, and the downfall of the Indus Valley Civilization is said to have been brought about by a combined effect of the shifting of river beds, decline of rainfall due to reckless denudation

*It is generally believed that civilizations die as a result of the conquest of a people by a more virile and intelligent race. But really speaking they die their own natural death.

of forests, encroachment of salinity from Kutch and the indiscriminate exploitation of vegetable resources resulting in the impoverishment of faunal forms. The neglect of man to maintain a balance in the ecological complex had its Nemises. The experience has been too costly, but it is doubtful whether man has yet learnt the lesson of a balanced resource utilization.

The earlier sociological speculations, though treated man as a part of nature, considered him in a deterministic fashion, and his efforts were regarded as extraneous forces rather than phases of ecological complex. Social progress was explained in terms of control over Nature. But now man is considered as a part and parcel of those interwoven relationships by which the regional balance is maintained, refined, shifted and broken. The pattern of life evolves as a complete whole. In many subtle ways and through intricate relationships man's designs, meanings, sensibilities, values, goals and ideals mix with land and water, plants and animals, and air and sunshine. Social progress is interpreted in terms of adaptations to geographical milieu or obeying Nature. Therefore, let us remember that culture will be sustained and progress will be maintained only so long as the regional balance is maintained through a highly imaginative and well coordinated policy of resource utilization.

Lastly it is, significant to note a few points: first, the inventive genius of nations tends to operate along the paths chaulked out by resource patterns.* The immense quantity

*The use of bones in the Arctic snow deserts, of stones in the regions of rugged relief, of wood in tropical forest areas and of shells in coastal fringes are a few basic examples. The paintings of Italy, sculpture of Greece, music of India, mumy cult of Egypt, ancestor worship of China and trade complex of Great Britain have similar explanations. Besides, the labour saving devices of the advanced machine civilization developed in thinly populated areas, and the coal and iron complex, highly developed banking and commerce and the efforts to subjugate agricultural people are the complexes of industrial-cum-commercial civilization.

and variety of our resources both in men and material are capable of creating and maintaining a highly advanced civilization provided the art, science and technology are applied to conserve the mobilized and mobilizable resources, and to utilize them in such a manner as to keep the natural balance intact. In this country of bounty and increment, as opposed to the regions of effort and lasting difficulty, the civilization must be primarily spiritual as opposed to essentially material. This should be taken as the basic policy of our efforts towards resource utilization. Secondly, the limits of development being reached to a larger extent in our thickly populated parts, the balanced resource-use demands a shifting of population to the thinly populated parts of the central regions of the country. The demarkations made for political and administrative conveniences act as an hinderance, and the recent demand of linguistic provinces will be a greater hinderance in a balanced resource utilization. Thirdly, the partition of the country and the creation of Pakistan has been a regional suicide. History has innumerable examples of such impositions of man. It has also many examples of Nature's correctives. But let us remember that these correctives are rather harsh and destructive. Let both the countries, therefore, be wiser in regard to the utilization of their resources. Lastly, we want to draw the attention of the Government of India and the State Governments concerned to the agricultural ruin which is taking place as a result of the development of the semi-desert conditions in Eastern Rajasthan, Western Uttar Pradesh, parts of Madhya Bharat and Parts of East Punjab. It is a creeping danger which, if allowed to have its own way, may repeat the history of the Indus Valley Civilization. The attention paid to it is too inadequate. Let the seriousness of it be fully realized.

APPENDIX A

Changes in the Sale Value of Land

By way of illustrating the changes in the sale value of land a few examples are given below.

(*a*) Uttar Pradesh : Agra district. (Value in terms of multiples of Net Profit.) (Rs. per acre.)

No.	Circle	1940	1945	
1.	City	34	40	Net profit is roughly calculated as 55-60% of rental value which varies according to soil, right in land and availability of water.
2.	Suburban	32	36	
3.	Dahar	32	36	
4.	Canal	31	32	
5.	Khadar	14	16	

(*b*) Madras : Chingleput District. (Average sale value per acre Rs.) Statistical Atlas of Madras Presidency, 1936, p. 493.

