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II. Population in Relation to the Development of Agriculture.

Preliminary draft report submitted by P. L. Sherman, Rapporteur

(This draft is circulated for comment among participants in the Conference. It is not for publication in its present form.)

The Background

1. The relation between agricultural development and population cannot really be isolated from problems arising from man's relationship to all the natural resources available to him on earth, sea and in the air. The size, efficiency and living standards of agricultural populations depend increasingly on communications, machinery, fertilizers and pesticides, and above all on the demand for agricultural products from urban populations whose income in turn depends on the successful exploitation mainly of non-biological resources on an ever expanding scale.

2. If in the past sharper fears have been expressed about the possible failure of agricultural rather than non biological resources to meet the needs of a growing population, it is simply because food is one of man's basic fundamental requirements - and because, in a real sense, the whole sum of man's activities, the successful fulfilment of all his needs and the creation of new needs that play so important a role in the evolution of civilization, depend on his food needs being met. This is a fact that mankind can ignore only at its peril.

3. The dangers that at present confront the world have arisen in large part because this fact has not been adequately acted upon. Indeed, in some part of the world an abundance of goods and services on an increasing scale is being produced, some of which may appear to have little relevance to the genuine needs

of an evolving civilization, yet in others large numbers of people do not have enough to eat and malnutrition with its inevitable effect on health and efficiency is widespread. This paradox is perhaps all the more remarkable in that man's optimum requirements for food are largely fixed both in quantity and largely in quality, and thus set a tangible objective for achievement, whereas no apparent limit can be placed on the expansibility of man's needs for the products of industry or other activities.

4. Approximate estimates have been furnished to the Conference of the increase in food supplies needed to feed the population expected in 1980 at levels somewhat higher than those currently prevailing, especially in the less developed areas. The effect on national average requirements of changes in the age and sex composition of population, except for one or two countries, does not appear to be appreciable. Significant changes in per caput requirements may of course result from changes in the sizes and distribution of national income and from changes in occupations. This is a field of research in which much work clearly needs to be done. Ignoring such changes, it has been calculated that in order to achieve a moderate improvement in nutritional levels by 1980, supplies of cereals - the most important staple food - need to be increased by nearly 50 per cent. The relative increases are even greater for protective foods - meat by roughly 70 per cent, milk 75 per cent and fish 90 per cent. This compares with an increase in population of about 40 per cent in 1980. The required increases would of course have to be far higher especially in the less developed over-populated regions, where prevailing consumption levels are very low and higher still if requirements are based on an optimum diet instead of moderate improvement. These figures disclose something of the dimensions of the problem, the most important aspect of which is the need to narrow the wide gap between the well fed and undernourished regions of the world.

The Problem

5. With this background the Meeting examined and attempted to provide clues to the solution of the main questions linking agricultural development and population:

(a) Can existing and potential agricultural, fishery and forestry resources be effectively mobilized to ensure over the next decades an increase in food, agricultural and forest production in excess of the growth in world population, so as to meet more fully the world's need for food and forest products in all parts of the world? What are the prospects that this will be achieved and what means must be used?

(b) What changes in the size, composition, efficiency and living standards of the agricultural population must accompany the achievement and what are the prospects and possibilities?

The marked differences in the stage and status of agricultural development in different parts of the world - at one extreme heavily over-populated rural areas whose population barely eke out a miserable existence on tiny plots of land, at the other extreme areas where land is abundant and the use of modern techniques and scientific knowledge are exploited to obtain the highest agricultural productivity possible - call first for explanation and interpretation if solutions are to suggest themselves. How far are these differences due to variations in the types and quality of the soil and climatic and geographical conditions and how far to social and cultural conditions which have retarded progress through antiquated systems of land tenure, religious and social inhibitions, illiteracy and the like and to the consequent poverty which has impeded economic development?

