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THE HUMAN ENVIRONMENT AND ECONOMIC DEVELOPMENT IN LATIN AMERICA

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/Introductory note

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1. In the years that have elapsed since the Second World War, a far-reaching technological revolution has taken place that has enabled a number of privileged countries to enjoy rapidly increasing prosperity of a kind unknown hitherto to man, at least in the same degree and to the same extent.

2. In addition to acting as the driving force of material progress, this technological revolution - together with other factors, chiefly the concentration of economic activity and the growth of urban centres - has had the effect of degrading man's environment in the highly industrialized countries to such an extent that Governments have been forced to consider adopting radical measures to halt the process, which is having increasingly adverse effects on the living conditions of the population in industrialized countries.

3. In Latin America, the poor condition of the environment is mainly the result of the low level of economic development, together with a defective distribution of income and social structures that tend to perpetuate the status quo. Once the region began to industrialize, in order to move out of the stage of underdevelopment and began to use modern techniques, new environmental problems were added to the traditional problems, further worsening the already deteriorated environment of rural and urban areas. In Latin America, perhaps more so than in other developing regions, the environmental problems inherent in underdevelopment now exist side by side with those generated by technological progress.

4. This situation occurs in the various countries of the region, in different regions within individual countries and in urban and rural centres. It occurs, too, inside the cities where the high-income strata live in modern housing while enormous masses of humanity subsist in slums in minimal living conditions, and it also occurs in rural areas where the environment is degraded because of poverty, poor land management and ignorance, and also by excessive use in some areas of pesticides and fertilizers.

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5. If, as seems the case, underdevelopment modifies and determines the form taken by environmental problems in Latin America, problems which then join all the other characteristic features of underdevelopment, then there is no other alternative but to continue to assign first priority to development plans and policies, with the proviso that they include all the new elements that emerge from a consideration of the problems of the environment, which are already sizable in some countries and will become even more important in the future.

6. The present study, which has been prepared by the ECLA secretariat in collaboration with ILPES and the FAO Regional Office, is a preliminary attempt to provide an over-all view of environmental problems in Latin America; to examine their main causes; and to explore some guidelines for action.

7. The study contains four chapters. The first, headed "Development and the environment in Latin America: the economic issue" is designed simply as a basis for discussions on a topic which has not yet been sufficiently examined by economists and sociologists.

8. Chapter II, entitled "The situation of the environment in Latin America" is a description of the general situation of the environment in the region. In order to keep the section general in tone, many specific situations had to be left out since they did not fit into the conditions described in the study.

9. Chapter III, headed "The environment in national development policy", offers some comments on the topic which, like the comments in chapter IV "Some international implications of environmental problems" are very preliminary in nature and hence subject to review once they have been discussed in full during the Latin American Regional Seminar on the Human Environment (Mexico City, 6-12 September 1971).

10. The ECLA secretariat would like to stress that this is a preliminary report comprising contributions from specialists in the different fields considered. It hopes that, in conjunction with the national reports prepared by Governments and the technical documents prepared by the OAS, IDB and PASB, it will serve as a useful basis for discussions during the Regional Seminar.

11. Once the Seminar has concluded, the ECLA secretariat will revise the present study to take account of the Seminar's discussions and conclusions.

/I. DEVELOPMENT

I. DEVELOPMENT AND ENVIRONMENT IN LATIN AMERICA: THE ECONOMIC ISSUES

12. The first difficulty encountered in attempting a rational and systematic examination of the problems of the environment is to define them both in sufficient depth to cover all the wide variety of concerns that they provoke, and in enough detail for them to be put forward in a consistent manner as components of economic and social policy.

13. There is consensus among the experts [1/] that the approach that must be taken to environmental problems differs considerably depending on the stage of development, and this is a point that must be borne in mind when assessing how important the environmental issue is to Latin America. Everything would seem to indicate that the reasons behind the inadequacy of the human environment in the Latin American countries are the region's lack of development, its position in the international economic system, and the over-all development trends of the current-day world. Basically speaking, these issues are the same issues that have to be raised in an economic and social analysis of development; they simply add a new dimension to it.

14. A distinction can thus be made between the aspects of a country's lack of development that disrupt the environmental balance and adversely affect human life and the disruptions caused by the current features of industrialization in Latin America. In principle it may be assumed that the wide variety of the problems of development and underdevelopment is matched by an equally wide variety of problems involving the disruption of the environmental balance, and that the policy objectives decided upon should also be equally varied. But can also be assumed that all these problems and objectives can be placed within some kind of framework that will help to identify the causes of environmental disruptions and to establish how much is likely to cost the Latin American countries to maintain desirable environmental conditions, compared

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1/ See "Development and Environment", Report submitted by a Panel of Experts convened by the Secretary-General of the United Nations Conference on the Human Environment, 4-12 June 1971, Founex (Switzerland).

