Chapter IX
PLANNING THE LAND USE

Some basic principles of Land Use Planning

The idea of land use planning is to secure the best possible use of the land resources and to avoid their misuse, since the land is a heritage which cannot be created by man and in whose use it is easier to make mistakes than to rectify them.** It is, in essence, the determination of the optimum use of every acre of land. But optimum use must change from time to time so that any land use planning must be capable of being adapted to changing conditions.**

When planning land use provision must be made for a foreseeable future for the satisfaction of the basic needs of work, food, clothing, housing, roads, recreation, social congregation, festivals, prayers, bathing and cremation ghats, graveyards, etc.

Work means agriculture, industry, commerce, and various services. Agriculture is concerned with the arable land, while most other requirements are concerned with the non-arable land. An essential use of land is also for the administrative services, since it would be impossible to enjoy the fruits of the land planning without a good administration, which alone can enforce a feeling of security that is necessary to carry on regular day to day activities and to put the land plan into effect.

Much of the land should serve more than one use, e.g., forestry, animal rearing, sporting and recreation can go side by side. Even a green wedge used for agricultural purposes may provide open air in the heart of a town*. The land must be so used as to satisfy the multiple needs of the community as a whole and not for the advantage of the favoured few. Personal initiative must be respected but planning should create greater opportunities for the people and make them more intelligent to act better in their personal as well as national interests. Planning becomes necessary where there are problems and it starts with the study of the existing problems.

From the analysis of the problems of land use in the Koradabad district it has been seen that there are three main categories of these problems, viz.,

1. Problems related to the physical setting.
2. Problems of agrarian structure.
3. Problems connected with the inefficiency of land use.

Thus, land use planning in this district will be concerned with solving these problems as far as possible. No land planning can, however, be carried out in the district, in isolation, since it is the state which formulates laws and regulations governing the land policies and land use in all districts within its jurisdiction. The state itself acts under the

directions of the sovereign parliament which determines policies in the country as a whole.

As noted in the foregoing land in this district is held in family holdings and it is the family needs and the family brains which determine how the land is used from time to time. Various families living in a village are mutually connected by bonds of relationship, friendship or neighbourhood. Generally they use their land holdings in the traditional ways, but they are also influenced by the suggestions or advice or practices adopted by their relatives, friends or neighbours. Thus, arises a similarity in the patterns of land use in various holdings in the same village, though physical factors such as soil texture, soil moisture, etc., tend to create differences. Various villages adopt similar land use practices within a geographical micro-region, owing to identical physical and socio-economic conditions. In a macro-region, a broader similarity is noticeable due to the same reasons. Hence, land use planning to be effective in the conditions available in this district must be carried out at the following levels:

(a) The family level,
(b) The village level,
(c) The micro-regional level or block level,
(d) The district level,
(e) The macro-regional level,
(f) The state level and
(g) The national level.
Attempts at Land Planning Up to date

The recurrent famines of the eighteenth century had set the intelligent people as well as the government on thinking about the agricultural problems. With the growth of cities and industries, resulting in congestion and slum conditions, their attention was also drawn towards land problems of larger settlements. Some social workers stressed the need of developing roads, railways, canals and other types of non-arable land use and focussed greater attention on the land and its problems. Political issues also got involved in this thinking so that the first major change demanded and planned was in regard to the problems of agrarian structure. We have already noted the various steps taken to get released the land from the shackles of the zamindari system and to raise the status of tenants. But, these land reform measures have resulted in the creation of a large number of small and scattered land holdings held by peasants with no capital to invest on land improvement. The consolidation of holdings has been started to remove their scatteredness. But, it cannot make the farm units economic. Hence, the feeling has grown that some system of cooperative farming must be adopted and a provision for the same has already been made in the laws of the land.

After the separation of Burma (in April, 1937), which used to supply rice, and the entry of Japan into the Second World War, resulting in cutting off all foreign supply of foodgrains, there occurred, in 1943, an acute food problem for the country as a whole. The famine of Bengal, in that year in
particular, focussed the attention of the nation on the need for an action, on a national scale, to deal with the problem of food shortage. The partition of the country in 1947, further accentuated the situation as it cut off the surplus food areas of Sind and West Panjab. At the same time, when the food position was worsening, the population was increasing at an alarming rate. As a result, the food consumption went very much below the minimum standards of nutrition. Thus, the food problem came to be regarded as *a problem of bringing about such a large expansion of agricultural production as will assure to an increasing population progressively rising levels of nutrition.*

Grow More Food Campaign

The first major step taken in the direction of solving this problem was the initiation of the Grow More Food Campaign, which initially aimed at growing more food by switching over from cash crops, mainly from short staple cotton to food crops, by intensive cultivation of cultivated lands and by bringing under plough fallow and waste lands.** But, soon after the partition an acute shortage of cotton and jute was also felt in the country. Hence, a policy of increasing production of these articles along with foodgrains was announced in June 1950, and this programme also envisaged diversion of area from foodgrains to these crops to a considerable extent. Later on schemes relating to fisheries, livestock, subsidiary foods, crop competitions, granting of loans and subsidies to the cultivators for

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** Ibid. p.9.
various purposes etc., were added. But, 1951-52, was the last year of the Grow More Food Campaign and the first year of the First Five Year Plan prepared by the Planning Commission of the Government of India. Simultaneously, projects under the Indo-U.S Technical cooperation and the Ford Foundation Schemes were initiated, among which the most important were the community development and the tube-well construction programmes.

The Grow More Food Campaign had failed to achieve its declared aims owing to various shortcomings, the most glaring among which was the fact that "it was not realized that all aspects of village life are inter-related and improvements could not be split up into a number of detached programmes operating independently. The whole campaign was organised on a temporary basis; its execution was entrusted to staffs hurriedly got together under difficult conditions, each set responsible for a different programme. The coordination between the permanent state agricultural and other development departments and the regular state administration was imperfect, except possibly in a few areas. Unity of effort was thus impaired".**

The Five Year Plans

With the initiation of the community development programme, the government accepted the policy of an integrated rural development as the basis for increased production in the agricultural field. The first Five Year Plan started with a great

* Ibid. p.11.
** Ibid. p.42.
emphasis on agricultural and community development programmes. In the Second Five Year Plan, the emphasis on the community development and National Extension Schemes (N.E.S) was further increased. Another step with regard to agricultural planning was taken when the Central Ministry of Food and Agriculture put forward proposals for fixing reasonable minimum prices for important agricultural commodities and the government issued a Press Note (on 14th June, 1957) assuring the agriculturists that the prices of foodgrains and other agricultural commodities would not be allowed to fall below economic levels.

For the purpose of the N.E.S. the Moradabad district has been divided into a number of blocks (Fig. 61). The phased progress of these blocks is given in the appendix table XXXVIII. The work of these blocks includes the distribution of fertilizers, seeds and agricultural implements, holding of agricultural demonstrations, digging of compost pits, reclamation of land, construction and repair of wells and tanks, installing of pumping sets and undertaking of small irrigation schemes, starting

* But, very soon there grew a feeling that unless agricultural production was given the highest priority in these schemes, it would not be possible to achieve the higher targets of that production. The sixth development commissioners' conference (in April, 1957), therefore, recommended that a break-up of additional production targets should be made for each N.E.S. block and that each village should have an agricultural plan. Vide, Govt. of India, Report of the Foodgrains Enquiry Committee, 1957, Ministry of Food & Agriculture (Deptt. of Food), p.33-34.

** Ibid, p.34-35.

The increasing use of chemical fertilizers results in increasing yields and much emphasis is being laid on their use. Great care is necessary in the use of chemical fertilizers. Before their application, the soil requirements of the various areas should be ascertained by means of soil surveys, a practice commonly followed in Japan. Vide Govt. of India, Agriculture in India, Publications Division, 1950, p.23 and Kumarappa, J.C. Op.cit. pp.17.
of key villages, artificial insemination centres, castrating bulls, supplying pedigree bulls, construction and repair of village roads, soaking pits, rural latrines, drains and drinking water wells, starting of schools, adult education centres, recreation centres, etc. The multipurpose Village Level Worker (V.L.W.) is the backbone of these schemes. His beat is a Nayana Panchavat consisting of about 10 villages.

There is no provision in the Plan* for the survey of the existing conditions in various parts of the district nor it is based on any such previous surveys. It does not take note of the regional differentiations of soil, moisture and other conditions prevailing in various parts of the district and lays little emphasis on the particular local problems. Owing to the lack of any specific information about the field of his work the V.L.W. can carry only vague and generalised ideas to the people.

SUGGESTIONS FOR PLANNING THE LAND USE

There cannot be two opinions about the fact that any planning programme to be successful must start from the survey of local conditions both physical and cultural. Secondly, it must create local enthusiasm for the development schemes and promote local leadership for their achievement. The inhabitants of the area must be taken into confidence from the very start. Thirdly, when the felt problems and needs of an area are known the immediate action should be concerned with them only. Fourthly, all governmental machinery should be so geared as to act for the

* A brief sketch of the Second Five Year Plan for the district is given in the appendix IV for reference.
welfare of the community. Only good trends in the local cultural conditions can be exploited to achieve the development programmes. New ideas are not so easily imbibed by the people without the ruthlessness credited to the totalitarian states. What the U.S.S.R or Communist China have achieved in their agrarian field may be very alluring but that would require a total change over from a democracy to socialist dictatorship. Failing that land planning must take a course from below upwards. Research is the basis of all modern development in agriculture as elsewhere. It has three aspects; first, knowledge has to be acquired; secondly, it has to be tested under field conditions; and thirdly, it has to be put to use for land improvement. The ordinary

* By way of comparison if we look at the machinery set up for the execution of the British Town and Country Planning Act,1947, we find that, there, the planning is carried out at three planes: the National plane, the Regional plane and the Local plane. At the local plane the county councils and county borough councils are entrusted with the responsibility of the preparation of plans and their administration. At the regional plane, there are three technical sections - Research, Planning and Estate Management. The first step in the preparation of a plan is the carrying out of a survey of the area. It covers the physical features of the area, water-supply, soil fertility, minerals, growth of population, industries, housing, open spaces, public buildings, means of communication, etc. The survey is expected to present a reliable and detailed analysis of the community from every aspect, and an estimate of its future growth and needs. It needs the cooperative effort of geographers, economists, sociologists, ground water engineers, soil scientists, agronomists and other professions to secure the knowledge of all facts about the area, including the characteristics and wishes of the people. It thus becomes a complete inventory of existing physical, economic and sociological conditions- the starting point for the analysis of the potentialities and future requirements of the area. There is a great emphasis on maps and tables. On the basis of the information gathered in the survey and of an analysis and interpretation of those facts, the local planning authority prepares and executes a development plan. The function of the research section is the collation and processing of information pertinent to concrete planning proposals of all sorts put forward either by a national department, a local authority or some private individual. Vide Haar Charles M., Land Planning in a Free Society, Harvard University Press, Cambridge, 1951, pp.11-55.
bureaucratic machinery is not suited to the requirements of the planning and development programmes. It must be subordinated to the functions of the researcher and the planner. Hence, actually the M.E.S. should be manned by experts of the various aspects of land use planning and converted into a coordinated research cum planning service, while each group of more or less homogeneous villages, i.e., a geographical micro-region should form the basis of administration.

Planning Land Use at the Family and Village Levels

For planning efficient land use there are two alternatives:

(a) Planning land use in family holdings,
(b) Planning land use in cooperative farms.