Potentialities

6. Many gaps in our knowledge make it impossible to give precise answers to this question. The effects of weather conditions on crop production and the suitability of different crop for different climates are not sufficiently known. Many conflicting estimates have been made of the earth's food and forest potentialities, but without much more study both on the national and international levels, such estimates remain largely guesswork. Exhaustive and detailed surveys of actual land use in all parts of the world are urgently needed. Without this knowledge the historical, physical, social and economic factors influencing the way people actually use their land cannot be properly understood. Equally urgent is the need for exhaustive and detailed soil surveys in all parts of the world. Over major areas of the world where agriculture is important now or potentially, existing soil maps are of little or no use for agricultural interpretations. Without such soil surveys estimates of potentialities or plans for guiding agricultural development cannot be adequately made. Many years will be required to train enough soil scientists to do the work thoroughly, but in view of the great need, relatively simple procedures by which soil surveys of underdeveloped areas can be carried rapidly to an early stage, should be carefully investigated.

7. However, despite these gaps, it is possible to assert on the basis of existing knowledge, that neither poverty of soil nor unfavourable climatic and geographical factors constitutes an insuperable obstacle to a large expansion of agricultural production in the world as a whole and in different parts of the world. For example, it has been pointed out that with the aid of careful soil surveys and research, perhaps as much as 20 per cent of the unused tropical soils, especially those in the continuously hot and wet belt of tropical forest lying athwart the equator, could be cultivated adding

some 400,000 hectares or roughly 30 - 40 per cent to the world's present arable area. Large areas can be made more productive, especially for mixed farming, in the vast tropical savannahs of Africa, Latin America and Northern Australia, at present used almost exclusively for grazing, because of excessive summer rainfall followed by long dry seasons. Considerable scope exists for bringing more land into cultivation by irrigation both in the monsoon lands of Asia and some arid areas of Latin America, Central America and Northern China. Possibilities also exist in the Northern Podzols for extending area under mixed farming based on adapted cereals and forage crops and for the more intensive use of well watered, temperate zones in Australia, Uruguay and Southern Brazil, where sparse population has hitherto resulted in a purely pastoral economy.

8. The technical possibilities for increasing agricultural production by raising crop yields, expanding livestock numbers and yields per animal are perhaps even greater and in many respects less difficult and costly. A very wide margin exists between yields obtained in the more advanced countries and those prevailing in less developed regions. Climatic conditions, of course, can play an important part in these differences, but it can now be affirmed with some confidence that techniques and facilities are chiefly responsible. These differences can be greatly reduced by more irrigation, building up of soil fertility, the introduction of improved varieties of seed and species of animals, better pastures and feed supplies, better equipment and the widespread application of better farm techniques. On the basis of the performance of the average farmer in some of the advanced - but not necessarily the more advanced - countries, the resources and technical basis appear to exist for an output of cereals and crops at perhaps least twice, and in the case of livestock products perhaps four or five times the present leve. And this applies especially to the less developed regions of the world.

9. Similar scope exists in the fields of fishery and forestry. At present fish production of about 26 million tons annually provides only a very small part of the valuable animal protein available for human consumption. With the aid of research, it may be technically possible to double or treble the harvest from seas and inland waters without tapping more than a small fraction of the productivity of the waters. Forests, apart from providing man's needs for timber, also play a vital role in protecting agricultural land against erosion, flood and desiccation and in regulating water supplies. About one half of the present world forest area of roughly 4 billion hectares is as yet inaccessible; one third of the accessible forest is still unexploited. This constitutes a reserve which, after allowing for the likelihood that some part may be converted to agricultural use, is still large enough to meet the timber requirements of a much greater world population at even higher levels of per caput wood consumption than at present. Moreover, such expansion is held to be technically possible, while at the same time making fuller use of the protective role played by forests.

10. The realisation of technical possibilities for expansion of the nature described above would in any case imply tremendous investment and coordinated efforts on the part of governments and international institutions. Certainly such expansion can no longer be achieved, as of old, by the enterprise of individual pioneers. But even if we knew enough to gauge the world's potentialities with precision, it would be fatal to allow optimistic conclusions to engender a false sense of security. For the really vital question is, can these resources be successfully exploited in the face of all the innumerable obstacles interposed by economic, social, cultural and political factors, to meet the needs, year by year, of the world's expanding population? Here the evidence is far less satisfactory.