No.	Soils	1896-1900	1906-1910'	1916-1920'	1926-1930'
1.	Red loam (Tank & River fed)	132	234	325	368
2.	Red loam (Rain fed)	77	154	285	398
3.	Black loam (Tank & River fed)	353	415	486	548
4.	Black clay (Tank & River fed)	152	214	186	247
5.	Black sand (River fed)	170	152	410	485

(*c*) Madras. Different Districts. Average sale value per acre. Rs. (Dr. Sayana Readings in Rural Problems, p. 54.)

No,	District	1939		1945	
		Dry.	Wet.	Dry.	Wet,
1.	Vizgapatan	300	525	550	875
2.	W. Godawari	250	910	2,500	3,500
3,	Nellore	200	600	450	1,400
4.	Bellary	200	400	500	900

(*d*) Hydrabad : Nizamabad and Warangal Districts. Land value in Rs. per acre. (Rural Economic Enquiries in Hydrabad State, 1951, p. 123 ; Board of Eco. Enquiry, Hydrabad Govt.)

No.	Circles		1940	1949
1.	Hydrabad State. (Wet & Dry)		65	142
2.	Nizamabad.	Dry.	37	140
		Wet,	86	307
3.	Warangal.	Dry.	39	120
		Wet.	81	448

APPENDIX B

The Community Concept

Historically Considered the community Concept has evolved from a simple to a complex one. Originally the word Community designated a geographical area with definite legal boundaries occupied by residents engaged in inter-related economic activities, and constituting a politically self-governing unit. Thus hamlets, villages, towns and cities were considered to be communities, and were thought of parts or fragments of large social units like countries, states and nations. The conception of community was primarily derived from ideas of structure, a geographical area, a system of inter-related economic institutions, and an independent framework of government. The newer conception of community, on the other hand, is derived principally from ideas of process. The conceptual evolution came as a consequence of general social change by which

communities were significantly influenced, and is a result of the introduction of newer disciplines specially those derived from psychology, into the thought of social scientists. Taking its explicit elements, community is any consciously organized aggregation of individuals residing in a specified area or locality, endowed with limited political autonomy, supporting some primary institutions among whom certain degree of interdependence is found; and taking its implicit elements, it is a process of social interaction which gives rise to a more intensive or more extensive attitude and practice of interdependence, cooperation, colleboration and unification.

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INDEX.

Adalat, panchayati, 152-157
Aereboe, F, 88
Afforestation, 234, 269
Agricultural activity, nature of, 26–29
— Community, (see community)
— Economics, 1-11, 32
— Economy, 36, 39, 63
— Environment, 32,–36
— Fundamentalism, 12-17
— Hazards, 39
— Life, 22, 33, 66 (also see farm life)
— Output, 29-32 (see production)
Agriculture, as subsidiary occupation, 83-84 ; for town dwellers, 82-83 ; social environment of, 114-118
Akbar, 162, 177/a
Alchohol, 316
Alkali, 255, 257, 309
Alluvial, 266, 268, 285, 300, 304, 305
American Civil War, 131
Anantvarman, 277
Anstay, V., 115
Appraisal, 85, 86, 91, 203
— Process, 85–86
Arid, 255, 285
Artisan, 104, 109, 112, 131
Arya, 97, 98
Aurangzeb, 163
Avata, 275
Babylonian, 177/a, 270, 275, 348
Badarian, 184
Bakhar, 258
Bari, 257
Barker, 12
Barsodi, 12
Bennett, 218, 230
Bhagirath, 276
Bhaskara, 277
Bluffs, 266
Board, Advisory Planning, 298 ;
Agriculture and Animal Husbandry, 256; Central Technical Power, 324
Bombay Plan, 23
Brand, K., 14, 90
Briggs, 134
Brihaspati, 276
Brook, N., 182/a
Business, selection of farm, 78-79
Campbell, 182/a,
Canal, 275. 278, 279, 286, 292, 293, 301, 302, 304, 330
Capacity, 43
Capitalization, 86, 87, 90
Caste, 115, 119
Cato, 10
C T. O., 261
CWINC, 295, 296, 301, 304, 324
Ceremonies, Social, 116
Chalisa, 163
Chandragupta, 177/a
Chew, P., 14
Civilizaiion, 17, 35, 36, 38, 39, 122, 138, 204, 245, 268, 348, 350 ;
Industrial– cum– commercial, 125
Coal, 316–319
Cobweb, 141
Colonization, 262, 279