The small land owners, are unable to use their land efficiently due to a number of factors. The first concern of the land planning, therefore, becomes the determination of the size and nature of land holding which can be run efficiently by these peasants and of the suitable type of farming for the same. Other main problems of these peasants are lack of capital, ignorance of new techniques and, above all, lack of an independent means of water supply, by which is meant the Persian wheel. Owing to the want of a dependable and cheap means of irrigation these peasants cannot plan to undertake a scheme of intensive and continuous cultivation. The state tube wells and canals cannot encourage that type of cultivation since the water supply cannot be depended upon when it is needed simultaneously in the whole area. With a view to ascertaining the felt needs of the peasants, the writer interviewed a large number of them in various parts of the district. The remarks here are based on the same investigation.
area commanded by them. Moreover, they are expensive means of irrigation and wasteful of water in many ways. The more profitable market garden produce needs only a light and limited water supply which is possible only through the Persian wheels independently owned by each land holder.

Given this means of irrigation (costing about Rs.2,500/- to 3,500/- at the present prices), suitable crop rotations can be evolved to provide all year round work for the whole family of the peasant and to increase the farm income considerably. As at present, from March to July the arable land remains in dry summer fallow. But, when irrigation facilities are dependable melons, forage crops, vegetables, onions, etc., may be raised in that period. Following are two examples of all year round crop rotations which may then prove to be much more profitable to the small peasants than their foodgrain farming:

**Example I:** Maize sown in early July and harvested in September; followed by potatoes in the rabi, harvested in March; followed by onions in the zaid, harvested in June.

**Example II:** Green manure sanai, dhaincha or guar sown in early July and ploughed in, in August-September, and followed by wheat in the rabi and zaid crops in the dry summer season.

Suitable crop mixtures or inter-cultures can be developed to get a variety of produce from the same fields in various seasons. Thus wheat, gram, peas, sugarcane, linseed, rapeseed, mustard, etc., can be inter-cultured in rows, all sown in late October. Whereas the rabi crops will be harvested in March-April, sugarcane will occupy the fields throughout the
summer season and would be ready for cutting in the next autumn. By and by as it is cut, its fertilized fields can be devoted to potatoes, wheat, barley, peas, lentil, oats, vegetables or anything pertaining to the winter and early summer harvests. Cotton can also be adjusted in any of these crop rotations and crop mixtures. In addition crops such as sann-hemp, castor, papaya, mul-berry, guava, banana etc., can be grown on the margins of the fields. It would add to the beauty of the landscape besides yielding sources of cash earnings and balancing diets for the farmer's family.

The next profitable practice can be to take sugarcane alone planted in autumn. It has yielded Rs.203.53 per acre more than the spring cane alone. But in this case the cultivator loses a rabi crop which might be so essential for feeding the family and livestock both. Thus, the third choice of taking inter-cropped autumn cane with gram, though slightly less profitable, becomes better than all other practices. It has yielded Rs.174.76 more per acre than the spring cane alone. These facts are clear from the figures below:

<table>
<thead>
<tr>
<th>Practice</th>
<th>Gain or loss</th>
<th>Average yield</th>
<th>Price of cane</th>
<th>Price of gram</th>
<th>Ad valorem</th>
<th>Profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sugar cane alone</td>
<td>414.0</td>
<td>20.0</td>
<td>240.0</td>
<td>50.0</td>
<td>120.0</td>
<td>203.53</td>
</tr>
<tr>
<td>Sugar cane with gram</td>
<td>463.0</td>
<td>nil</td>
<td>213.53</td>
<td>nil</td>
<td>10.0</td>
<td>203.53</td>
</tr>
</tbody>
</table>

The economics has been calculated on the basis of spring cane alone as control.

Courtesy Agronomist, Sugarcane Research Station, Muzaffarnagar.
It is a way in which the independent entity of a land-owner, depending on his own initiative, enterprising spirit and family cooperation can be maintained. If the peasant has a persian wheel of his own, he can manage to pursue this type of intensive cultivation. He can improve his standard of living as well as produce surplus for the non-agricultural population provided an initial capital or credit facilities for investment on fertilizers, better seeds, better implements, better livestock and the know-how about new techniques of improving crop yields and proper soil management are available. Arrangements are also necessary to ensure regular supply of the means of production as well as daily necessities of life. Most of these things can, of course, be achieved conveniently through the organization of credit, supply and marketing societies financed jointly by the government and the people and their pattern may be adapted from Japan or other countries. The K.K.S. can furnish the know-how.

Potential Yields.

(A) Evidence of crop competitions: That the low average yields in this district are not due to any unsurmountable phenomena is borne out by the fact that many individual farmers from various parts of the district have in these years, raised very high yields for the crop competitions organized at the district and state levels as shown in table XXXIX. In the year 1956 to which the enquiries of the carrying capacity pertain, the winner of the first wheat award in the district competition produced 1404 kg. wheat per acre; that of the first paddy prize
raised 1951 kg. paddy per acre. In the year 1959 the first wheat prize was won by the producer of 1863 kg. of wheat per acre. In the case of paddy, the competition output had been much higher in 1957 when the first prize was awarded for the yield of 2,138 kg. per acre. The average of the first prize yields for the years 1955-59 is 1918.1 kg. for paddy and 1594.6 kg. for wheat.

(B) Evidence of crop-cutting trials: Recently, some crop cutting trials have been carried out in the N.E.S. Block areas under the regulations of the National Sample Survey, Delhi. These trials were started from the Kharif of 1959-60. The results of these trials in the Joya Block have been summarized in table XE. It shows that the average yield is 280 kg. per acre of unirrigated paddy while it is 667 kg., per acre of irrigated paddy. In the former case the trials were very few so that much reliance cannot be placed on this average, though this figure comes quite near to the average rice yield obtained by the writer by door to door enquiries in the sample villages where all the paddy has been unirrigated.

These crop cutting trials have shown:

1. That irrigated rice yields better though its range has been from 351 kg. per acre to 966 kg. per acre.

* Courtesy District Agricultural Officer, Moradabad.
** In 1949-50, the Government of India entrusted to the Indian Council of Agricultural Research, the task of conducting independent surveys for the verification of additional production by cutting (of crops) experiments on cultivators' fields. Vide Govt. of India, Report of the Grow More Food Enquiry Committee, Ministry of Food & Agriculture, June 1952, p.16.
ii. That the local seed has yielded the highest.
The improved seed of T-21 variety has been used in fair cases of paddy sowing but its maximum yield has been 710 kg. per acre. The yield of the local seeds has exceeded this figure in six out of the 16 trials.

iii. That the method of sowing appears to influence the yield. Thus in five out of the six high yielding trials the crop was trans-planted. In the sixth case (759 kg.), it was line sown behind the plough like most of other trials. No comparison can, however, be made with the broadcast rice since only one trial belonged to that category and it showed fairly good yields (594 kg.)

iv. That the fertilized crop yields better. The minimum yield in the case of any manured or fertilized trial has been 313 kg. in the case of unirrigated crop and 351 kg. in that of the irrigated crop while the unirrigated and unmanured paddy had the minimum yield of 246 kg. In the case of unmanured but irrigated crop improved variety T-21 has yielded better (675 kg.) than the local seed.

As regards the variety of manures, the maximum yield (986 kg.), was obtained from the trial where 120 mds. of farm yard manure per acre was applied. The maximum yield obtained by applying Ammonium Sulphate was 930 Kg. in the two cases but in most cases it remained medium.

The loss due to unfavourable weather and pests has been assessed as varying from 10 to 35% in 5 out of the 20 trials.

with regard to jowar the influence of irrigation seems to be only slightly favourable. The average yield of irrigated
jowar is 217 kg., that of unirrigated crop is 197 kg. per acre. The highest yield obtained from unirrigated jowar alone broadcast but treated with Ammonium Sulphate at the rate of 20 seers per acre has been 351 kg., whereas the highest yield in the case of irrigated jowar mixed with urd in the ratio of 80:20, line sown, but unmanured has been 362 kg. It must also be noted that the lowest yield (84 kg. per acre) also belongs to the irrigated crop: in one case pure, broadcast and manured with compost, in the other case mixed at 80%, line sown but unmanured. wherever jowar has been mixed with urd, it has yielded moderately well, though unirrigated. Jowar-paddy mixture, too has yielded above average. Line sowing seems to make little difference. The seed has been local in all trials.

In respect of Bajra the average yield of the unirrigated crop is higher (248 kg.) than that of the irrigated crop (237 kg.). The highest yield of the unirrigated crop (528 kg.) is much above the highest yield of irrigated crop (332 kg.) and it is worth noting here that whereas the former was mixed with lobia in the ratio of 50:50, the latter was almost pure. The former was manured with farm yard manure and the latter with compost. There was no loss due to weather, pests etc., in either case. All bajra has been of local seed sown broadcast. The treatment with Ammonium sulphate has not given higher than average yields. Rather they are lower considerably. The treatment with farm yard manure and mixture with lobia, urd and groundnut have been more effective.

Although these trials are not sufficient in number
to take us to any definite conclusions with regard to various techniques involved in the raising of higher yields for these crops, yet there are some indications which may be summed up as under:

1. Paddy needs irrigation, transplantation and application of manures and fertilizers to yield better and thereby the yields may be increased therefold, if not more.

ii. Jowar may yield slightly better with irrigation and fertilization.

iii. Bajra is a drought-resisting crop. It benefits little by artificial watering. But, suitable mixtures with leguminous crops and fertilization with farm yard manure can go a long way to increase its yields, say by twofold.

(C) The Evidence of Agricultural Research Work: The results of sugarcane research work show that the application of 60 to 120 lbs. nitrogen on an average gives an increase of 75 maunds of cane per acre, i.e., 1 lb. of nitrogen gives on an average an increase of 0.83 maunds of cane per acre in the cultivators' fields. The responses to level of irrigations and number of hoeings also show that there is a progressive increase in cane yields with increasing number of irrigations and hoeings. If adequate manuring (60 lbs. to 120 lbs. Nitrogen) with four to six irrigations and sufficient number of hoeings are given, the

average cane yield can be increased to 500 to 600 maunds per acre in cultivators’ fields.

Yields decrease if the same crop is repeatedly raised in the same field year after year even with the help of fertilizers and manures. However, the average rate of fall in yield has been the least in the case of farm yard manure treatment and highest in the case of ammonium sulphate treated plots. The utility of applying farmyard manure at least to meet a part of the total manurial requirement seems to be quite clear.

The autumn planted cane alone has given the highest yield of 642.6 mds. of cane per acre being significantly superior to spring planted cane taken after pea or gram or wheat. But it was at par with spring planted cane intercropped with onion, spring cane alone, autumn cane mixed with gram and autumn cane mixed with pea.** Thus in the first instance, late planting of sugarcane should be discouraged. In case it has to be done Co.S.515 and Co-S 245 seem to be suitable varieties. Further improvements in yield cane be obtained by providing more irrigation.

Taking into consideration the average yields of sugarcane and different rabi crops under different treatments, the overall food production per acre worked out to be the highest in case of sugarcane-with-pea treatment followed by sugarcane (Autumn) + lahi, sugarcane (Spring) after lahi, sugarcane (Autumn) + gram, sugarcane (Spring) after pea, and

** Ibid. pp.326-29.
sugarcane (autumn), respectively. Where only a sugar-cane crop is taken the results were conspicuously poorer than all mixed cropping and after - rabi planting treatments barring sugarcane after gram.