Agricultural Productivity

11. The most important problem is clearly how to raise the standard of farming in the Far East and in the backward countries of the Near East, Africa, Latin America, and Eastern Europe closer to the levels achieved by the average farmer in some of the more advanced countries of the world. Experience in the advanced countries has shown that increase in agricultural productivity per man is the real key to the growth in agricultural production. In Western Europe, for example, the sustained expansion of agricultural production - except for wartime interruptions - of roughly 2 per cent per annum in the past decades has been the result of an increase in productivity, probably at a somewhat higher rate. This is true also for countries like the United States, Australia and New Zealand, where the rate of increase both in gross farm output and productivity has been even higher. How formidable the problem is may be seen from some estimates, admittedly imperfect, submitted to the Conference, of agricultural productivity per man in less developed areas, compared with those for more advanced countries. Neither population nor agricultural censuses provide adequate data, especially on the actual number of man hours spent in agricultural employment, to facilitate reliable estimates of agricultural productivity. There is a real need in this field for much more research and for greater efforts on the part of Governments, to assemble more basic data. In general, production per head of the farm population in Oceania, North America and North/West Europe appear to be 10 to 20 times greater than in the Far East, Near East, and Latin America. It is true that estimates of production per hectare show a different story. Here countries like Japan, Egypt, Malaya, and Ceylon are to be found near the head of the table. But this situation usually reflects heavy rural over-population. Labour intensive methods of farming are the only way to maintain

the people. In some of these countries specialization on export crops of high value like cotton, rubber, tea and coffee provides a way of increasing productivity. Valuable exchange earnings accrue to the country, but as a rule not much benefit is received by the mass of subsidence or semi-subsidence producers who are compelled to concentrate on high energy foods like cereals and starchy roots to obtain a bare minimum calorie intake. Not only is agricultural productivity per man in these areas very low, but apart from indications of some improvement in most recent years, it has virtually stagnated for generations. Production per head in sparsely populated underdeveloped countries, for example, in Latin America, is usually higher owing to the greater abundance of land, but lack and misuse of capital and inefficient systems of land tenure impede development. Yields per hectare remain stationary at low levels. Obviously, the task is long and difficult. Its solution can be found only in overcoming the major retarding forces that have prevented the evolution of agricultural development along lines most suited to man's needs.

Evolution of Agriculture

12. The most typical pattern developed in advanced countries may be retarded as a process of gradual intensification. Settled agriculture began with low crop yields, sometimes maintained only by shifting cultivation. As population increased and techniques improved, methods were found of increasing yields and maintaining fertility of soil, especially by crop rotations and annual manures. The final step, however, only became possible when the growth of industry, urban population and incomes provided a market for additional production under conditions which, on the whole, gave the farmer both the incentive and the techniques needed to increase output. A fully intensive agriculture was developed by the integration of crop and livestock husbandry and by the introduction of specialized crops, thus achieving a high productivity per man as well

as per hectare. This type of mixed farming, with livestock husbandry predominant, in a sense completes an evolutionary cycle, for in primitive times the herding of animals preceded settled agriculture. In the newer advanced countries, largely opened up at the time when industrialization on both sides of the North Atlantic created a growing market for livestock products, the abundance of land made it unnecessary to go through an intermediate stage. Livestock husbandry became the main type of farming at an early stage, but more intensified crop production may come later with the growth of population. In the less developed areas, on the other hand, some countries, for example in Africa, have scarcely advanced beyond the first stage and shifting cultivation is still frequently practiced. In the heavily overpopulated regions in the Far East, in the Caribbean and in parts of the Near East, agricultural development has been arrested at varying points in the second stage. There is usually little diversification of food crops. Chemical fertilizers and specialized feed crops are rarely available. Such animals as are kept are mainly for draft purposes. Because of the heavy rural population, human manure sometimes takes the place even of animal manure.