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with the cost of achieving development priorities. This kind of comparison between the objective of maintaining a proper environment and the needs of development provides an analytical framework for considering the environmental issue as it affects Latin America.

15. The first issue to be considered is the role of technology in society and in economic life. With differing degrees of complexity and diversity and at different levels of development, man's activities take on concrete form through the techniques he uses. Technological problems can be looked at as differences in productivity which have led to long-standing disadvantages in the terms of trade, or as differences between the various sectors of production as regards their capacity to accumulate capital and increase their productive capacity.

16. Within the broad spectrum of the region, the use of techniques can be used as a yardstick for dividing the general problems of the environmental balance into major groups. A distinction can be drawn between the problems of urban and rural areas, between the specific problems common to particular regions, and between the different sectors of production.

17. If the problems of the environment are classified into their urban and rural features, it will be easy to pick out one of the most important aspects of Latin American development in recent years. The rapidity of population shifts to the cities has considerably modified the order of importance of the various types of ecological disruption that prevailed hitherto. In the majority of cases, moreover, rapid urbanization has been concentrated in the major cities, the result being that the urban system has become polarized and generally very marked regional disparities have been further heightened. Because of the unchecked growth of cities in several Latin American countries, environmental problems have arisen that are similar to those characteristic of the capital cities of the developed countries - chiefly air and water pollution. In rural areas, on the other hand, the problems characteristic of more backward economies have persisted, such as the loss of renewable natural resources (soil, water, vegetation).

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18. It is very difficult to predict which of these two sets of problems will have the most adverse effect on the future development of each country. Although the urban problems characteristic of development are usually more well known, this does not mean that they are necessarily more serious. In the densely populated agricultural areas of the underdeveloped countries, agricultural practices have created great deserts and have reduced the fertility of the soil, owing to unsuitable farming methods and the lack of farm investment programmes.

19. The rural problems of underdeveloped agriculture usually stem from excessive use of the environment and take the form of erosion or loss of fertility of the soil, deforestation, and overgrazing of natural pastures. But their effects are comparatively more localized, and the solution is to recover what has been lost wherever possible. Highly modernized agriculture on the other hand, introduces elements that are alien to the natural environment, such as herbicides and pesticides, whose side effects are sometimes unexpected and which affect much larger areas.

20. The two basic kinds of environmental issue correspond to the predominance of agricultural, mining and industrial activities and to the production techniques common to each sector. Because its industry is underdeveloped, Latin America has basically been a purchaser of the techniques produced by the more advanced countries, industry being the sector that indicates the level of technology achieved in the other sectors. Nevertheless, in gauging the damage that can be caused through using such imported technology, it must be borne in mind that the efficiency of the industrial sector might be reduced to such an extent that the Latin American countries were unable to compete in the world market. The way to evaluate this is similar to a cost/benefit analysis, although it must be remembered that this kind of analysis has serious limitations as regards problems with a high social content. Not all environmental problems are measurable in economic terms, and the benefits that can be derived from a proper environment suitable for man cannot always be expressed in financial terms. But the cost/benefit approach does help to show the relationship between each socio-economic objective that a country sets itself for improving the quality of the environment, and the social costs that these objectives may have if they postpone the achievement of other goals.

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21. The cost/benefit approach is useful, however, for it involves, first, choosing among a number of options for strategic investment from the sectoral, urban and regional standpoints in terms of their short-term cost. An example of this is a decision regarding the location of a factory that generates a great deal of waste in an urban area that is already very congested, given that such a factory might have major indirect effects on the level of efficiency of the industrial sector as a whole.

22. There is also the question of comparing production costs with the cost of production plus that of eliminating waste once the product has been consumed. For example, a natural material, such as cotton, might be more expensive than polyethylene in the manufacture of bags, but if the cost of eliminating polyethylene bags is added in, cotton may once again become competitive. The problem here is that for the environment the question of consumption does not exist, this being an economic concept that applies to only a small part of the environmental cycle covered by the market.

23. Similarly, certain options may be temporary in nature and affect the priorities a country sets itself for its development. Thus the reasons behind a decision on the location of a factory, as in the example given above, may vary considerably if account is taken of the development of technology and of the demand for the goods and services the economy can produce.

24. Cost/benefit analysis can also be used to consider whether to step up the exploitation of a fuel, the price of which may be falling because it has been superseded technically and economically by other more efficient inputs, or to reserve the fuel for industrial purposes that are still being developed but are potentially very efficient. The environmental issue could be tackled in terms of the probable amount of waste generated in each case, and of the costs of changing production techniques to reduce or prevent environmental pollution, as is done in the developed countries.