From the overall economics of different treatments it appeared that the sugarcane- with - pea treatment proved to be most lucrative for cane growers and sugarcane- with - gram, sugarcane (autumn) and sugarcane- with - lahi treatments were next in order of merit. (Also see footnote on P.350). Among spring and late spring planting treatments sugarcane- with - lahi gave the best results. It has, therefore, been concluded that a mixed cropping practice in which pea is intersown in single rows in between every two rows of autumnal planted cane, besides leading to production of better quality crop for the factories, is most profitable for cane growers under the soil and irrigational conditions as exist at Shahjahanpur. This practice is specially suitable for such growers as possess small holdings and wish to take some food crops from their fields reserved for sugarcane planting.*

(D) Evidence of Improved Techniques of cultivation: A reference to appendix table XII will show that the comparative costs of rice cultivation by the Japanese and the local methods is in the ratio of 13:10 but the yield is greatly increased and so the net profit. As regards wheat, the U.P. Method of Wheat Cultivation (see appendix V) promises better yields than the local methods.*

Conclusion from the above noted evidence

The evidence provided by the crop competitions, crop cutting trials on the farmers' fields, agricultural research work and improved techniques of cultivation shows that the possibilities of increasing the yields of crops have not been exhausted. The soils need water and manures in the case of some crops, while in that of others a suitable crop combination and crop rotation may be helpful to enable them to yield better. As compared to the world conditions (cf. Table XLII) a very high percentage of land in this area is actually under the plough so that most of the land planning here must be concerned with the development of the arable land.

When one compares the per acre yields in this area with those of the countries of west Europe or Japan, (see Table XLIII) one is led to presume that, if this area is also farmed as efficiently as those countries, its output can be increased considerably.

While the increase of per acre yields is very essential to make the agriculture profitable and capable of supporting the growing population of the district, the increase of double cropping by introducing early maturing varieties of crops, better crop rotations, etc., can also be much beneficial in increasing the output, in providing all the year round work to the peasants, in enhancing their incomes, in decreasing their dependence on the produce of a single harvest and thus decreasing the need for the storage of the produce, etc. It will further
keep the soil covered and under the care of the peasant and thus render it less liable to erosion. Moreover, the variety of the produce will increase and it will naturally influence the composition of the diet of the people. Only through the application of the scientific methods of agriculture and the adoption of highly intensive farming techniques the agricultural output of the area can be sufficiently raised and a proper planning of the arable land be possible. The arable land is not only limited but also decreasing in amount with the extension of settlements, roads, etc. The little wasteland that remains is required for many non-arable needs. The planning of the use of the arable land, therefore, has to be viewed in the context of its gradually decreasing amount and of the rapidly increasing pressure of population and livestock on it. Naturally, therefore, it would centre around the progressive increase in the per acre yields, the raising of more than one harvests from each field and the diversification of crops with a view not only to meet the various needs of the people but also to maintain the fertility of the land in a system of intensive cultivation.

Determination of the Minimum Family Holding for Efficient Farming

Of course, one fundamental principle about the planning of land use at the family level must be that each farm family should be able to produce sufficient for itself and to spare something for the non-agricultural population as also for purchasing its non-agricultural needs. No farm holding unable to satisfy this basic principle should ordinarily be allowed to exist. Small holdings must find out suitable high yielding and double or triple cropable crops such as potatoes, yield of which
was obtained as high as 11,817 kilograms per acre, for the state crop competition in the year 1957-58, six times higher than the competition yield of either wheat or paddy (cf. Table XXXIX), in the neighbouring district of Bareilly. For a family devoted to market gardening and potatoes and doing continuous and intensive cultivation, a much smaller farm holding is necessary than for the peasant family, which grows foodgrains and fodder crops. If most of the small farmers are able to change their diet habits and type of farming the problem becomes simple. In that case even much smaller family holdings can be retained independently where a dependable source of irrigation, initial capital for investment on fertilizers, seeds, etc. and the knowhow are available.

Turning to the table of balanced diet (Appendix Table XXXV), we find that a family of six persons would annually require foodstuffs as detailed in the table below:

<table>
<thead>
<tr>
<th>Article of Food</th>
<th>Annual food requirements per family of six persons</th>
<th>Percentage of total calorific intake</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cereals</td>
<td>276 Cereals 3,048,380</td>
<td>46.4</td>
</tr>
<tr>
<td>Pulses</td>
<td>188 Pulses 624,150</td>
<td>9.5</td>
</tr>
<tr>
<td>Market garden produce</td>
<td>188 Market garden produce 96,550</td>
<td>1.5</td>
</tr>
<tr>
<td>Vegetables</td>
<td>626 Vegetables 374,490</td>
<td>5.7</td>
</tr>
<tr>
<td>Condiments &amp; Spices</td>
<td>In small quantities</td>
<td></td>
</tr>
<tr>
<td>Sugar &amp; Jaggery</td>
<td>125 Sugar &amp; Jaggery 477,420</td>
<td>7.3</td>
</tr>
<tr>
<td>Vegetable Oil, ghee, etc.</td>
<td>125 Vegetable Oil, ghee, etc. 1,116,900</td>
<td>17.0</td>
</tr>
<tr>
<td>Milk</td>
<td>623 Milk 503,700</td>
<td>7.7</td>
</tr>
<tr>
<td>Fish &amp; Meat</td>
<td>125 Fish &amp; Meat 213,900</td>
<td>3.3</td>
</tr>
<tr>
<td>Eggs</td>
<td>2,190 eggs 107,310</td>
<td>1.6</td>
</tr>
</tbody>
</table>
A study of the above table shows that four different types of foodstuffs constitute a balanced diet:

(a) Cereals, pulses and oilseeds which comprise the products of ordinary foodgrain farming;
(b) Market garden produce including fruit;
(c) Sugar & Jaggery obtained from sugarcane cultivation;
(d) Animal products obtainable from mixed farming.

About 56% caloric intake must come from the cereals and pulses, 7.2% from market garden produce, 7.3% from sugarcane cultivation, 17.0% from either oilseeds or ghee (thermally cleaned butter), 7.7% from rearing milking cows and buffaloes, 1.6% from poultry farming and 3.3% from either fish-culture or sheep & goat or pig rearing.

Now, if each family must be self-sufficient with regard to its food resources, how much land should be devoted to these requirements, severally, would depend upon the agricultural efficiency of each family. Let us assume that each family holding has a persian wheel for irrigation and the initial capital for investment and let us take for example the average yields of the crop cutting trials on the farmers' fields in Joya Block to be effective (Table XL). Then the average yield of irrigated paddy will be 667 kg. per acre yielding 445 kg. of rice. The average yield of bajra, mostly unirrigated, will be 242 kg. per acre. The balanced diet would require 313 kg. of bajra and 563 kg. of rice per year. This would be available from 1.3 acres of bajra and 1.22 acres of rice, i.e., 2.52 acres in all. Suitable crop mixtures and crop rotations can provide the require-
ments of pulses, oilseeds and market garden produce from the same area if the cultivation is carried on intensively, producing more than one harvest a year as suggested above. Allowance may be given for the cultivation of sugarcane to get the requirements of sugar and jaggery and also for a pond needed for fish culture. In all not more than 3.5 acres of land is necessary for these food items, while the necessary animal products would be available if mixed farming is carried on and animals are stall fed. The by-products of foodstuffs and some fodder in rotation would be available for the cattle, pig and poultry. An additional acre of land would, however, be necessary for the production of fodder necessary for the oxen who would draw the plough, the persian wheel, the chaff-cutter and the carts. Thus 4.5 acres of land may be sufficient for the subsistence of a family. But as regards its non-food requirements which it has to purchase mostly from the market as also for the payment of taxes it must produce something extra. How much extra it should produce would depend upon the comparative prices of the agricultural and non-agricultural goods prevailing in any year. But if the government is watchful and mindful of the interests of the cultivators it can, perhaps, regulate the prices on a fairly egalitarian basis. Here the role of state planning becomes conspicuous. The rural masses can themselves reduce the burden and risk of fluctuating markets of non-agricultural goods by depending more and more on the country-made products of cottage industries, some of which, such as the handloom and handspinning,

* In general if all the fodder required is to be raised under irrigation with no good natural pasture available, about 100 acres of land will be required for a herd of 200 cattle. Vide Kelkar, G.K., Establishment and Management of the Dairy Farm (1917), p.11.
can be adopted as a spare time work even in the peasants' families. Yet taxes, housing, light & fuel, clothes, tobacco and beverages, medicines, education, fairs, livestock, implements, fertilizers, manures, extra labour, and above all marriage, death, other ceremonies and litigation, etc. lay great demands on the resources of the peasants. As already noted these requirements increase with the improvement in the economic conditions of the peasantry, since, so far, they are limited to the minimum level. In moderate conditions on an average not less than ₹ 400/- per head or ₹ 2,400/- per family per annum are necessary for these purposes at the present price levels. To produce sufficiently extra commodities to earn for this expenditure, each family would require about 10 acres of rice land if single-cropped and monocultured. But if proper crop rotations and crop mixtures are developed to raise three harvests a year and emphasis remains on potatoes, vegetables, sugarcane, groundnut, etc., perhaps, one-third of that land will be adequate to produce sufficient for these requirements.

While a balanced diet must be provided to each person of the family and sufficient fodder must be provided to each head of its livestock, an adequate housing must also be available for them all. The family must also have some source of fuelwood lest it should turn to the cowdung for that purpose. Provision must also be made for easy movement within the farm which should further have link with the rural cart track or a public road as far as possible. About one-third of an acre of land is necessary for the non-arable needs such as housing space, animal sheds, storehouses, Persian wheel, compost pits, field mends, paths,
cart track, etc. Thus we arrive at the minimum unfragmented economic holding of 8 acres. As the per acre yields are stepped up to the competition levels, the standard of living of the farm family will rise, but to maintain that the family must plan the number of its offspring lest the increasing numbers should burden its living standards by increasing the pressure on the land holding which is sufficient for six persons only. Fig. 62A shows the likely appearance of the map of village Bahadurpur when such economic holdings are provided to its farmers.

**Land Planning through Cooperative Farming**

The existence of farm families self-sufficient in regard to most of their needs, involves a repetition of land use pattern in different holdings. The land is heterogeneous in quality, which varies from place to place even in the same village. This is one of the reasons for the fragmentation of holdings and one of the main hurdles in their consolidation into compact blocks, one for each holding. Moreover, there are some essential economies which cannot be possible in small units of operation. Particularly, little benefit can be obtained from the application of agricultural machines if pattern of cultivation is repeated in different holdings in small plots of land. The application, on a wide scale, of scientific knowledge and increased capital investment in various forms is easier to secure where land is managed in fairly large units than where it is worked in petty and fragmented holdings. "In a farm of substantial size it is possible to eliminate several wasteful operations
and to secure better planning of the use of land, including selection of crops, rotation of crops, soil conservation, development of irrigation and introduction of improved techniques. Economies which cannot be availed of by small farms are available to the large ones. By its very nature a larger unit of operation and management can secure more credit and finance and can apply these to greater advantage, can diversify its economy and can make a relatively greater contribution to the solution of the country's food problem. To ensure better tillage, rational use of draught animals and the introduction of better agricultural implements which individually farmers are unable to secure, some sort of cooperation in farming activities must be introduced. Double and triple cropping needs much more labour than the individual farmer can afford, so that the existence of cheap landless agricultural labour in the countryside becomes a necessity. The individual farmer also shirks taking risks in adopting new techniques, while the cooperatives sharing labour, expenditure, intelligence, resourcefulness and risks among a large number of its members can be more enterprising and more industrious and on a much larger scale than the individual farmer can be. In case of cooperative effort, the illness or other handicaps with the individuals, would not come in the way of good tillage and proper land use. The farming cooperatives can look after the fields neglected by the individuals for any reason whatsoever. Cooperative farming would, moreover, obviate the necessity of consolidation of individual holdings and thus

save the farmers from its extra burden and complications. The provision of extra paths between different chaks would become unnecessary so that there would be a little saving of the arable land. Fig. 62B shows the likely shape of the map of village Bahadurpur if it is organised into cooperative farms. A comparison with Fig. 29 makes the difference quite clear.