Rural Overpopulation

13. But rural overpopulation is not itself an explanation of arrested development. Rural overpopulation is indeed not a simple concept because, apart from considerations of climate, soil and topography, the number of people a given quantity of land can support depends on the level of technical skills, transport and communications, capital available, the presence of restrictions of various kinds, etc. Rough estimates were submitted to the Conference of the agricultural labour capacity of land for different staple crops mostly in less developed countries, where methods of cultivation are relatively backward or even primitive. Estimates were also given of the extent of rural unemployment. The tentative nature of these estimates once again emphasizes the need for Governments to

establish reliable data on agricultural employment and underemployment. Nevertheless, from the evidence available it is clear that, except in certain circumstances, increasing density of rural population does not necessarily mean lower output per man. On the contrary, some of the more densely settled areas of the world are to be found in the smaller countries of Western Europe where, because of modern techniques, abundant fertilizers and large degree of industrialization, productivity both per man and per hectare is high enough to enable the labour of one farm worker to support many. Indeed, there appears to be little reason why any region in the world with adequate water and sunlight, should not be eventually cultivated by a farm population as dense as that in the most densely settled regions in Western Europe.

14. On the other hand, if economic, social and cultural development stagnates, the law of diminishing returns operates with increasing force as densities increase, until, as in some regions, the labour of one man fully at work on a farm will barely suffice to feed two people - and the limit of subsistence is reached. Life among the vast and heavily overpopulated rural areas of the less developed regions is characterised by this constant struggle against the law of diminishing returns. Some early civilizations may have indeed passed away when soil fertility was depleted. In our own era, population has multiplied, but only at the cost of recurrent famines and the barest subsistence standards for many millions.

15. The key to the problem in these regions is clearly a profound modification in the patterns and techniques of agricultures that have persisted for centuries. This can be achieved only by the spread of knowledge of better ways of farming, by the provisions of better seeds, fertilizers and implements, by the control of plant and animal disease, by consolidation of fragmentary holdings, by the provision of capital for expanding operations, and by the existence of large

urban markets, including the means of transportation to enable the farms to market increased output. In certain limited fields quick and important results can be obtained at small costs, for example in the control of animal and plant diseases or in the wider adoption of simple but more efficient methods of cultivation, such as, for example, the Japanese methods of rice cultivation that are being gradually applied in India. But in the main, progress can only be slow because of formidable difficulties.

Capital Investment and Industrialisation

16. Not the least is the vast amount of capital required to finance agricultural development programs. Agricultural population in the densely populated underdeveloped areas usually constitutes 70-80 per cent or even more of the total population. With low agricultural income, national income must also be low. In such circumstances farmers have little or nothing to spare for agricultural development, nor can Governments collect much revenue for this or other purposes except by oppressive taxes on land, animals or crop production, which further tend to lessen incentives to production, or by measures which may have serious inflationary effects. In less developed societies, farm credit has been mainly limited to assisting farmers over seasonal difficulties or crop failures, buying of farms, paying out co-heirs or expenses for weddings, funerals and the like. Landlords, middlemen and local money lenders have usually been the main sources of such credit, often imposing harsh and usurious terms. Beginnings have been made in many such countries to provide better means of credit but the entire scale of efforts needs to be raised. Little domestic capital is available for investment in farmers services characteristic of modern societies such as water control, storage facilities, processing marketing, transport and power, health and education. Finally, little capital is available for general industrial development. Without industrialization farmers cannot readily obtain goods

required for better farming nor sell increased output for the market. Outlets for surplus rural population are blocked. Indeed, industrialization is sometimes believed to be the main answer to the problem. But, while recognising its great importance, it should be kept in proper perspective. That the provision of man's basic needs for food can be achieved merely as a by-product of his other activities, would be a dangerous philosophy. On the contrary, the rate of industrial development is itself largely conditioned by progress in the agricultural sector. Urban communities depend for their expansion on adequate supplies of food and agricultural raw materials. A flourishing farm population is necessary as an important market for the products of industry. Experience in recent years, especially in sparsely populated countries in Latin America, and Oceania have shown that too speedy industrialization in response to temporary situations tends to divert much needed labour and capital resources from agriculture to industry, not only seriously affecting agricultural development, but causing undesirable distortions in the general economy. A balanced growth of the economy requires that agriculture and industry must keep in step. The best proportion of the total capital investment which should be directed to the agricultural sector and the types of investment needed, depends on the circumstances of individual countries. The requirements of capital in agriculture for a steady and substantial increase of agricultural production in the less developed regions are too large to be financed mainly from external sources. They must be met mostly from the regions themselves. The scale of foreign assistance is, however, still far lower than the amount that can be effectively utilized, and still greater coordinated efforts on the part of Governments are needed to enlarge it. But apart from the difficulties of mobilising capital for development, cultural, social and other obstacles must be overcome if programmes for development are to have

much chance of success. It would be idle to utilise large amounts on programmes which presuppose the abundance of skilled technicians and high standards of literacy and knowledge among backward peasants farm populations.