25. These examples demonstrate that a large amount of costly investment is required to maintain an environment conducive to human life in such a

/way that

way that the developing countries are not even further prejudiced. Clearly, there is always the possibility that new techniques will be discovered that reduce capital costs and also do away with environmental problems. For the moment, however, it may be assumed that most of the techniques that the developing countries are likely to use will fall into the intermediate range of technology of the kind currently being used by the developed countries, in which so far little account has been taken of environmental problems.

26. Lastly, investment strategy decisions in the developing countries will have to take account of the environmental problems that are currently considered to be reversible, i.e., those which can be corrected subsequently through investment that will eliminate their harmful effects without destroying the economic viability of the activity concerned. This point is particularly important in view of the fact that pollution in the Latin American countries is currently at much lower levels than in the industrialized countries and, hence, the region may have a margin for future correction in its economic calculations that the developed countries do not enjoy.

27. Comparing the costs of maintaining the quality of the environment with all the various development priorities, which can only be defined on the basis of specific conditions of underdevelopment, constitutes a basic component in any economic evaluation of such problems.

28. From the economic standpoint, environmental issues all come down to the fact that the intensity with which economic activity and transport becomes concentrated leads to a deterioration of the quality of the environment at a time when it is increasingly more costly and risky to restore the environment to its original condition. Hence it is possible to speak of the cost - both direct and indirect - of maintaining the quality of the environment, the issue in the case of the underdeveloped and semideveloped countries being a question of the allocation of resources.

29. With the Latin American countries, the problem is further complicated because the degradation of the environment characteristic of underdevelopment exists side by side with the characteristics of the developed countries.

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The latter become more important with the introduction of imported techniques required for industrial development, and there is a kind of technique substitution process which is particularly rapid in the more dynamic sectors.

30. The replacement of techniques has a given cost not only because of depreciation and the physical wear of equipment, but also because of international competition, since technological progress and the structure of investment in the developed countries determine the minimum levels of efficiency at which the underdeveloped countries can compete in the international market. Those countries which do not achieve this level need subsidies to be able to operate in the national market, but unless the cost a country pays for these subsidies is used to improve the efficiency of the recipient enterprises, inefficiency will remain - as it has frequently in the Latin American countries - and will certainly prevent them from competing on a reasonable footing in the world market.

31. The need to achieve and secure certain minimum levels of efficiency, which have been established by countries that have a much more abundant supply of capital, limits the capacity of the Latin American countries to take economic decisions relating to the use of techniques, and this is particularly true because of Latin America's very limited ability to create the techniques it needs.

32. As the techniques currently in use correspond to a given fixed capital structure, the replacement of techniques involves a capital replacement cost, which can reasonably be assumed to be no less than the cost of new equipment.

33. These arguments would tend to indicate that there is a set economic relationship between the development of the currently underdeveloped countries and the general process of the replacement of techniques, which is dependent on the technological progress of the developed countries. Thus, if the developed countries adopt a policy to clean up the environment, it may have repercussions on certain aspects of the economic life of the Latin American countries, <u>inter alia</u>: (a) a rise in the production cost of certain goods, which would affect Latin America's capacity to compete in the world market; (b) the technique

/substitution process

substitution process and the type of waste that new techniques tend to generate; and (c) the utilization of unexploited resources and their production costs.

34. The economic drawbacks involved in the selection of techniques are particularly great in the underdeveloped countries, chiefly in the sectors considered to be the key sectors in keeping the economy as a whole moving. It is not likely that the fact that countries with different social systems and objectives will not have the same views on this will make much difference, since in the final analysis the capacity to form capital depends on each country maintaining an acceptable minimum level of efficiency in its economy. In other words, whether or not the Latin American countries can achieve their social objectives, including maintaining a high level of employment, depends on whether they can safeguard an economic efficiency that cannot be separated from decisions regarding technology.

35. Given the above, it may be assumed that the economic decisions taken in the underdeveloped countries regarding the adoption and use of techniques will lead such countries to minimize the cost of adapting and creating the techniques they use and to prefer techniques produced in the developed countries in their original form. This trend would seem to indicate that, as the Latin American countries step up their development effort, it is likely that certain types of environmental pollution will increase unless suitable means of controlling pollution are found in the centres generating the techniques. The economic reasons that determine the selection of techniques and favour the continued use of production processes that generate pollutants automatically involve some kind of decision on the type of waste that will be generated and hence on the type of environmental degradation to which an economy will be exposed. It then follows that the selection of techniques can be taken as the starting-point for developing policies for improving the environment.