Thus, for a proper land use in this area of small and scattered holdings, cooperative farming offers a clue to many problems. The planning at the family level as outlined above necessitates a minimum holding of eight acres of average land and a persian wheel at the command of each farmer. The provision of these basic needs and also of the basic credit to each farm family will be a stupendous task for the state. It may further prove to be impractical in view of the fact that the present farm population is much larger than the provision of such holdings would permit. In addition, there are certain common needs of the villages which cannot be easily adjusted if the farm holdings are held individually. Among these needs may be counted the drainage, transport, cold storage, woodland strip, etc. If the whole land in a village is pooled together for proper land use, a better planning can be done.

But, in view of the existing wide differences in the social groups such as the large and small holders and with a view to avoiding neglect of land and reduced production even for a short time, it may be proper, at the first instance, to organize only the small and uneconomic holdings into cooperative farming units. The assessment of performance of various agri-
cultural and other operations done by the members of a cooperative should be made on the basis of a system of 'norms', the 'norm' being a standard of daily performance in regard to the quantity and quality of output expected of an average member working under normal conditions of health. In this regard much can be learnt from the experience of the U.S.S.R. and China where cooperative and collective farming has progressed much*.

* Various forms of uniting peasant households were tried out in the course of the organisation of collective farms in the U.S.S.R. e.g., the TOZ and KOLKHOZ. The peasants joining the TOZ pooled their plots of land and cultivated them together. The livestock and agricultural implements were not collectivised. In the Kolkhoz the peasants pooled together their plots of land, part of their productive livestock, labour, chief means of production, all the draught animals, part of the farm buildings, agricultural machines and implements. They retained part of their productive livestock, poultry, buildings for these animals and for themselves, minor agricultural implements and a small plot of land near the house for use as a kitchen garden. The earnings of the collective farm are divided amongst its members according to the principle: he who works more and better receives more products and money. To account for the quantity and quality of work done by its members, a workday unit has been introduced. There are norms or daily output quotas in all lines of work, based on what a man of medium physical strength is able to perform. These norms are approved by the general membership meeting of the Kolkhoz once a year. One norm means one workday unit. Failure to fulfil the norm results in incomplete workday unit being credited to the peasant concerned, while a person can earn more workdays by over-fulfilling the norm. The quality of work is also taken into account while determining the norms for different types of work which is thus categorised in a number of classes. The work of each worker is measured and recorded daily by the group leader and the record goes to the book-keepers who keep personal accounts of all members of the collective farm. After a fortnight the workdays are recorded in the work books held by the members of the farm and in the event of some error they can get it corrected. The annual record of workday units serves as the basis for the distribution of the common earnings, after payment of taxes, repayment of loans and deductions into the farm development fund (the seed fund, forage fund, building costs, purchase of equipment, etc.). Vide Zelenin, I.E., The Indian Express, December 9, 1959, p.8, col. 1-2 and S. Nebesny, Ibid. p.9, bottom, cols. 1 to 5.

In China, after the liberation and the redistribution of land, first, mutual-aid-teams were organised. Later on, these were converted into agrarian cooperatives. Therein the assessment of the performance of various operations by their members is made on a system of norms similar to that developed in the U.S.S.R. Vide Report of the Indian Delegation to China, op. cit. pp. 44-45.
Some provision can also be made for the gradual compensation to the peasants who pool their land and means of production above a certain norm and a gradual deduction from such peasants as have pooled these things less than the norm. Necessary adjustments can be made to fit in with the democratic set up but the land must not be allowed to suffer owing to the resourcelessness of the small holders.

As regards the landless labourers in the countryside, Acharya Vinoba Bhave's Bhoodan and Gramdan movements are well known. He collects gifts of land for distribution among the landless. The recipients would possess the land as long as they continued to cultivate it subject to some periodic re-adjustments by the Bhoodan councils in accordance with variations in the size of their families. Since these recipients have no resources for the improvement and proper use of land, it would be better to organise them into cooperative farming societies rather than allotting them separate pieces of land. Where, however, cooperative farming is adopted as the basis of agrarian structure, the problem of the landless labour may vanish automatically, since those who will work on land would receive its products in proportion to the quantity and quality of their work as outlined above, the land and other means of production being held as the common pool of the cooperatives, allowing some compensation to their original owners. Through cooperatives, working on this basis, the present owner farmers as well as landless labourers will find wider horizons to show their physical and intellectual capabilities, since they will not fear any exploitation.
One basic principle about the land use planning at the village level must be that the village should not only be a self-sufficient unit in regard to its needs of land produce, but it should also be capable of exporting something to the urban areas from where it would get many of its non-agricultural needs. In addition to the mixed farming, market gardening, fruit orchards, etc., necessary for providing a balanced diet to its inhabitants, a woodstrip to provide fuelwood and timber for housing and a pasture to provide grazing grounds for the livestock would also be essential. The lack of these things in the countryside results in the burning of valuable cowdung manure and in the damage to crops by roaming livestock. Wholly stall fed livestock cannot retain good health. The provision of common pastures in the villages is, therefore, essential.

Planning of land use must be done for the village community as a whole. Even if the larger and well managed holdings are not included in the farming cooperatives, they must be subject to some central control which should decide in consultation with the planning authority of the block or region how a particular piece of land should be used in the village. When this arrangement is possible much of the existing misuse of land can be avoided. As at present, each individual holder wastes some land, misuses some more and under-uses most of the rest of his holding, owing to certain handicaps with his men or materials. But in cooperative farming the capacities would be many-folded and land utilization subjected to a central
PLANNING THE LAND USE

1. CONVERTING KHADAR WASTES INTO WOODLAND & PASTURE IN BHAGWANPUR KHADAR

2. ELIMINATING DUPLICATE & WORN OUT TRACKS & IMPROVING DRAINAGE IN KHALIQPUR KALAN

3. CONVERTING RAILWAY WASTE INTO PARKLAND IN BAHADURPUR

4. STRAIGHTENING PATHS & NULLAHS IN KHABRI GANDU

FIG-63
planning scheme. Viewing the village as a whole, planning of paths, cart tracks, public roads, drainage channels, washing ponds, fish ponds, singhara-ponds, irrigation channels, threshing grounds, village latrines, compost pits, public places, etc. can be made more easily. The sinuous paths and drainage channels can be straightened while some of the unnecessary ponds reclaimed (Fig. 63). The land thus saved can be allocated in a separate strip for the woodland and pasture or for other uses. Even much benefit can accrue by planting trees along the village paths, drainage and irrigation channels and around ponds.

So far, owing to the consciousness of individual holdings and personal property, little attention is paid to the proper utilization of wastelands and lands which have been put under the charge of the gram panchayats since the abolition of zamindari. The governmental property is no man's property. In cooperatives whose profits are divisible according to the "system of he who works more receives more", people may take more care of all misused land, since they would earn more, thereby. Thus a healthy competition for more and better work would begin when the basic means of production would be pooled together for exploitation in the common interests of the community as a whole.

Land use Planning at the Micro-regional or Block Level

Land use planning at the micro-regional or block level can consist of two functions:

(a) Research and
(b) Planning.
Micro-climatological and micro-regional studies lacking, little attention has been paid in the past to the suitable siting of special types of farming such as market gardens, fruit orchards, etc. and to the most suitable crops and crop rotations.

Classification of Land

The question of determination of the suitability of land for the location of settlements, industry and agriculture and the need for selecting proper land for the crop production emphasises the necessity of a classification of land according to its fertility, productivity and best use capability. Apparently, an exhaustive soil survey must form the basis for determining the inherent fertility of the land, for which the soils must be thoroughly analysed both chemically and physically and their yields recorded on the basis of crop-cutting experiments over a long period of time and with a very large number of samples. But, that is a Herculian task which requires a team work by a very great number of experts in their respective fields. It would require a huge expenditure and a long period of time. It would require a highly trained specialist staff to combine detailed mapping and laboratory investigation of soils and thus record the fundamental basis on which land use is determined. After the determination of soil types and series there would remain the investigation of the optimum utilisation of each. Yet, that would not provide a complete picture of fertility–productivity since climate, especially rainfall plays a governing part therein. The effectiveness of precipitation and the provision of irrigational facilities may
make the whole difference. The action of the plough, drainage and the application of fertilizers are some more factors quite effective in this respect. So far, we have the land revenue classification of soils which is in a way based on the rough estimates of fertility-productivity of various fields. This soil classification affords a convenient means of subdivision of a region.

In measuring actual production one is measuring not only the natural fertility of the soil but also the efficiency of the farming systems and that of the farming community so that the per acre yields may express primarily the standard of farming. There are marked local differences in the general level of intelligence, initiative and standard of living and husbandry amongst the farming communities, in the district. These cause variation from the norm, but crop yields generally do tend to reflect the fertility or productivity of the land under existing economic conditions and present systems of farming.

Land utilization in the period 1953-58 forms a very useful starting point for the land classification since it marks a stage from where the land planning actually starts in the area. The foregoing study of the present day patterns of land use has already brought out the land use regions. Each region has its characteristic type or types of farming. The spatial distribution of selected crops suggests an essential division of the area into sub-regions. It does not, however, mean that the present day land-use in any tract is the optimum.
Some information exists of land utilization in the district in the past. Between 1871-78 a cadastral survey was conducted by the Land Revenue Officers and detailed maps of all villages were prepared. The utilization of each field was recorded, sometimes on the maps but mostly in the settlement volumes maintained in Urdu. By identifying the field numbers on the record with field numbers on the map, land-use for that period has been mapped for the sample villages. Some more similar maps may be prepared for the land settlement years 1910-11 and 1939-40. By a careful use of this historical material and with the corroboration of statistics and contemporary descriptions (e.g. the Distt. Gazetteers), it is possible to trace the history of land use in the past century and this has been done on sample basis by the writer in this work. The general results of these studies have shown that

(a) there is a remarkable stability of land use on the best land, cf. Naglia Kathair (Fig. 23, 24 & 35);

(b) there is also a considerable stability of land use on the poorest land, cf. Bhagwanpur Khadar and Matawa Oke (Fig. 47);

(c) the maximum of change and fluctuation is found on land of intermediate value, cf. Ramnawala and Chaki Khera, (Figs. 56 & 57).

The land which has remained untiled for a century indicates that it is inherently poor, though some of it might be reclaimed at a great expense which is not within the means of the ordinary peasants. Of course, modern methods of land reclamation, drainage, cultivation and land improvement can succeed where older methods failed. But, taking the position
in general, the cultivation history of a region is a good guide to its potentialities.

The present utilization of the land has a very great significance in a long-settled country in reflecting the combined influence of the varied factors concerned: the physical factors of relief, soil and climate; the more purely economic and social factors of markets, prices, transport, labour; the historical factors of land ownership, local usage, tenure, and even tradition and custom*. Land response denoted in the per acre yields may be utilized for farming highly generalised estimates of the areas under various types of land. It is, however, not possible for the writer to attempt a detailed classification of the land in the district on the basis of these sample studies. Different types of land are so intermingled everywhere that they can be separated only after a thorough plot to plot survey throughout the whole length and breadth of the district.

The classification proposed is as under:

Category A—Good Quality Land:* Land in this category is "highly productive when under good management". It is a well-drained, level, gently sloping or undulating bangar upland with a deep loam or loamy clay soil, a fairly high water table, 10 to 12 feet below ground level, and facilities for irrigation, means of communication, high densities of rural and

* Stamp, L.D., Land of Britain, op.cit., p. 355.
** The nomenclature and definitions of various classes of land have been adapted from those of the classification of land in England and Wales. Stamp, L.D. Ibid. p. 363-361
rurban population, etc.