Commercialization, 117
Commission, Agricultural, 108, 240, 252, 280
—Central Electricity, 324
—Central Water & Power, 319, 321, 324, 333, 339, 345
—Famine Enquiry, 282, 300
—Indian Famine, 166, 170, 171, 185, 280
—Industrial, 251, 323
—Irrigation, 273, 280, 296, 298, 302
—Lyall, 186
—Mac Donnell, 186
—Planning, 24, 234, 239, 251, 252, 261, 299, 309, 311, 334
Committee, Coalfiels, 316, 318
—Food Grain's Policy, 259
—Fooder & Grazing, 259
—National Income, 17, 20
—River Training & Irrg. 274
—Soil Conservation, 251
—Usar Land Reclamation, 257
Community, agricultural, 6, 7, 9, 21, 22, 33, 37 ; farm, 33; disintegration of village, 101-108, self-sufficient village, 102, 104, 106; village, 96–108, 183, 301 ; human, 347, 348; underdeveloped, 23
—enterprise, 272, 297
—interest, 7
—ownership, 101-102
Gompany, E. I., 163
Conservation, 236-238, 244-246
Cultivation, intensity of, 5_-56; shifting, 96, 137, 227
Cultural Complex, 348
Curzon, 186
Customary Law, 108
Dalhousie, 130, 134, 249
Dams, 275, 276, 277, 282
Daubeny, 10
Davis, J. S., 13
Decentralized, 146
Deciduous, 241
Deforestation, 158, 227, 245, 252
Delafosse, 181
Deluge, 266
Diminishing Return, Law of, 27, 44–52, 56
Dipterocarps, 241
Distribution, occupational, 42, 128, 129
Divided, National, 7
Dose, marginal, 48
Double-cropped, 290
Drainage, 300 (also see underground)
Dravidians, 97, 98
Dredging, 266, 270
Earthflow, 219, 223
Ecological, 41, 245
— Complex, 347, 349
Economic activity, regional distribution of, 145-147 ;
— Backwardness, 36
— Efficiency, 43
— Evolution 118, 128
— Forces, 129, 137
— Institutions, 119, 120, 125
— progress, 123, 145
— Motive, 7
— Transition (see transition)
Economics, 4-5, 9, (also see land, labour and agricultural)

Economising, 5, 7, 9
Economy, agricultural, 36, 39, 63, 126 ; Deficit, 35 ; Price, 4 ; Money, 129, 132; Surplus, 73 ; Self contained, 15, 38, 110 ; Welfare, 4;
Egyptians, 270, 275, 348
Elphinston, 102
Electricity, 316, 319; development of, 322-326, 329, 330, 332, 346; future development of, 333-340 ; Present position of, 326–333 ;
Electrification, rural, 340-347
Enviroument, 35, 36, 51, 107, 121, 143, 146, 147, 202, 206 agricultural, 32-36; geographical. 36; physical, 36, 201; social, 114-118, 119, 122, 123; relationship between social and economic, 118. 123
Epharmological, 41
Equilibrium, 205, 218, 245
Erosion, 216-219, 348; causes of, 226-228; effects of, 228-231; extent of, 231–234 ; geological, 216; types and forms of, 219-226
Etiological, 41
Euphrates, 177/a
Extension, agricultural, 258-264
Fallow, 212, 213, 214-215
Famine, 158, 173, 279, 280 ; Bengal, 169-172, 173; causes of, 158-160; concept of modern, 175; history of, 160-172; nature of, 175-176;
—Code, 188
—Compaign, 189-192
—Insurance grant, 280
—Relief, 178/a, 179/a-189, 280
Farm, selecting the, 79-82 ; classification of, 57; types of, 57-62
— Community, 33
— Life, 66, 137
— Practices, 73, 137
— Production, 63; variation in, 39
— Management, 3, 10
Farming, advantages of 65-66 ; as an occupation, 62-66, 77-78; choice of, 6, 77-79; diversified, 59, 67-68, 70-72, 73 ; collective, 60 ; commercial, 59, 137 ; co-operative, 60, corporate, 60 ; family, 62; joint, 60 ; mixed, 59, 74-77 ; owner, 61 ; State, 60 ; subsistence, 59, 73, 104 ; Tenant, 61 ; specialized, 58, 67-70, 137
Ferozshah, 163
Flood, 266-271, 293; causes of 267-268; control of, 268-270 307
—irrigation, 305
—level 292
—ways 265
F.A.O., 8, 14
Forces, modern economic, 129 137; sociological, 5
Forests, 234, 235, 237-240, 316, 349; types of, 240 243; utility of, 243-244
Ganges, 277, 279
Ganga, 276
Gaon Sabha, 148-150
Geographical milieu, 202, 348, 349