II. THE SITUATION OF THE ENVIRONMENT IN LATIN AMERICA

1. Human settlements

36. The form of development and under-development in the Latin American countries has given rise to a wide variety of social and economic problems which are associated in one way or another with the environmental conditions of social life. At present, as noted earlier, the Latin American countries have achieved a certain level of industrialization which coexists with the forms of economic and social organization characteristic of marked under-development. The disparity between living conditions in urban and rural areas tells a great deal about how irregularly development and its benefits have been distributed in each country and have reached the population. Urbanization and industrialization, on the one hand, and agricultural and agrarian development on the other, have led to a situation in which living conditions in society have been very disparate, and it has frequently been the case that the hopes of gradually extending the social benefits of industrialization to cover all the inhabitants of each country have been dashed. Environmental conditions in the Latin American cities have increasingly reflected the distortions of geographically circunscribed processes of social development; moreover, agricultural and agrarian development has been characterized by a passive perpetuation of unfavourable environmental conditions in rural areas. All this explains the accelerated trend towards urbanization, the geographical concentration of unemployment, and the great variety of socio-economic problems that continue to prevail in rural areas.

37. These trends in urbanization correspond to the way the economic use of space has developed, which has also led to a wide variety of distortions in the use of agricultural areas, affecting not only the inhabitants of such areas but indirectly influencing the living conditions of city-dwellers. These are the two faces of a single issue which raises economic and social problems that, because of their intensity and other special features, give under-development in Latin America a special place in the world scene.

/38. Certainly,

38. Certainly, the form and trends of the use of space at the regional and urban levels stem from problems involving both industrial and agricultural development; but in order to examine the effects of these two factors on man's environmental conditions, it may be useful to look at them separately.

(a) In the urban environment

39. The deterioration of environmental conditions in urban areas in the Latin American countries is mainly due to the extremely rapid rise of urbanization, with a concentration of unemployment accompanied by a considerable upsurge in industrial development.

40. Within this general context, demographic trends have been of capital importance, and partly explain the current features of the urban process in Latin America. Since 1920, the Latin American population has grown faster than that of any other region. Population growth started a slow upward trend before 1920 and rapidly gained momentum from that year onwards. Currently, the population of Latin America is increasing at an annual rate of 3 per cent, and it is estimated that this rate will begin to fall before the end of the 1970s, after a brief period of stabilization.

41. It should be noted that in recent years population increments have been concentrated in the urban centres. Since 1960, the average annual rate of increase in urban areas has been 5 per cent. In 1960, the urban population was five times what it was in 1920, while the rural population had only doubled. An idea of the rapidity of the urbanization process in Latin America can be gained by looking at what has happened in other parts of the world over the same period (see table 1), (for a breakdown of the projected urban and rural population by country, see table 26 of the Economic Survey of Latin America, 1968 (United Nations publication, Sales N°: E.70.II.G.1)).

/Table 1

Table 1

INDEXES OF THE LEVEL OF URBANIZATION, 1920-1960

(Percentages of the total population living in localities with 20 000 or more inhabitants)

	1920	1960
Europe	35	44
North America	41	58
Africa	5	13
Latin America	15	32

42. This movement is the result of a steady increase in the rural population between 1920 and 1960, which has fallen off significantly over the past decade. The over-all trend comprises some important features that help to explain the urban social problems of Latin America and show the diversity of the situation in various countries. In Argentina and Uruguay, where rapid urbanization began comparatively earlier, the rural population began to decline at the beginning of the 1950s. In other countries, the increase in the rural population has stabilized and the major urban centres have gradually absorbed all the population increment.

43. This is the major cause behind the increase in social pressures in the Latin American cities. In 1960, 19 per cent of the total population of Latin America lived in cities with over 100,000 inhabitants, this proportion being only 9 per cent in the other underdeveloped regions of the world. Since 1960, the urban population has become concentrated in cities of more than 1 million inhabitants.

44. Estimates covering the near future indicate that these basic trends will become more pronounced. It is calculated that by 1980 the urban population of Latin America will account for 60 per cent of the total regional population. This figure is particularly significant if it is remembered that 54 per cent of Brazil's population (close to 66 million) and 81.5 per cent of Argentina's population live in urban areas. Even in the comparatively less industrialized countries, such as Bolivia and

/Paraguay, the

Paraguay, the urban population is estimated to come close to 42 per cent of the total, while in Ecuador and Chile the figures are estimated at 58 and 76 per cent respectively.

45. The rapid growth of urbanization over such a short period of time has had serious repercussions on social life in the urban environment. Imbalances in income distribution have increased, and the price of urban land has risen considerably. As an indirect result of these two phenomena, the urban services deficit has increased and the housing situation has worsened, with unsatisfied demand for transport, communications and other services swelling. As industrialization has accelerated over the same period, also concentrated in the major cities, the problems of air and water pollution have become greater.