Resistance to change

18. Resistance to change is perhaps the most serious impediment to progress in the less developed agricultural communities. The traditions that support high fertility are rooted deeply in the cultures of most of today's agrarian societies, especially the least developed. For the large masses of agricultural people who carry on farm work with simple methods and tools and who lack animal or mechanical power, possibilities of increasing production are directly related to the number of hands available, especially at seasonal peaks. During large parts of the year there may be little to do. Total income for the individual worker may therefore be very low, but no other possibilities appear to be open. In such circumstances the only clear way in which the farmer can feel secure is to assure his labour supply within his own family. The network of family relations, duties and obligations which are a feature of the functioning of other institutions of such societies, reinforce the ideal of the large family. Such societies readily accept measures that promise to reduce mortality, but if methods of production remain unchanged and additional land is not readily available, pressure of population on resources grow. Where other outlets are not developed, this leads to surplus agricultural, underemployment, fragmentation of holdings, oppressive tenancy, and landlessness. This in turn makes any real improvement in agricultural efficiency difficult or impossible. Where little opportunity exists to acquire capital to put new practices or equipment into operation, the farmer can scarcely be expected to risk even a small part of his production by new methods. Resistance to change, therefore, appears as a cultural response to growing economic pressure on limited agricultural resources. The large family

attitude also makes difficult the transmission of intact farm holdings to the next generation. In many areas of the world, equal division among the heirs has been a factor in excessive fragmentation. Even where measures for exchange and consolidation of holdings and for limitation of the rights of sale or future subdivision are in effect, severe pressures arise when there are large families and therefore a large number of claimants. In the Western world on the other hand, the awareness of the consequences of continued subdivisions of holdings has been a factor in the acceptance of the smaller family pattern in agricultural areas. In an agriculture organised on modern capitalistic lines, the necessity to secure cash to pay off heirs may mean the liquidation of the holding. Thus, social pressures in modern societies are against the maintenance of the large family pattern.

19. Resistance to change among less developed agricultural societies can, however, gradually be overcome, provided basic values in these societies are not violated. For example, the advantages that might accrue to large families which could send many members into factories, soon yields to the insistence of children that they dispose of earnings in their own way. The higher fertility in agricultural communities observable in nearly all parts of the world does not remain unaffected by changes occurring in cities, especially where movement of people between country and town takes place in both directions. Again, efforts to reduce mortality have been remarkably successful because they promote the accomplishment of social values. In the same way improved methods and equipment are finally adopted once they are shown to be compatible with culture. Literacy, knowledge and better nutrition the impact of which is already widening, can be fostered still further by carefully conducted campaigns. In particular, better nutrition can play a role of far reaching importance not only in the more effective and economical use of food supplies but also in the health and efficiency

of people. This, in turn provides a psychological basis for the adoption of more progressive attitudes and a greater willingness to exploit opportunities.

20. Improvements in agricultural productivity and changes in attitudes and patterns of culture exert a reciprocal influence on each other. As attitudes slowly change, the possibilities for putting into effect basic measures like land reform and for the adoption of better techniques of production are increased. More resources can then become available for agricultural and general development and this in turn must considerably affect the size, structure, and efficiency of the agricultural populations. This is part of the long term process by means of which economic and cultural standards of rural population are raised more nearly to those enjoyed by urban populations.