1(A) First class land capable of Intensive cultivation:

Land in this class is highly productive and capable of multiple cropping. It comprises deep, easily worked loams, retentive of moisture and manures and rich in mineral salts. It is on level or gently undulating tracts where drainage is free and water table not too high or too low to prevent tillage at any season. In addition, it is situated near the settlements where it can receive the close attention of the cultivators and can cater to the demand for green vegetables. It has irrigational facilities necessary for cultivation at all seasons. It is in the possession of industrious tillers such as the Baghbana and Muraca.

Such land, owing to its well-drained and level nature, is also sought eagerly for both industry and housing which are gradually encroaching upon it. But, where fully developed for agriculture, it is devoted to market-gardens, fruit orchards, plant nurseries, etc. In places, potatoes and other root crops are grown. Wheat, maize, jowar and, sometimes, rice may be grown in rotation with vegetables and root crops. It is tilled in very tiny and high rented holdings.

This land has been under continuous tillage for hundreds of years. Its qualities, in many cases, have been introduced through the persistent efforts of the industrious tillers. The land at a distance from the settlements would not have received as much care during the politically disturbed
medieval times, for nobody could be sure of reaping the harvest where troops or bandits may be marching any time. But, land near the settlements obtained greater care and closer attention by both the landlords and tenants, since they all depended for their food resources on it.

Land of this type is very limited in extent amounting to less than 1% of the total area of the district. With the growing urbanism its need is increasing all the more for the production of fresh vegetables and fruit for the town dwellers, while the industry and housing are also making inroads into it. Its reservation for market gardens is very much desirable. It must be saved from 'urban erosion'. The local self-governments must not indulge in the indiscriminate utilization of this most valuable type of agricultural land for non-agricultural purposes, nor should they allow private persons to use it in that way. In Daulat Bagh, for example, the Moradabad Municipal Board is maintaining compost pits over an extensive area which used to be cultivated formerly (cf. Fig. 46). These pits should be removed to some inferior locality along the Gangan nadi.

The area under this category is about 14,000 acres.

2. **Good General Purpose Farmland**

Land in this class is also workable throughout the year and the soil texture permits the growth of both root and straw crops as well as sugarcane.

Such land is quite extensive especially in the Katehr upland and well-drained parts of trans-Ramganga lowlands.
The soils are mostly loams or clayey loams of varying thickness. Water table varies from 5 to 15 feet in depth and water-logging does not occur. Irrigation facilities through wells, tube-wells and canals are well developed to keep cultivation quite stable against 'dry' seasons. This class of land may, however, be sub-divided as under:

2(3). It comprises the areas particularly suited to sugarcane cultivation owing to the vicinity of sugar-mills and means of transport. Wheat and other crops are also grown in rotation.

2(4b). It is the rest of the land in this category where sugarcane is relegated to the secondary position and wheat or other foodgrains predominate. Most of the sugarcane is used by power crushers or in local 'Kohlu' crushing for jaggery making. The average output of foodgrains is 350 kg. per acre or more.

Most of the land in this type has been continuously cultivated for many centuries, though the popularity of sugarcane has enhanced with the establishment of sugar mills. Maps constructed for the years 1871-74 show few differences from the present fundamental utilization of land (cf. Figs. 35 & 54).

It is from this type of land that the district must get much of its foodstuffs as well as crops for sale off the farm to provide the raw material for many of its industries. The type of farming practised, however, also requires the production of fodder crops for the livestock. Near to the village hasti a little land may also be devoted to vegetables,
potatoes and fruit orchards or other groves. Much expansion of settlements is likely in such areas and some of the larger villages of today might become rural centres in the years to come. It is especially possible where metalled roads and railways have come to link these settlements.

The area under 2(S) is estimated about 80,000 acres and that under 2(AS) about 186,000 acres.

3. Good but Light Land

This land is characterised by light soils such as Dumat II and Bhur I. They are easily worked. But the land should be level or gently undulating yielding well under irrigation. In this category fall the inferior bangar tracts and the superior Bhurlands.

Such land is the most extensive in this district, especially in the central uplands where irrigational facilities have progressed much in the recent past. Water table in such areas is generally more than 20 feet deep. Without irrigation it has been devoted to dry farming, raising food grain and feed crops, which used to suffer during the periods of drought. Irrigational facilities through the extension of tube-wells and canals have protected cultivation against drought and have also made double cropping a practical proposition. Means of communication and transport are substantially developed in these areas so that both foodgrains and sugarcane cultivation for sale off the farm can be carried on extensively. Two subdivisions may be noted in this class of land also.
3(A). It is the land devoted mainly to foodgrains and feed crops. Such land, though within the command of the tube wells and canals, does not receive irrigation as conveniently as 3(AS). It, therefore, grows very little sugarcane. Mixed cropping of millets, pulses and oilseeds is usually practised in the kharif season and wheat mixed with barley is grown during the rabi season. The average output of foodgrains here, is 300 to 350 kg. per acre.

Much of this land has remained under tillage for centuries, but, formerly it was devoted to inferior crops and single cropping by dry farming methods (cf. Figs. 51 & 52). With the extension of irrigational facilities its utility has increased and with more such facilities it can become as useful as 2(AS) above.

Together with 2(AS) this class of land comprises the main areas from where the district would get most of its foodstuffs and cash crops. All the larger settlements of the district are situated within these areas so that much surplus produce must be raised here for feeding the urban population. By keeping improved breeds of milch cattle the farmers nearer to the settlements can also develop dairy farming activities. Pig and poultry farming may become subsidiary to the same. Much development of such areas is possible in future and some of the present villages may become rural centres in due course.
The area under 3(AS) is estimated about 150,000 acres while that under 3(A) about 250,000 acres.

4. Good but Water-affected Land

Land in this category has a high water table or suffers from occasional flooding or 'udla' phenomenon. Soils are varied. Mostly heavy loams, loamy clays or heavy clays are found. In places sandy belts also exist owing to the extension of bhur ridges. The soils are workable throughout the year and the soil texture is suitable for the cultivation of both root and straw crops. But, in years of heavy rainfall the land suffers from water-logging owing to its defective drainage. A succession of wet years is very harmful but, slightly lower rainfall is useful in making these soils more suitable for cultivation. Irrigation facilities through wells and tube-wells are sufficiently available. It is found mostly in UDLAtract.

Foodgrain and feed crops comprise the main products of these areas. Some sugarcane is grown for local crushing. Means of communication are poor. Along the roads sugarcane becomes somewhat more important. In addition to wheat and millets, rice, urd, peas and groundnuts also become significant in these areas of varied soils. There is much mixed cropping as well as double cropping. People have to adjust the cultivation according to the seasonal character. They take precaution against a total loss of the kharif harvest by mixed cropping. Sometimes, they mix even rice and jowar or rice and sugarcane. But, usually, the mixture is of one or more of the
-381-
millets with *sawan*, *guar*, groundnut and pulses. The average output of foodgrains is 250-300 kg. per acre.

Most of this type of land has been continuously tilled since hundreds of years ago (cf. Figs. 44 & 49). But, it appears that the phenomena of 'udla' and its evil effects have spread over a wider area since the construction of roads and rail tracks parallel to the contours and without providing sufficient culverts under them (cf. Fig. 9). The extension of tube-wells, indiscriminately, also seems to have had contributory evil effects as has been explained in a separate section.

This land can be made more productive and its cultivation can be rendered more stable by providing sufficient drainage facilities, e.g., by dredging, widening and straightening the shallow, narrow and sinuous chhoyu nullahs which drain these tracts and by providing a large number of culverts under roads and rail tracks at convenient points for water flow. In this way, if the main defect of this type of land is overcome, it can be rendered almost as productive as 2(AS) by the use of manures, etc. The wetter depressed parts can be devoted to pastures and there livestock rearing can become quite important. The extension of metalled roads, on the other hand, can render the main tract as a feeder to the sugar mills at Amroha and possibly many power crushers can be established in its different parts.

The area under this class of land is estimated about 150,000 acres.
5. Good but Heavy Land

This type of land comprises the heavy and moist clayey soils lying in depressions suited mainly to paddy cultivation. They are found mostly in the north eastern or the trans-Ramganga tract, where they are known as the jhaddas. Locally, they are found in certain depressed situations in the north central uplands and in the Ari depression. The clayey soils are highly retentive of moisture and when dry they bake into clods.

At present, this type of land is devoted mainly to the cultivation of rice, year after year. Sometimes, gram, peas or oats may be grown in the rabi in the same fields, which have yielded paddy in the kharif. Rice is rain-fed and no irrigation is provided. The yield of rice is fairly good, almost as much as in type 4 above.

Most of this land has also been under cultivation since long (cf. Fig. 39 inset maps and Fig. 4 Tikhunti) and it appears that it will comprise the chief areas supplying rice in this district, even in future. Double cropping should, however, become more practicable. For that purpose suitable and sufficient drainage facilities must be provided so that the soils become dry enough for the cultivation of rabi, soon after the paddy is harvested. The cultivation of feed crops and grass may also be tried on these soils, provided facilities of irrigation are available during the dry periods. If it succeeds the areas may become centres for dairy cattle. Land which will, without the need for other feed, fatten entirely on grass at least one bullock per acre
may be considered definitely as first class grassland*. Mole drainage, liming and basic manuring will often convert the land (good but heavy clay) into first-class pasture**.

The area of such land is estimated about 62,300 acres.

Medium Quality Land

Land in this main category is 'of only medium productivity even when under good management' owing to shallowness of soil, steeper slopes, defective moisture conditions, liability to frequent flooding, remoteness, inaccessibility, etc. Though an almost endless combination of these defects is possible, mainly two subdivisions of this category are to be found comprising the 6 and 7 class land as described below:

6. Medium Quality Light Land

This type of land has lighter soils than those included in class 3 above. Dumat III and Bhur II are included in it where lying on the uplands and lacking irrigation facilities. Dumat II, Bhur I and, in the undulating uplands and on the slopes of the adhak villages, other slightly inferior light and thin soils are also to be included in this class.

On the other hand, the silts of the khadar areas may also be included in it. These soils are usually light and thin though sometimes heavy.

Such land is thus found in the southern section of the

* Stamp, L.P. Land of Britain, op.cit. p. 370.
**Ibid. p. 372.
Bhurlards of Hasanpur, in parts of central Amroha Bthur and other Bthur tracts in the north central uplands, in the Bagad upland, particularly in its northern section, in parts of the Ganga and Ramganga khadars and valley slopes (cf. Pahladpur, Chaki Khera, Matenas, Bhagwanpur khadar and Laghrpur chholya, Figs. 4, 34, 43, 47 & 52).

Such areas are devoted mainly to the cultivation of bajra alone or mixed, barley alone or mixed and wheat alone or mixed. Dry cultivation and single cropping are the normal practices on the uplands and slopes. But, in the khadars, the soil is naturally wet owing to the frequent flooding and a high water table. Hence, the cultivation is based on crops requiring sufficient soil moisture, so that bajra and barley are replaced by wheat, jowar and sometimes maize and rice (cf. Fig. 38). Sugarcane is unimportant in these areas (also see Fig. 48). The average yield of foodgrains is 200 to 250 kg. per acre.

Many of these areas have been under the plough since long. But, wastelands have also been quite extensive in some parts so that much reclamation of wastes has taken place in the recent years and the area under cultivation has been extended (also see Fig. 56). The state of cultivation is, however, precarious. On the uplands and slopes drought is harmful and proves the inferiority of this type of land. In the khadars, years of heavy rainfall, local or in the mountains, are witnessed by devastating floods. Kharif is always doubtful, though rabi often succeeds. Much of the land is cultivated by 'pahl-kashi' or non-resident tillers, who live in villages situated on better
sites.

The future of this type of land rests with cultural developments. On the uplands and slopes provision of irrigation facilities, etc. can render the light soils quite productive, though not as productive as class 3 above. In the khadars, on the other hand, measures to save the land from floods may lead to its becoming quite useful owing to its level nature as well as finer silts, which are fertile, naturally.