46. There has been a rapid increase in the marginal population, which generally has little if any work and has very unhealthy living conditions. Although it is very difficult to estimate the exact size of this marginal population, because the concept of marginality is somewhat relative, there is no doubt that it is quite considerable in all the Latin American capitals, and is estimated that it has grown more rapidly than the total urban population.

47. The increase in the number of marginal nuclei within urban settlements has considerably stepped up demand for urban and semi-urban land, with the result that people have settled on vast unused tracts of land or on land that fulfilled other purposes within the structure of the city. This has been the case in Buenos Aires, Mexico City, São Paulo, Lima, Santiago and Bogotá. In various cases, there has been intensive settlement within city boundaries, which has produced overcrowding.

48. As a result of the existence of such large groups of people, usually without enough of a regular income to satisfy their needs, there has been extraordinary pressure on the capacity of cities to provide urban services, since because such people's incomes are so sporadic they cannot afford the urban services that in theory they should receive.

49. This pressure on urban land has had various effects on the supply of many types of housing, generally taking the form of a shortage of housing for families in the lower income strata. The gap has widened

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between the trends in housing supply - generally the result of the existing institutional and financial machinery - and the trends of housing demand from the marginal sectors, which by definition are outside the prevailing financial system. In such circumstances, and given that most types of financial machinery are only authorized to operate in the orthodox financial market, the decline in the social situation of housing has been evident in virtually all countries. This can be seen both from the deficit in the number of houses, and from the makeshift nature of the housing of the marginal population on the urban periphery and in the central slums.

50. It can be said that the marginal populations in the Latin American countries live in environmental conditions that are incompatible, in all respects, with human biological and social development. Not only are they usually more exposed to the general pollution of the urban environment, but they also do not have a regular supply of drinking water and energy, and do not enjoy even the minimum of sanitation, such as easy access to sewerage facilities. The overcrowding resulting from the lack of space projects deficiencies into the social sphere that would seem in principle to be proper to the physical urban environment.

51. The rise in the relative importance of the marginal sectors has created a need for urban services for which insufficient resources are available, particularly as regards drinking water and sewerage services, refuse collection and disposal and energy supply, which in virtually all cases are the responsibility of public bodies, it being the responsibility of local governments to provide them for all citizens. These services were generally installed before the current process of urbanization began, and have had to be expanded on several occasions as cities have spread out and the density of use per square kilometre has increased.

52. Nevertheless, such expansion programmes have come up against growing financial difficulties. On the one hand, the surface occupied by people with incomes and a demand capable of financing such services has tended to increase considerably, so that the city network of urban services is very spread out. Because of their purchasing power and their position in society, such people have normally managed to have urban services extended

/to them.

to them. On the other hand, the concentration of the marginal population on the periphery of the cities has also led to a costly extension of services, but while the density of use is high, the income derived from it is very low.

53. The growing difficulty of providing adequate urban services in the major cities illustrates how the structure of the cities was not prepared to receive these two types of growth. Many of the problems encountered now - the economic cost of providing services, to say nothing of the crucial problem of pollution - could in large measure have been avoided through urban planning, but this has been lacking in most Latin American capitals. The impact of industrialization on the urban environment in the major Latin American cities has to be assessed in the light of a virtually complete lack of urban planning.

54. Furthermore, as the city becomes industrialized, increases in the supply of urban services cannot be achieved simply by making more intensive use of installed capacity and it has frequently proved necessary to expand them considerably by means of major infrastructural works. Very often, the administration and financing of such services is in the hands of local decision-makers, but the huge shortfalls in supply cannot be financed out of municipal resources alone.

55. In many respects, industrialization and urbanization have been simultaneous phenomena in the Latin American countries, especially Brazil, Colombia, Venezuela and Ecuador, where the manufacturing sector developed strength after the Second World War. The two phenomena are due to two sets of quite different causes. Urbanization is the reflection of such factors as the decline in mortality, the improvement of internal communications and the maintenance of rural social structures, which have taken place even in the least industrialized countries. Industrialization was promoted under a specific set of international circumstances and has stemmed from the national economic policy of each country, particularly as regards import substitution. The effects of industrialization on the rapidity and manner of urban growth in Latin America have gradually made themselves felt as the industrial nuclei have achieved some degree of economic significance. This is evident when looking at the way in which cities such as Guayaquil, Recife, Salvador, Londrina, Rio de Janeiro, Panama City and Bogotá have grown.

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56. The location of industry has been the result of a number of different causes, inter alia the supply of skilled and trainable labour, the concentration of purchasing power - making up what constitutes virtually the entire national market - and the concentration of the supply of services, not only urban services but also medical, dental, telephone and telegraph services, air transport, etc.