Geological Survey, 317
Ghats, 167, 179, 232, 241, 321
Gilboa, 177/a
Girnar, 276
Granulation, 227
Gravitational, 227
Gravity, 226, 319, 320
Gray, 3
Greeks, 177/a
Grid, 339
G. M. F. C., 282, 286
Growth, 42, 147
Gully, 219, 221, 228, 231, 232, 233
Gypsum, 257
Handicrafts, 142
Harappa, 184
Harijan, 33
Hass, G. C.. 89
Hastings, 164
Heitland, 10
Hibbard, 3
Himalayas, 231, 232, 240, 241, 242, 321
Hindu Law, 98, 108
Hopi, 184
Howard, 3
Humid, 255, 285
—region, 225, 285, 300
Humous, 216
Humphries, 12, 13
Hydraulic, 276, 278, 321
Hydro-electric, 320, 321, 323 ;
—plant, 320, 322
—project, 321
—stations, 322, 327, 328, 330, 338
Hydrological, 321
Ibn Batuta, 162
Incas, 177/a
Income, capitalization of, 86 ; variation in farm, 27 ; national, 7 ;
—approach, 87
Indian Electricity Act, 323
Individualism, 132
Indravarman, 277
Indus Valley Civilization, 348, 350
Industrial Revolution, 12, 37, 108, 122, 127
Institutions, economic, 119, 120, 125 ; social, 114-125
Intensity, optimum degree of, 55
Inventary, physical, 85
Irrigation, 138, 271-272, 281, 286 ; importapce of 272-275 ; extent of 283-290 ; extension of 300-315 ; history of, 275-283 ; methods and practices of, 290-295
Isolation. 106, 110, 111, 112, 113-114, 118, 136, 140
Job-opportunity, 34, 121
Joint cultivation, 138
—family, 115, 119, 120
—products, 29
—village, 99-100
Jouzier, 1
Kallar, 257
Kans, 258
Kautalya, 276
Khadar, 261
Kharif, 288
Kikar, 240
Kolarians, 97, 98
Kulya, 276
Kunda, 276
Kupa, 276
Labour Economics, 9
Land, 40, 46, 52, 93 (also see virgin and marginal) ; importance of, 39–44; pro-

ductivity of, 43–44 ; value of, 43 ; utilization of, 211-214
—classification, 211-214
—economics, 8, 9
—hunger, 32
—reform, 33
Lawrence, 166, 182/a
Leaching, 237, 258
Leavee, 270
Life, corporate, 102, 107 ; charge in rural, 132-140 ; community, 96-111, 146 ; farm, 66, 137, 139
Linguistic Provinces, 350
Location, 43, 81
Localization, 135
Lyall, J., 186
Malthusian, 178
Management, farm, 3, 10
—Forest, 253
—River, 265–266
—Soil, 236
Manor, 105
Manu, 99
Manusmriti, 276
Maori, 184
Margin, 48, 49, 249
Marginal dose, 48
—Land, 48, 49
—Productivity, 48
—Return, 44, 45, 47, 49, 51
Marshall, 3, 4, 45
Mears, J. W., 323
Metcalfe, C., 103
Migration, 120, 181, 182
Milieu, (See Geographical milieu).
Millet, 288
Mir, 105
Mobility, (see social mobility)
Mohinjodaro, 184
Monsoon, 159, 173, 241, 274, 289, 290
Moqui, 184
Moreland, 115, 179/a
Morse, T. D., 87
Motive, (see economic motive)
Movement, 140–141 ; mass, 219, 202 ; social, 140
Mudflows, 219, 223
Multipurpose, 322
—Projects, 334
Nala, 276
Nalika, 276
Nandivarman, 276
Narad, 276
National Income Committee, 17.
NPC, 234, 239, 296, 298, 300, 301, 304, 315, 319, 320, 333
Nautor, 235
Navigation, 229, 266, 281, 307, 309
Nazul, 149
Nika, 276
Novgorod, 161
Occupation, choice of, 109 ; primary, 41 ; secondary, 41 ; tertiary, 41
Occupational distribution, 42, 128, 129
—Groups, 109
Optimum, 43, 236
Organism, 147
Organization, economic, 127
Overgrazing, 227
Padmakara, 276
Pakistan, 330, 350
Plestine, 177/a