Agricultural Incomes and Size of Agricultural Population

21. For there is no inherent reason why incomes in agriculture should be appreciably lower, as they are in nearly all countries, than incomes in other activities. Agriculture requires a labour force as skilled and intelligent as that in industry. The greater simplicity of life in rural areas and the higher degree of illiteracy among the rural population in less developed areas are not permanent factors. They will gradually disappear with improved communications and interpretation of town and country ways of life and thought. The main reason for the present disparities is probably historical. Agriculture preceded industry as the main human occupation and provides the principal reservoir for further recruitment to industry. Even in countries where industrialization has been in progress longest, there is still a steady drift of labour from agriculture to industry. Despite the many compensations of farm life, this recruitment persists because the rewards in industry are on the average usually higher than in agriculture. This movement has sometimes been retarded or even reversed in periods of industrial depression. But the process will obviously continue

until labour requirements in agriculture and industry come into balance, in circumstances in which the skill, techniques and efficiency of the agricultural worker is on a par with that of the urban worker. If in such circumstances, one man in agriculture, for example, can feed himself and 9 men in other occupations, the balance will be reached with an agricultural population of 10 per cent. The ultimate proportion is of course a matter of speculation.

Economic Demand and Trade

22. But this theoretical conclusion applies only to self-contained societies or to the world considered as a single unit. For individual countries, the proportion must also depend on each country's natural resources and other advantages for agricultural production compared with those for other activities. Many food deficient countries, even with increasing agricultural productivity, will not be able, except at prohibitive cost, to meet more than a part of their food requirements from their own food output. Food exporting countries, with abundant land and other advantages for food production, will continue to expand their food output to cover the needs of others, only if markets for their products remain favourable. Thus for many countries, trade in agricultural products has an important bearing on the balance between the agricultural and industrial sectors of their economy. A good deal of research has been devoted in recent years to the response of food demand to rising income and changes in food prices. Much more work needs to be done in this important field, especially for less developed regions, before food demand of future years can be forecast with any degree of success. As far as Western Europe is concerned, rising income will not call for any significant increase in average calorie intake, but a large shift from cheaper to more expensive foods, especially animal products, is likely. Livestock products require large amounts of grain and fodder crops for their production. A substantial increase

in the demand for such feed crops will occur. In countries with low per caput income, rising income will result mainly in a larger per caput demand for high energy foods, particularly cereals. Since the food exporting areas of North America, Oceania and Latin America are experiencing very high rates of population increase, the pressure on their food exports in the future could easily become considerable. Unless therefore there is an assurance of adequate markets and supplies at prices fair both to producers and consumers, the planning of agricultural export and import programmes and, therefore, of production may become difficult, if not impossible. Violent instability of agricultural prices on world markets are particularly disruptive to proper planning. In addition, the development of sparsely populated regions, for example in Oceania and Latin America, provides one of the most important possibilities for the transfer of people from overpopulated countries. Immigration of this nature is seriously impeded when booms and slumps dislocate internal economics.

Achieving a Balance

23. In the modern world the advantages lie chiefly with large areas under unified economic control, where land and other natural resources are abundant in relation to population, and where the absence of restrictive traditions has made possible the full development and application of modern techniques of production. In many small countries in the Western world modern techniques are applied, but economic units have become too small in relation to requirements. Tariff barriers and other obstacles impede full economic development. In the less developed countries of heavy population, the possibilities for increasing agricultural production are considerable, but knowledge of better techniques has not penetrated to the broad masses; low income and unchanged traditions make progress difficult. In many sparsely populated less developed regions,

large new areas could be brought into cultivation and the scale of production raised if capital on the required scale were available and if systems of land tenure can be modernised. The solution of these problems calls for far greater and sustained individual and coordinated efforts on the part of Governments than are at present being made. Failing such efforts there is no assurance that population and agricultural production can be brought into balance in all parts of the world. For unless productivity and development can be greatly increased in the less developed regions, the powerful factors responsible for the adjustment of population patterns in the industrialised parts of the world will not exert their full influence. On the contrary, in some areas pressure of population may become intensified. Even with a much larger scale of national and international effort, progress in many parts of the world will inevitably be slow. In a few countries, population is already so heavy in relation to natural resources that a balance may not be fully achievable by increasing productivity and industrialisation. In some others, income and productivity is so extremely low that economic development may not be rapid enough to bring a balance in sight. In such cases, efforts on the part of Governments to adjust population by other means may be inescapable.