The area of this type of land is estimated about 300,000 acres.

7. Medium Quality General Purpose Farmland

The land in this class is workable throughout the year. But the soils are deficient in some way, the land is undulating and the climate too humid. The dominant soils are inferior loams (cf. Ramnawala in Fig, 4). Heavy rainfall of the area has led to much soil erosion of the undulating surface. Numerous gullies are present. In places, depressions are seasonally filled with water. But, the water table is generally more than 20 feet deep and irrigation facilities are not available. Means of communication have also been lacking until recently. Humid climate is favourable to the growth of weeds, pests and insects, all of which do a lot of damage to the growth of crops. The most significant area included in this type is the Thakurdwara uplands.

Owing to the wetter climate the area is devoted to the cultivation of upland rice, which is usually followed by gram.
Other crops include wheat alone or wheat-gram mixture, jowar, etc. But sugarcane is negligible. Some patches of wasteland are still found here and there. The area is not so densely populated and there are no large settlements excepting the small and decaying town of Thakurdwara. The average yield of foodgrains is below 200 kg. per acre.

This area has suffered many vicissitudes. For example, the sample village Bamnawala (see Fig. 56) was mostly cultivated during the latter part of the last century. But, later on, it was deserted and was converted into waste and jungle. Again it has been reclaimed more recently. Since both the old zamindars and their tenants were very little interested in this 'marginal' land, some adverse circumstances could easily lead them to neglect the area and leave it to nature.

But, since the rehabilitation of some refugees from West Pakistan and the desire of the government to reclaim wastelands, the conditions have changed and the wastes have been cleared for cultivation by over 80%. These energetic refugees are, however, resourceless and, mostly ignorant about better methods of cultivation. They are mutually quarrelsome, too. Their services should be better utilized by the state in a condition of partnership; the state owning the land, providing machinery, implements, livestock, manures, fertilizers, scientific know-how, marketing, agency and means of transport, while these refugee cultivators should provide labour. Given the necessary equipment and good management, this land can be maintained at a level of medium productivity. Since the population is not very dense in
this area, it can be surplus food grain region of the district, supplying much wheat, gram and rice to the urban population. In the hands of the individual farmers, however, it will remain a poor food grain area and may be deserted in time of duress or if the refugees get better fortune elsewhere. Under good management, however, it may also be put under grass and feed crops on which livestock can be reared. The opening of the Kashipur-Thakurdwara metalled road and its extension north-westward can also encourage sugarcane cultivation provided cheap irrigation facilities are available. There is a sugar mill at Kashipur (Nainital) and another at Seohara (Bijnor) at the two ends.

The area of such land is about 65,000 acres.

**Poor Quality Land**

It is land of low productivity owing to extreme wetness or heaviness of the soil requiring extensive drainage works, or extreme shallowness or course sandy nature of the soil rendering it highly dry, water thirsty and hungry for manures, to highly undulating character, e.g. the sand dunes and rawines on the river valley sides, to re-infection in the soil or to heavy soil erosion resulting in khabar surfaces. Such land can be subdivided into various classes but, briefly they are as under:

8. **Poor Quality Heavy Land**

It includes the tracts of Matiyar III lying in some of the depressed parts and the marshland in the Ganga khadar. Such areas are mostly wastelands. In places, some rice, gram or other moisture loving crops may be raised in small strips, particularly
in the north-eastern tracts. They have been so, for ever, since it has not been within the means of individual farmers to reclaim them on a large scale.

The future of such land rests with the interest of the government in its reclamation. It can, however, provide rich grazing grounds for the cattle after reclamation and reseeding with suitable grass.

The area under this class is estimated about 35,000 acres.

9. Poor Quality Medium and Light Land

It includes the patches of 'baniar' having some natural or semi-natural vegetation or seasonal coarse grass whereon livestock graze for some weeks during and after the rains. Some of them are located near settlements and along roads and rail tracks. But mostly they are found in the khadars of the Ganga and Ramganga rivers. Coarser sandy wastes are, however, found in the bhurlands, where they are 'burnt' during the hot season. But, after the rains, some scattered blades of grass shoot up through the sand (Plate II). Sitarbani is a common weed of such areas while tamarisk grows in the khadars. Both these provide rough grazing and material for fuel. The best product of such land, however, is the thatching grass, which is manufactured into the rough bed-twine and screens (Plates X & XI).

Excepting the belts of wastes along with the roads and rail tracks which are new additions, most of these areas have remained wasteland for ever. They should be left to wilderness
with the addition that some trees should be planted here and there among them. But on the uplands, nearer the settlements and wherever possible elsewhere, they should be preferred for the extension of settlements, roads, railways and other non-agricultural uses, thus, saving an equal extent of good and medium quality land for arable purposes. As regards the wastes along roads and rail tracks and those near the settlements possibilities of planting suitable trees and reseeding with grass must be exploited (see Fig. 63).

Land in this category is estimated about 50,000 acres.

10. **The Poorest Land**

It is the land agriculturally useless in its present state and also requiring prohibitive expenditure for its reclamation. The various mounds of debris marking the sites of old deserted settlements, brick kilns, dug up places, pure sand dunes, deeply gullied slopes, etc. fall in this category. It is mostly the result of man's conscious or unconscious activities to exploit the land without caring for the future consequences. Huge efforts will have to be made to reclaim such land even for non-agricultural uses. Yet, it will have to be reclaimed sooner or later as the pressure of population increases more and more.

The area under this class is estimated at about 30,000 acres.

Fig. 64 shows the tentative distribution of these classes of land on the map. It is clear that the good quality land, which can be highly productive under good management is
abundant. It amounts to 60.7% of the total area of the district. But a large part of it is suffering from lightness of soils requiring more of irrigation facilities while a considerable part requires proper drainage for its full utilization.

Medium Quality land amounts to 24.9% of the total area of the district. In it also the share of the light land is major so that much of it can be improved by the extension of irrigation, while the rest requires a thorough check up of the whole system of land management.

Poor Quality land amounts to only 7.8%. Its utility can also be exploited by adopting certain measures which are not within the means of the individual farmers, but can be provided by the state.

Appendix Table XLIV sums up the estimates of the various types of land in the district.

The present outline of the N.E.S. blocks seems to have been determined arbitrarily. It needs certain readjustments with reference to the regional aspects of the various tracts (cf. Figs. 61 & 65). Giving a regional character to the administrative blocks would emphasize some of the local problems and facilities towards which special attention must be devoted by the officers in charge of the planning administration. Even the names of the blocks should be significant enough to pronounce certain regional characteristics. The lessons of the sample studies carried out by the author are summed up in the following paragraphs as an outline for the detailed work required for
actual regional planning.

Planning of land use in the Katehr Bangar

In the Katehr bangar and other areas where there are well-drained, easily tillable and fine humus soils, where irrigation facilities are well developed and there is no lack of will to work on the part of the inhabitants, the uneconomic holdings, poverty or lack of resources for improvement, ignorance and low yields leading to low nutrition, drudgery and wastage of human capabilities are the main problems which affect proper land use. Planning under such conditions should be directed towards subsidising the willing workers with money, persian wheels, implements, manures, better seeds and the know-how to increase the per acre yields. Cooperative or joint farming may reduce the evil effects of the smallness and scatteredness of the holdings. Demonstration cooperative farms should be set up in some of the villages with full support and awards from the government for increasing the per acre as well as per capita yields. Such farms should be made the centres for the propagation of the new developments in the sphere of agriculture. They can also serve as regional experimental centres for research in the application of new techniques to agriculture.

In these uplands, there is little land for the extension of agriculture. Whatever waste is left it lies along the governmental properties, e.g., railways, roads, ponds, etc. The departments concerned with their management should be prevailed upon by the planning authorities to use these wastes properly, say, by putting them under trees of various descrip-
tion and by seeding them with grass (F: 10, 43 A).

Planning of land use in the upland of lighter soils

In the uplands with lighter soils, lying to the north of the Katehr tract, though the tube-well irrigation facilities have improved through the efforts of the state and private persons, much help is required to provide an adequate number of Persian wheels to the peasants for the required intensive cultivation. Underground pipelines should be laid to avoid wastage of tube-well water in transit, while the water charges should be regulated on the basis of the extent of irrigation and not the time for which the well is worked or the electricity consumed. This will reduce the difference in the costs of production of crops in different fields. The western Ramganga canal annually provides irrigation to about 15,000 acres of land in the tract between the Ramganga and Ban-Gangan water courses. Should it be possible by a small canal irrigation scheme to utilize the waters of the Gangan Nadi in the tract lying to the south of it, then, the provision of cheaper irrigation water may make this area more productive than at present.

The slightly undulating topography in this tract renders the occurrence of shallow depressions of heavier soil and broad ridges of lighter soil a common feature, which can be utilized in the diversification of crops and farming activities. Mixed farming in this region would provide the organic manures essential for binding lighter soils. Three large towns, viz., Moradabad, Amroha and Sambhal are situated at the three corners of this tract and their urban population requires much dairy
produce besides foodgrains and sugar which are the main products of the area.

Planning of land use in the Udla and Panmar tracts

The Udla and Panmar tracts require an altogether separate treatment, since, their main problem is the defective drainage. It may be improved by providing sufficient wide culverts under the rail and road tracks connecting Moradabad with Delhi and by dredging such rainy season streamlets as the Jol near Khaliqpur Kalan, and the Chhoiya near Nizam Nagla and Semli. The land in the beds of the 'chhoivas', 'jols' and 'ghails' should be acquired by the state and its cultivation prohibited forthwith. They are the natural drains developed according to the topography of the area. As far as possible they should be made straight and dug deep. A drainage and groundwater survey is essential to provide a reasonably permanent pattern of drainage, here. Broad leaved water loving plants may also be planted to advantage on the sides of all paths, roads and water channels so that they may utilize some of the subsoil water by transpiration. The indiscriminate discharge of water from tube-wells in these tracts is undesirable and so it should be strictly avoided, while pucca drains must be provided to carry any extra water into the nullahs. The improvement of the drainage of this area would render it almost as fertile as the Katehr tract, since it has quite good soils. The existence of Sugar Mills at Amroha and of the rail and road facilities through the middle of this tract are great assets of the area. It can also have a diversified pattern of crops and farming.
activities owing to the presence of a number of shallow depressions of heavier soil and broad ridges of lighter soil within it.

Planning of land use in the Bhurlands

The bhurlands of Sambhal, Hasampur and Auroha have their main draw-back in their light, dry and shifting soils. Their improvement is possible by the extension of irrigation facilities and mixed farming yielding much organic manure for the light soils. The depressions therein are usually quite fertile and can be devoted to the cultivation of sugarcane. But some of the chhoiya depressions are too sinuous and need straightening; unless the flow of rain water is rapid enough, the bhur soils become liable to saturation and, hence, defective for cultivation. In normal years the bhurlands can be quite good producers of foodgrains and other crops provided water and manures are sufficiently available and suitable crop rotations are devised.

The Bagad bangar is also thirsty and needs the extension of irrigation facilities. In places it also suffers from defects of drainage. Moreover, it is far removed from the progressive parts of the district and lacks means of communication and transport. Provided these defects are removed, this tract can also improve with regard to its agricultural capabilities, since its soils are mostly stiff loams.

Planning of land use in the Thakurdwara uplands

In the rainier east, only protective irrigation is required. Its provision can lead to the improvement in the crop
pattern by facilitating the cultivation of transplanted rice, sugarcane, maize, etc. But the major defect of the uplands of Thakurdwara lies in soil which needs much curing and manuring. It has been rendered defective by erosion. Numerous nullahs have carved out deep and meandering channels through these uplands giving them an undulating character. Had it not been for the pressure of population this area would better have been devoted to forests and grasslands, where animal rearing might have been the main farming activity. Now, planning in this tract should be related to the checking of gully erosion and levelling of the undulations. Grassy meadows can be kept along the nullahs and devoted to the rearing of animals. A soil survey of the area is essential to determine the best use capabilities of the land there.