Pallava, 277
Panchayat, 148–157, 235, 242
Panchayati addat, 152–157
Parantaka, 277
Parda, 116
Pastoral, 96, 97
Peasant proprietorship, 61
Petrie, 181
Phoenicia, 177/*a*
Pine, 242
Plan, Five Year, 234, 237, 261, 281, 299, 312, 340
Planation, 216, 227
Poor house 189
Potential, coal, 318; power, 338; resource, 295; water, 294–295, 321
—Quantum, 296, 297
Powell, Baden, 100
Power, sources of, 315–322
Pranali, 276
Prap, 276
Price, agricultural, 133, 135, 139
Production, quality of agricultural, 31; trend of agricultural, 34; (see also farm production)
—Function, 141
Productive works, 293, 294
Productivity, 43, 44, 93; marginal, 48; law of varying, 45
Progress, 145–147; modern economic, 123, 145; social, 349
Protective, works, 293, 294
Public utility, 325, 329
Rabi, 288
Raiffeisen, 183
Ravines, 232, 235, 246, 258
Reclamation, 237, 255–258
Region, humid, 225, 285, 300; tropical, 160
Regional complex, 347
—System, 322
Relationship, economic, 127; human, 142–145
Relief, (see famine relief)
—Work, 178/*a*
Relativity, resource, 204
Reservoir, 269, 276, 282, 304, 305; underground, 295
Resources, dorment, 34; importance of, 41; classification of, 211; natural, 201–210, 281; shifting of, 38; coordination of, 347–350; water and power, 315–347
—Assessment, 201–206
—Appraisal, 203
—Utilization, 265–350
Return (see diminising return)
Rill, 219, 220–221, 228
River training, 265–266
Robbins, 5
Robertson, 246
Rock weathering, 216
Royal Institute of International Affairs, 14
Rudradaman, 276
Rural democracy, 33, 136
—Electrification, 340–347
Run off, 221, 226, 269, 296
Sales approach, 87
Sarpanch, 153
Sarsi, 276
Schultz, T. W., 14
Severalty villages, 99, 100
Seismic, 231
Semi-arid, 255, 274, 285, 350
Shahjahan, 162, 177/*a*, 278
Share-cropping, 61