57. All these advantages attract industry to the relatively cheaper land in the major cities, where they have helped to swell the demand for general urban services. Unplanned industrial concentration, however, is precisely one of the main causes of the deterioration of the urban environment, both through air pollution, and through the disposal of industrial wastes which pollute water reserves and water courses which are particularly important to the country as a whole when located close to urban centres.

58. Air pollution has become a serious problem in some Latin American cities - São Paulo, Mexico City, Bogotá and Santiago - even though in all of these cities industrialization is a much more recent phenomenon than in any major European city. The fact that a large proportion of industry is concentrated in a single city in each Latin American country, added to the virtually complete lack of urban planning and the disorganized siting of industry, has certainly helped to step up the problem of air pollution.

59. Furthermore, the fact that personal income is concetrated in a few cities in the region means that motor vehicles are also concentrated in those cities. The number of motor vehicles has risen sharply over the past decade as the motor-vehicle industry has expanded, while the use of liquid fuels has grown considerably as more and more people have come to own cars.

(b) In the rural environment

60. The wide diversity of geographical conditions and stages of development reached in the Latin American countries hampers any attempt to generalize regarding living conditions in the rural environment. Economic and social indicators - such as, per capita income and the availability of hospital beds - do not really convey full idea of the problem, the underlying

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causes of which must be sought in the form of economic and social organization: traditional latifundios in tropical and temperate zones, primitive agricultural communities scattered on the Andean Altiplano and in the tropical jungle, and large estates where modern high-productivity farming methods are used. The combination of these different forms of production organization which characterize the Latin American countries to a greater or lesser extent is reflected in the wide range of relations between man and the environment, and of problems of well-being, which are outside the scope of the present document. A few instances will suffice, however, to illustrate the complexity of the existing rural environment problems.

61. The use of land for highly profitable single-crop farming and extensive farming practices do nothing to spread the benefits of development among the rural population, which has continued to lag, even after the capital formation deriving from agriculture served as the financial basis for industrial development. In their various forms, the large farms are governed by patterns of income distribution which confine the economic results of agriculture to very small sectors of the population, while there are large sectors of under-employed, seasonally unemployed and workers earning very low wages.

62. In the evolution of agriculture in Latin America, what might be called a modern sector has gained ground and is more integrated in the national financial system than the traditional forms of agriculture, with more efficient links with the external market and more emphasis on the specialization of functions. This type of capitalist organization cannot be confused, from the social standpoint with the traditional export farms, since it establishes work contracts which are more like those prevailing in industry, although as a rule it offers poorer wages and conditions of well-being than those found in urban areas. However, this form of agricultural development accounts for the bulk of the productivity increases in the sector and, in principle, should presumably be able to provide living conditions superior to the average in agriculture.

63. In other forms of farming and forestry, the prevailing conditions hold out even gloomier prospects of raising the physical and material standards of living, except perhaps on medium-sized farms in the vicinity of urban centres, and the comparatively few collective and co-operative farms. However, even in those cases where it might be assumed from the criteria applied to income distribution and the allocation of investment that more priority is given to improving the rural environment, it is difficult to achieve those objectives because the population is so scattered.

64. Moreover, the under-capitalized minifundio, where the soil is usually poor, has helped to keep other large sectors of the rural population in conditions of poverty. The minifundio takes many forms in Latin America, result of land tenure systems that are as old as the export latifundio - which lack the production capacity to generate a significant process of capital formation. Minifundios such as those found on the Andean Altiplano, in Central America, Colombia and other countries sustain indigenous population groups which can rarely produce more than they need for their bare subsistence.

65. Community forms of farming - the Mexican ejido, indigenous communities and the new land reform settlements - also make up a group about which it would be too rash to generalize. Where they have good soil and access to credit and technical supervision, they may offer a way of redistributing income which would enable social problems to be solved, but it must be recognized that, in many cases, these forms of economic exploitation are practically unknown.

66. The migratory movements from rural areas over the past thirty or forty years, which have led to the present urbanization process in the Latin American countries, also include many movements from depressed under-developed rural areas to relatively more developed or expanding agricultural regions. There are well-established migratory movements from North-East Brazil to the industrialized South Central area, the west rural areas in the States of São Paulo and Paraná, and the booming areas in the States of Goiás, Maranhão and Pará. Migration to the agricultural Chiriqui area has helped to bring new farm land under

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cultivation in Panama, and similar situations have occurred in the eastern llanos of Colombia and the Beni area in Bolivia. There has been intensive interregional migration in Venezuela, and the development of the Guayanas region partly depends on movements of this kind. Migration from the Peruvian sierra to the coast is another example which confirms this trend.

67. These population movements between rural areas would seem to indicate that the attraction of the cities acts as less of a stimulus to migration in Latin America than the differences between stages of development.