Planning of land use in the trans-Ramganga lowlands

The lowlands of the trans-Ramganga tract have some of the most fertile and tillable loams. But they need protective irrigation facilities. A small canal irrigation scheme utilizing water from hill streams is under construction in the eastern part of the Thakurdwara tahsil (Fig. 66). On the Moradabad side to east of the Dhela Nadi also some such scheme should provide cheap irrigation, in addition to the undependable and limited terai canals which irrigate the north-eastern extremity of this tract. Moreover, subsidies should be freely given to the peasants for the construction of masonry wells or persian wheels.

* The map was prepared with the help of the officer incharge of the canal construction at Thakurdwara in November, 1956.
There are some clayey depressions in this tract where the peasants can grow little else than rice. By providing some drainage channels to carry off excessive water easily, it might be possible to make them suitable for double cropping, rice to be followed by wheat, gram, oats, peas, etc. It might also be useful here to plant broad-leaved waterloving plants on the sides of the paths, roads and water channels so that some of the extra soil moisture may be utilized and transpired by them.

**Planning of land use in the khadars of the Rivers**

As regards the khadars of the Ganga and the Ranganga rivers and the lower Gangan valley, where the havoc played by the rivers is the main factor affecting proper land use, planning should be directed towards finding such varieties of crops as can mature before the normal flood time. Or the hot dry season cultivation should be extended more widely, there. Measures should be adopted to make the precariousness of these areas as less as possible. The wastelands in them should be devoted to woodland and grass so as to stabilise the channels of the rivers and render their shifting less frequent. The same areas can provide extensive pastures for animals, while their woods can meet the timber and fuel requirements of the urban people. The extension of cultivation upto the waterside and, sometimes, within the beds of the streams should be discouraged. The hard labour of the poor peasants must not be allowed to be washed away by floods, year after year. The sanctity of these rivers should be utilised to arrange the settlement of many a religious-minded retired people there.
Land use Planning at the District Level

The total area of the Moradabad district is about 1,467,686 acres to serve the needs of 1,660,955 people (census 1951) while the population is increasing at the rate of 12.7% in ten years (1941-51). The agricultural classes number 1,111,288 while the total culturable area is 1,342,362 acres or about 0.95 acre per head of the agricultural people. If the whole of it is divided among family holdings at the rate of eight acres per family of six as outlined in the foregoing, then only 167,783 families or 47% of the total population can be accommodated in agriculture so that 67,467 families or about 29% of the present agricultural population will have to find livelihood from other means.

Assuming that the population of the district will be 2.1 million in 1971, to provide a balanced diet for it would annually require the foodstuffs as noted in column 2 of the table below. Assuming further that the per acre yields will have increased to the levels shown in column 3 the land required to produce these foodstuffs will amount to as shown in column 4 of this table:

<table>
<thead>
<tr>
<th>Foodstuffs</th>
<th>Annual requirements (in 1,000 kgs)</th>
<th>Average per acre yields</th>
<th>Land required acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foodgrains</td>
<td>306,600</td>
<td>400 kg</td>
<td>766,500</td>
</tr>
<tr>
<td>Pulses</td>
<td>65,800</td>
<td>300 kg</td>
<td>219,333</td>
</tr>
<tr>
<td>Green Leafy vege-</td>
<td>87,600</td>
<td>5000</td>
<td>17,520</td>
</tr>
<tr>
<td>tables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Root Vegetables</td>
<td>65,800</td>
<td>5000</td>
<td>13,160</td>
</tr>
<tr>
<td>Other</td>
<td>65,800</td>
<td>5000</td>
<td>13,160</td>
</tr>
<tr>
<td>Fruit</td>
<td>65,800</td>
<td>5000</td>
<td>13,160</td>
</tr>
<tr>
<td>Milk</td>
<td>218,050</td>
<td>800</td>
<td>272,562</td>
</tr>
<tr>
<td>Sugar &amp; Jaggery</td>
<td>43,750</td>
<td>2000</td>
<td>21,875</td>
</tr>
<tr>
<td>Vegetable oil, Ghee.</td>
<td>43,750</td>
<td>100</td>
<td>437,500</td>
</tr>
</tbody>
</table>
The requirements of Fish, Meat and Eggs will be additional.

The total land required to satisfy the food needs of the people is estimated to amount to 2,432,770 acres whereas the whole cultivable area is 1,342,262 acres. Evidently, this food supply can be secured only through increasing multiple cropping and by continuously pushing up the per acre yields.

Change in Diet Habits

If diet habits and likings of the people can be directed more in favour of the non-foodgrain sources of energy, agricultural production can be more easily increased and diversified. The processing of foodstuffs in suitable ways can also secure higher food values per unit of produce. Potatoes provide a high calorie crop, the yield of which is many times higher than that of the foodgrains. The average per acre yield of potatoes in some of the better farmed countries is 253 maunds in Belgium, 204 maunds in U.K. and 200 maunds in Germany. In India it is 73 maunds, in Uttar Pradesh 80.7 maunds; in this district, it amounts to about 94 maunds or 3,500 kg. per acre. At 700 calories per kilogram it represents about 2.5 S.K.U. Thus every acre under potatoes has much more carrying capacity than that under wheat, rice or any other foodgrain even when producing competition yields. Besides the potatoes do well in much poorer soils and climatic conditions than do rice and wheat. Then, the potato-land

* Govt. of India, Directorate of Marketing & Inspection, Ministry of Food & Agriculture, Report on the Marketing of Potatoes in India, Marketing Series No.85, Revised ed., Manager of Publications, Delhi, 1956, p.5 and Appendix V. The yield of U.P. is the average of five years 1948-53. The yield for Moradabad Distt., is by courtesy Distt. Agricultural Officer, Moradabad.
can be easily double or triple cropped to advantage. Land use planning should, therefore, include in its programmes the making of such items popular in the diet of people. At present the area under various sorts of vegetables and potatoes amounts to 9,895 acres. It must be increased manyfold to supply the needs of a balanced diet. As regards fruit orchards the present area (20,000 acres) under them is not small. It is more than would be required to meet the requirements of the population in 1971, if the yields are enhanced.

By fixing the minimum agricultural prices in advance and with central buying to afford a guaranteed market as in Japan, U.S.S.R. and China, it may be possible to provide the farmers the stable basis on which they might plan their crop programmes. The cultivation of desirable crops can also be encouraged by fixing the minimum prices at a higher level. Of course State Trading would become a necessity if planning of agricultural land use is to be made effective.

Whereas only 21,875 acres should be sufficient to supply the sugar and jaggery requirements of the population of the district in 1971, to be able to purchase some of its needs from elsewhere, the district must devote more land to sugarcane for sale, since geographical conditions are more suitable here for it than for other crops such as cotton.

The census of 1951 recorded 61,532 buffaloes and 57230 cows in milk in this district. This number can be
sufficient if the average annual milk yield per cattle and buffalo in milk is raised to about 5000 kilograms. Much benefit can be achieved through the extension of groundnut cultivation so that through local crushing units groundnut seeds should supply sufficient vegetable oil for the local needs.

Meat and fish diet is not popular, here, owing to the sustaining Hindu bias against it. Data is lacking with regard to the carrying capacity of livestock in this area. But, even in U.K., one of the most efficiently farmed countries, it requires 2\times times the acreage required for dairying and 10 times the acreage of wheat or potatoes to be meat eaters*. Hence, we may rule it out from our consideration. Pig, poultry and fish can serve the meat eaters without much burden on land. For fish, ponds and streams should be exploited fully. More people, however, take eggs than meat and fish. The present number of poultry (73,122) seems to be inadequate to supply the demands of the district. It can be multiplied as the eggs and fowls are becoming more and more popular.

Animal Husbandry

Obviously, for profitable animal husbandry and dairy farming the selection of good quality local breeds is the urgent necessity. Proper feeding may increase their milk yields. For that, however, a regular supply of green fodder throughout the year is very essential. As regards the draught animals a reconsideration of the relative merits is recommendable. For example,

one camel can do more work per day on the persian wheel than do two bullocks. One mule, pony or horse can do better work at the cart drawing than two bullocks. More donkeys can be used to carry lighter loads on their backs. But in the individual family holdings the farmers cannot afford to multiply the number of animals for the various jobs. They, therefore, use the same bullocks for the plough, the persian wheel, the cart and other jobs. In cooperative farming, these economies can be easily utilised and a rational use of the livestock made effective.

As regards fodder, naturally, a crop which puts forth a quick growth and at the same time which gives a sufficiently large quantity and a satisfactory quality of fodder should be the aim of the cultivator. In the kharif season, Jowar (sorghum) Maize, bajra, guar, etc., have been found to be quite suitable. Under irrigation jowar and maize can be grown for fodder in rabi, too. Carrots and peas in mixture, methi and kulthi are also good fodders. Lucerne (Medicago sativa) is the king of green fodders and is suited to dry atmospheric conditions. Root crops such as carrots, turnips, beets, etc., are also very nutritious fodders.

"Substituting turnips for jowar stalks in the cow's food the milk yield has been increased by 2 lbs. per head in ten days."

In the khadars, where surplus grass is available after the rains, the useless cattle can be segregated in gosadans. The census of 1951 returned 106,853 useless cattle: 99,775 were dry cattle and buffaloes, 5,750 bulls or bullocks over 3 years not in use for breeding or work and 391 cows and buffaloes over 3 years not in

use for work or breeding purposes. All such cattle must be removed to the wastelands.

**Improvement of waste lands for multiple use**

In the waste belts running along the railway tracks and roads in the district the planting of fruit and timber trees together with seeding of grass can be quite an economic proposition. In places double rows of trees can be grown with a suitable provision of watch and ward, which means employment for hundreds of families.

The principle of multiple use of land should be extended to the plots of land attached to the official bungalow like residences and governmental buildings found in the so-called civil lines of the towns. In the railway settlement of Moradabad, in particular, there are many such pieces of land. They can serve as open spaces as well as yield some fruit, flowers and kitchen vegetables.

As regards the old clay pits from where earth has been dug for making bricks or for other purposes, addition of fertility to the land, artificially, can bring them under cultivation again. The mounds left by old brick kilns afford sufficient burnt earth to fill up many undesirable pits near the towns. In this way both the mounds and the pits can be levelled up for recreation and building purposes, while an equal extent of the good agricultural land can be saved. Old towns such as Moradabad, Sambhal, Amroha etc., have considerable parts in their older sections which have been converted into ruins. A good town planning should aim at reclaiming these ruined spots for building purposes, parks etc.
Yet, the question looms large as to how to provide work and means of livelihood to 53% of the population or 188,620 families of six persons each. The establishment of a few large scale industries such as a textile mill will not absorb so much labour force. It is only the small scale and cottage industries and small scale business and multifarious services that afford some solution. The organisation of cooperatives for farming, credit, storage, supply, marketing, minor irrigation schemes, better housing schemes, road building, sanitary and educational services, social and cultural activities, research and planning schemes, etc., can also offer much scope for the absorption of this manpower.

Gur-making, ghee-making, oilseed crushing, cotton ginning, flour grinding, dal milling, rice husking, bakery, confectionery, khandsari, soap making, mat, rope and basket making, moonj twining, leather tanning, bangles and beads, woollen blanket making, handmade paper industry, bee keeping, cottage matches industry, handmade paper for decoration, bidi making, spinning and weaving of khadi and coarse cloth, calico printing, pottery and glazed earthenware, etc., can be carried on in the countryside. With their organisation in cooperative societies and their market supported by government against competition from mill products, they may employ many more persons whole-time or part-time in the countryside than they do at present. In addition, green house, nursery of plants, growing and selling
of first class seeds, compost making, preparation of blood, horn, hoof and hair meal, fish culture, tallow making etc., have a considerable scope.