Shelter-belt, 234
Smith, B., 181/*a*
Silviculture, 253
Sleeman, 177/*a*
Slippage, 219, 221, 224
Slumping. 219
Social groups, 109
—Mobility, 111
—Movement, 140
—Scale, 111
—Welfare, 5, 8
Society, rural, 111—114 ; urban, 113–114
Sociological forces, 5
Sociologist, 117
Soil conservation, 236, 237
—Exhaustion, 74
Solifluction, 219, 223
Specialization, 50, 73, 111, 117, 129, 135, 136
Standardization. 31
Storage, 269, 270, 272, 278, 296, 301, 302 ; underground, 302
—Works, 293
Strachey, R., 182/*a*, 184/*a*
Sub-marginal, 230, 237, 254, 262
Subsidence, 219, 224
Sub-soil supply, 295
Subsistence, 137, 138
System, medieval economic, 126—128 ; modern economic, 127–129 ; social, 125
Tala, 276
Tataka. 276
Tank, 276, 277, 278, 286, 293
Taylor, 2
Technology, 41, 51, 56
Temple, 246
Terracettes, 219, 224
Thar, 229
Thermal power, 318, 319, 330, 331
—Station, 320, 322, 328
Tidal, 268, 270, 271
Tigris, 177/*a*
Time lag, 30, 31
Tolley, H. R., 14
Transition, 130, 134, 136, 140—142 ; beginning of, 130–132 ; economic, 125–130 ; forces of, 130–132
Tropical, 241
Tube-well, 281, 286, 293, 304, 330, 343, 344
Under cultivation, 45, 53, 116
Under developed countries, 40, 144, 160
Underground drainage, 300, 308
—Storage, 302
—Supply, 296, 298, 301, 303
—Water 304
Unemployment, seasonal, 21
Urban community, 22
—Society, 113–114
Utilization, 34, 203, 205, 206, 207, 296 ; land, 211–214 ; water, 266 (see also resource utilization)
Urbanization, 143, 144
Unproductive works, 294
Usar, 257, 258
Valuation, 85, 91 ; methods of, 86—91
Value, economic, 139 ; capitalized, 87 ; human, 119, increase in land, 94-95 ; philosophical, 140 ; sale, 89—91 ; social, 111 ; theories of land, 91—94 ;
Village, 35, 96–111, 142–144, 163, 235 (also see joint and

severalty village); present organization of, 108–111 ; types of, 99–101 ; origin of, 96–98 ; self-sufficing, 110–111
—Handicrafts, 142
Vapi, 276
Varro, 10
Vedas, 275
Velocity, 221, 227, 233, 244
Virgin land, 52, 216
Virnarayan, 277
Voelcker, 240
Wadai, 181
Wadia, 115
Wants, 5, 6, 203
Water potential, 294–295
—Power, 319-322
—Resources, 294–300
—Logging, 236, 258, 308, 342
—Table, 244, 287, 304
—Ways, 229, 265
Wells, 275, 286, 293, 302
Weir, 305
Wilcox, 14
Wilson, 12
Xenophon, 10
Zones, electric development, 327-333

CORRECTION SLIP.

On page	Line	In place of	Read
30	2	crop	crops
34	Last column of table	capital	capita
40	21	geographical	geological
46	6	continuosly	continuously
63	2	asindustrial	as industrial
63	3	mark of asterisk	(to be deleted)
74	13	greaterem	greater em-
75	last	warriner	Warriner
83	20	In can	It can
84	17	or	of
84	table	warking	working
,,	item three	laour	labour
,,	foot-note, last line	Agr. & Co.	Agr. Eco.
105	2	buller	fuller
136	18	reitalization	revitalization
144	last line	phazes	phases
180	20	innature	in nat
185	20	mil.	mill.
189	19, 20. 25, 26	compaign	campaign
190	6	oreparations	preparation
207	voat note	Pezler	Pelzer
213	last	243,...	243,025
243	last line in table	70%	72%
261	29 and 31	mil.	mill.
262	8	,,	,,
286	4	banks	tanks
299	13	irrigrtion	irrigation
304	4	puming	pumping
305	13	apportunities	opportunities
,,	foot-note last line	henec	hence
306	last	are a	area
307	foot-note, first line	soundress	soundness
307	foot-not, last line	worldhead	woodhead
308	foot-note, line 1	N C P.	NPC.
310	foot-note, line 16	rustly	rusty
311	last	nation-widle	nation-wide
,,	foot-note, line 4	holdlngs	holdings
316	14	alchohol	olcohol
,,	25	electrict	electric
319	foot-note 2, line 8	posses	possess
320	24	primite	prime
322	15	over all	overall
324	11	tham	them
325	last but one	intalled	installed
329	7	areas	area
334	second para, lin	mul-tipurpose	multi-purpose
336	table, under U. P.	easternarea	eastern area
343	31	electrifiaction	electrification
346	foot-note 2, line 15	planing	planning

Besides, the number of pages on the form No. 24 have been repeated as on No. 23. The former should be treated as 177/*a*, 178/*a*, 179/*a*, 180/*a*, 181/*a*, 182/*a*, 183/*a* and 184/*a*. The gap is further made up from form No. 26.