68. One of the most serious material problems of the rural environment is the geographical scattering of the population, which is the result of the extensive farming practices which predominate, in particular, in the least developed rural areas. In many Latin American countries, this scattering has prevented the rural population from enjoying the same public services as those found in urban areas. Services which must be operated by high-level professionals, such as doctors and dentists, are noticeably scarce in rural areas, because the tendency is for these specialists to remain in the cities, where there are more amenities and cultural life.

69. The smaller increase in employment opportunities in the country and the relatively slow pace at which the agricultural sector is being integrated in the economic and social changes which industrial development has brought in its train, have also tended to keep the living conditions of the rural population relatively static; hence the prospects of economic and social change have generally been far more remote for these persons than for city dwellers, whatever their present state of poverty.

70. The improvement in internal communications in many Latin American countries has lessened this state of isolation, bringing the rural population for the first time closer to the urban population's living conditions and expectations of upward social mobility, although it has also helped to accelerate internal migration, thus aggravating over a very short period the problems stemming from the concentration of marginal

/sectors in

sectors in the major cities. Vis-à-vis the increased expectations of social improvement which are spreading throughout the rural areas, economic problems arise in connexion with the cost of satisfying those expectations, as well as institutional problems in the organization of social services.

71. An improvement in sanitary conditions, including the provision of drinking water and sewerage, and the minimum care of the population, is feasible only when the rural population is grouped in localities that enable the fixed costs of such services to be absorbed. In Chile, for example, as a certain number of rural families is settled in specific farming areas under the agrarian reform system, a rapid increase is noted in the demand for social services in those areas.

72. Rural housing problems are different in structure from the housing problems in urban areas, not only as regards industrial construction materials, which are scarcer and more expensive than in the cities, but also because, since there is virtually no market for rented houses, the housing problem is confined to direct construction, or the conditions imposed by the owners of large farms. The nature of the rural worker's contract in most Latin American countries rarely guarantees the construction of housing. Moreover, owing to the lack of institutional and financial machinery for the provision of these facilities, the problem must be solved with the scarce material facilities available on the spot. Even in most of the agricultural development and land settlement projects at present under way in the Latin American countries, the rural worker is exclusively responsible for the construction of housing. Another difficulty is the shortage of investment resources for social purposes, which is a characteristic feature of developing countries. It has not been possible to solve the above-mentioned problems solely by means of aid, or they have been lost sight of in national public health programmes. The best plan would probably be, therefore, to co-ordinate national housing and public health policy with agrarian and agricultural development policy.

/2. Natural

2. Natural resources

73. A characteristic feature of the stages of development of the Latin American countries is that the activities directly or closely associated with the exploitation of natural resources have an important impact on their economies, accounting for about 30 per cent of the product and employment, and over 90 per cent of total exports. Although these figures are declining, owing to the efforts to develop secondary and tertiary activities, the attention which these countries are paying to the protection of their natural resources is perfectly justifiable, particularly as their future prospects largely depend on a better utilization of physical space and the development of new natural resources.

74. Sectoral and regional studies are bringing to light cases where irrational use is made of resources, and some progress has been made recently in the application of measures to preserve them. In the light of the new criteria governing the development of the human environment, these efforts appear piecemeal and inadequate.

75. The first point that should be emphasized is the irregular nature of the basic information on the potential and utilization of natural resources. While sophisticated means of evaluation are being used in some sectors and regions, there are still notable gaps and, in general, a lack of homogeneous and functional inventories such as are required for planning, especially in the stages of defining national and regional strategies.

76. The use of physical space and the exploitation of natural resources are still strongly influenced by the structure imposed on them in the past by development models based on the export of primary products, which involved great urban concentration in coastal centres and a very uneven population distribution in the hinterland, with actively exploited areas and huge virtually empty tracts with widely differing potentials. This has resulted in a duality which is typical of developing countries: on the one hand, great industrial centres where environmental problems are taken care of by the authorities as they are perceived and a solution becomes imperative; and, on the other hand, a great many small-scale marginal or subsistence activities in which the resources and the environment are generally affected by problems whose solution is deferred because of their social implications.

/77. The

77. The warnings of competent authorities and the scientific community regarding these problems call for integrated policies which will take into account the relations between resources and the system which they make up, together with man, in what is known as the biosphere. Unfortunately, one of the main obstacles to the formulation and implementation of such policies is the lack of knowledge about how these systems operate, and of clearly-defined theories concerning their importance for economic and social development in the Latin American countries.

(a) Agriculture

78. The agricultural sector (including forestry and fishing) is the main user of renewable natural resources - air, water, soil and vegetation - in Latin America; hence its importance in the efforts to preserve the quality of the human environment.