By the present methods only 50 to 60% juice is extracted from sugarcane and the gur manufactured is of poor quality. Lack of facilities for stocking and marketing at the proper time lead to more loss. Should implements and other conditions improve, the cottage gur and khandasri industries can be more profitable than at present. Research work carried out at the sugarcane Research Station, Muzaffarnagar has shown* that the recovery of sugar from sugarcane is about 11% in gur making while it is only 8.5% in the case of mill sugar. Whereas the yield of juice from sugarcane by better type bullock worked cane crushers can be about 60 to 65%, in the mills it is generally above 80% and by the power crushers it is about 70%. Thus, the improved crushing implements can be employed to get a higher percentage of juice from sugarcane. In the case of gur making the necessary fuel is available from the superficial refuse (khol) of the cane which is sufficient for this purpose if the boiling pans are of suitable types e.g. the Bijnor and Meerut pans. The optimum period of harvesting cane coincides well with the gur making period. If a peasant grows an early variety like Go.313 in some plots and the mid-season and mid-late varieties like Go.421 and Go.433 in other plots, he can get best outputs both from quality and quantity point of view.

* Courtesy Cane Agronomist, Sugarcane Research Station, Muzaffarnagar. The experiments were carried out in the years 1954-56.
The non-edible oil-seeds such as neem, castor, mahua, etc., are wasted for lack of proper facilities for collection, grading, stocking and marketing. Whereas the provision of these facilities can save these seeds for the industrial uses, the edible oils, so far used in them, can be saved for human consumption.

The animal carcass after natural death of the livestock is mostly wasted. But if its various bye products are produced they can mean a saving of Rs. 50 to 60 per animal. A great deal of useful material is also wasted when bones are allowed to dry in the sun.

These illustrations show that there is scope for both increased employment and increased earnings though proper use of certain misused or under used resources and through the development of more efficient processes of work. Japan offers lessons in small scale industry and the resourcefulness of the working people. Much can also be learnt from the Amritsar, Jullundur and Ludhiana districts of Panjab where human intelligence has led to much progress of small scale industries, mostly based on imported raw materials. If proper efforts are made and the incomes increase, many articles of house decoration such as mats and printed cloth can find large demand. Vessels of glazed pottery can also be made popular. From Japan can be learnt a greater use of wood, straw, bamboo and handmade paper for the preparation of various objects.

* The Indian Express, Jan. 1, 1960, p.3, col. 5.
** Kumarappa, J.C., op.cit., p.21.
of footwear, umbrellas, rain coats, rain hats, bags etc. The possibilities of hosiery, footwear, porcelain ware, enamelled wares porcelain teeth making, glass blowing, insulators, sanitary wares and glazed tiles, bicycles, sewing machines, water pumps, agricultural implements particularly persian wheels, small tools, sugarcane crushers, diesel engines, electric goods, utensils of iron and steel, optical instruments, sports goods, umbrellas and umbrella parts, matches, dolls, mechanical toys and other toys of various description, wire netting for sieves, tea strainers, windows and fencing, etc., rubber tyre retreading particularly for the country carts, plastic articles, watches and clocks, etc. must also be utilised in the urban and rural centres. Whereas waste rags, etc., can be shredded, carded and spun into yarn and woven into carpets, canvas or gunny cloth may be used for making carpets by embroidery on stencilled patterns with specially devised needles. As the cultivation of sweet potatoes increases, starch can be made out of them. Tamarind seeds can also be used for extracting starch from them. In so far as well-polished rice is prepared for the urban markets, its bran can be used for the extraction of valuable oil and the bran cake can be utilised as fodder or fertilizer.

The scope of industry in this underdeveloped area is unlimited and with proper efforts and organisation it can be made to absorb most of the population which may be rendered surplus by the rationalization of agriculture, animal husbandry etc.
The census of 1951 enumerated 231,400 households in the district - 255,605 in the rural areas and 75,795 in the urban areas. Keeping the trend of population increase in view and also the improvement in age structure, we can visualize that by 1971 the total number of households in the district may be about 500,000 - 386,000 in the rural areas and 115,000 in the towns. Though frugality in the use of land is essential, a basic minimum living space for an average household must be provided.

For each household in the towns, where most houses are double storeyed, an average housing space of 250 square yards seems to be essential. To provide it would require nearly 6,000 acres of land. The growing tendency of having open bungalow type residences on the outskirts of the towns must also be taken into account. They generally average about 10 to the acre. Much housing space is also required in the urban areas for the growing needs of industry, business, storage, educational institutions including students' hostels, governmental establishments, cinema halls, bus stands, petrol pumps, hospitals, rest houses, etc., together these may mean almost as much land more as required for actual housing accommodation, i.e. 6,000 acres.

Houses in the rural areas include more space for storage, animals, etc., than the houses in the towns and mostly

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these houses are single storeyed. Each rural household, therefore, needs/average housing space of about 500 square yards. This would mean about 40,000 acres of land for the rural housing inclusive of the streets inside the villages. Besides, in the rural areas, provision must be made in the better planning of villages for compost pits, panchayat gharg, schools, threshing grounds etc. At an average of 3 acres per village this would mean 8,000 acres more. Brick-kilns and earth-works supplying building material and raw material for the indigenous pottery industry, etc., also must be provided for. About 5,000 acres may be required for them. Much space is also needed, in both towns and villages, for playgrounds, parks, bathing ghats, ramila grounds, mosques, idgahs, temples, churches, graveyards, cemeteries and cremation ghats. About 10,000 acres will be required for these purposes.

Land Requirements of Roads, Railways, Irrigation & Drainage

Roads also need much development to meet the requirements of the growing volume of traffic. If we provide for 3,000 miles of all sorts of roads and give them an average width of 30 feet their land requirements would amount to about 11,000 acres. The land space required for the 200 miles of railways, railway stations, rail-yards and go-downs allowing an average width of 80 feet would mean about 2,000 acres. Then, provision must be made for canals, irrigation channels, wells and drains. With the required development in irrigation, drainage and drinking water facilities these would mean about 12,000 acres.

* cf. Figs. 21 & 67.
2,000 acres for wells, providing about a hundred wells per acre and 10,000 acres for irrigation and drainage channels providing a length of one mile for every fifty acres and with an average width of one yard. To this must be added the present average area under water i.e. 42,589 acres.

Thus, on a rough estimate the above detailed needs would require about 142,589 acres of land. At present, the total land agriculturally unproductive amounts to 125,424 acres so that this category of land would increase by about 13.7% when planning of non-arable land use is carried out, properly.

Planning the Development of Rural Centres

One important fact that has been noted in the course of this study is that cultivation is carried on more intensively in the neighbourhood of larger settlements than away from them. This fact seems to suggest that if the population is more evenly distributed in a large number of rural centres with population varying between 10,000 to 20,000 each, it might be more convenient to foster this type of mixed farming and market gardening on a wider scale in the district. Hence, it is suggested that, on the one hand, the growing size of the large city like Moradabad should be controlled at about 1,50,000 persons; for Amroha, Chandausi, etc., it may be 50,000 persons. On the other hand, number of smaller towns should be planned to be increased up to 25 so that there may be about one town for every 100 square miles. Besides the present towns, the settlements which may be selected
MORADABAD DISTT.
SITUATION IN MACROREGION
for this type of planning are shown in Fig. 65. The spread of educational facilities, water supply, electricity and transport will make this scheme quite practicable.

**Land use Planning at Higher Levels**

The functions of the micro-regional planning are expanded at the macro-regional level where studies relating to the climatological conditions, market conditions, broader aspects of crop suitability, crop yields and crop relations, etc., can be carried on in larger institutions. Planning of the major drainage and irrigational schemes, supply and marketing including transport facilities, location of larger towns and their expansion in relation to their umlands, etc., can be done only at the macro-regional level and the land use planning activities at the micro-regional and district levels must be under the direct supervision of the macro-regional authorities. Fig. 68 shows the situation of the Moradabad district in its macro-region. Most of the bigger and long term schemes related to the development of irrigation, drainage, power, transport, commerce, industries and demographic structure influencing the district must be chalked out having the whole of this area in view. As at present, the western Ramganga canal which supplies irrigation here has been constructed in the Bijnor district. The terai canals pass through Nainital. The newly planned canals in Thakurdwara tahsil will take their water from a hill stream in the Garhwal Himalayas. Electric power in the district is supplied from the Ganga hydro-electric Grid. The sugar mills at
Rampur, Kashipur and Seohara partly draw upon the sugarcane from this district while the trade of Moradabad benefits much from its contacts far and wide. Such illustrations can be multiplied, but they would all emphasise the same fact of macro-regional planning as stated above.

The role of the state and national governments in land use planning is quite evident, since all organizational and administrative changes necessary for this planning must have legal sanctions, possible only through the state and national legislatures. The welfare state as we have in this country has to play a great part in the economic and social well-being of the people. On the one hand land use planning involves certain restrictions on the favoured few, on the other, it necessitates the provision of certain facilities to the overwhelming majority of the small land owners. Some suggestions have already been made in this regard, in the foregoing, here, it seems sufficient to point out that the main functions of the state and national planning consist of providing

(a) A suitable agrarian structure e.g., a minimum economic holding to each peasant family or cooperative farming.

(b) Cheap, if not free, and dependable irrigational facilities, better a Persian wheel to each farm family.

(c) Necessary drainage facilities.

(d) Basic capital, implements and manures to work the farm efficiently.

(e) Credit facilities for the requisite improvements.
(f) Improved seeds, improved implements, better breeds of livestock, etc., at reasonable prices.

(g) Guaranteed minimum economic prices for all types of agricultural produce.

(h) Central buying to save the peasant from the exploitation by the unscrupulous middlemen.

(i) Necessary know-how to adopt the improved techniques of agriculture and the results of research work. Model farms run by the peasants in cooperation with the experts of the agricultural sciences.

(j) Crop competitions for all types of agricultural products at various levels and for various aspects of production, e.g., yield per acre, yield per capita, quality of yield and improvements in agricultural techniques.

(k) Necessary soil and ground water surveys showing the best use capabilities of the land in various localities. A team of such surveyors and research workers should be always on duty to serve the peasants' needs and to watch continuously the results of the application of their suggestions.

(l) Micro-regional and macro-regional planning authorities to guide and control all land use in the region. Their decision as to how to use a particular piece of land should supersede the decision of the land owners.

(m) An honest and enthusiastic administrative set up to enforce law and order as well as to carry out the planning programmes.

(n) Since land planning needs a continuous watchfulness
Central and State ministries of land utilization and land planning must be established.

(o) Numerous small scale and cottage industries to absorb surplus population and to reduce the pressure of population on land. In this area women do auxiliary work or household duties mostly. But they can be as good bread-winners as men as in Japan and other countries, where great many industries depend on them for skilled work. They are naturally painstaking, hardworking and agile.

(p) Necessary relief to the poor peasants who are depressed economically and cannot stand on their own legs.

(q) Proper utilization of the governmental lands, e.g., the waste belts along rail tracks.

(r) Standards of agricultural efficiency should be determined and enforced. If only potentially productive land is subject to taxation, the taxation of under-cultivated land can promote land reclamation and development.

(s) Efficient land use requires an intimate knowledge of the new techniques, demand and markets, a close touch with other workers in similar fields, sources of essential supplies, etc. Hence, at the base of all progress must lie a suitable type of adult education of both men and women.