79. It is estimated that 40 per cent of the region is covered by forests and 20 per cent by natural pastures, which constitute the bases for the forest and livestock industries, respectively; 7 per cent is cultivated, and the remaining 33 per cent is made up of deserts, mountains and cities, which are not used directly for agriculture but form part of hydrographic basins, serve for recreation purposes or in other ways help to improve the human environment.

80. It is further estimated that only 3 per cent of the available water is utilized, 85 per cent of this volume being used for agriculture. About 0.33 per cent of the whole region is irrigated, and projects are needed for improving irrigation in nearly half of this area.

81. An important problem in Latin America, as in other parts of the world, is the inefficient use of water owing to the inadequate design or operation of irrigation systems, ignorance of the amount of water required for crops, and lack of co-ordination between the construction and agricultural phases of irrigation and drainage.

82. The use of water by man alters the hydrologic cycle and has both favourable and unfavourable effects on the environment. The favourable effects are daily evident, while the adverse effects are sometimes less visible,

/but lead

but lead to problems such as changes in the over-all water system causing floods or droughts, changes in the micro-climate, soil saturation, and health hazards; deterioration of water resources owing to poor river basin management and lack of soil conservation; destruction of water resources due to over-exploitation of the water-table, causing the infiltration of salt water into the groundwater in coastal areas, or the reduction of groundwater with a consequent decrease in the water-retaining capacity of the soil; and increased erosion and salinization.

83. These destructive effects are interrelated and will be more noticeable as more use is made of water. Man has improved his living conditions by controlling and making use of water resources, but at the same time he has altered the natural balance, in some cases to his own disadvantage. The pressure of future populations and their food requirements will necessitate further exploitation of water resources, but man now has the knowledge to forestall any possible harmful effects of such exploitation.

84. Past trends indicate that the area under cultivation in Latin America is growing at the expense of forests. Permanent pastures are also spreading, although usually because of the neglect of arable land, which develops a grassy vegetation without recovering its forests. The border between crops and natural vegetation at the more arid end of the spectrum varies with short-term changes in weather conditions, but the land is becoming increasingly arid owing to the destruction of the plant cover and soil. At the other end of the spectrum, particularly in the humid tropical region, agriculture continues to gain ground. Here, too, the ecological balance of the environment is very precarious.

85. With a knowledge of future trends it will be possible to prevent some of the destruction of the environment by means of proper development planning. However, the main problem lies in the present use of renewable natural resources in agriculture vis-à-vis its role in protecting the environment. Up to now, the situation has not been encouraging.

/86. Agriculture

86. Agriculture is essentially an extractive industry in Latin America, with poor yields per unit of cultivated area and a low level of return to the production environment. Moreover, there are many examples in Latin America of degradation of extensive areas owing to poor soil and pasture management in relation to the existing soil and climatic conditions.

87. Great quantities of sediment are washed off the unprotected surface of sloping agricultural land by the surface flow of rain-water, even in semi-arid regions. This results in the progressive formation of a desolate landscape of ravines and gullies where formerly there were forests and it was possible to obtain rich harvests from land that had been deforested some decades ago. Added to the initital phase of water erosion by layers, there is also a loss of nutrients which causes a steady decline in production, and this steps up the erosion process. Moreover, as a result of the over-exploitation of natural resources in the upper reaches of the rivers, the resulting floods on the plains below and the sediment carried down by the torrential flow of water not only ruin the crops but also cause irreparable harm through the degradation of fertile land, silting up of reservoirs and water courses, and flooding of population centres.

88. Extensive areas with a semi-arid climate also suffer from wind erosion as a result of over-grazing and indiscriminate cultivation. In this case, too, the damage is not limited to irretrievable productivity losses in the area concerned; it also affects the surrounding regions, where agricultural land is gradually being buried under the advancing dunes.

89. The fact that most of Latin America lies in the tropical zone also contributes to the environmental deterioration. The destruction of forests in order to grow crops disrupts the precarious balance in the lateric soil, which is intrinsically poor in nutrients and organic matter. Thus, in the Amazon region of Brazil (the confluence of the rivers Madeira and Madre de Dios) it proved impossible to cultivate the land five years after deforestation, owing to compacting and depletion of the soil.

90. Moreover, it is estimated that in the whole of South America only about 1,230,000 tons of fertilizers were used in 1969/1970, or 14 kilogrammes per hectare compared with 150 kilogrammes per hectare in Europe. These extractive practices also resulted in soil erosion. An estimated 79 per cent of the cultivated area in Argentina shows some degree of erosion, 22 per cent being classified as severe to critical. In the Andean countries, where

/agriculture is

agriculture is practiced on far more broken ground, the situation is even more critical. In some cases, it involves a land settlement problem, since the solution would be to change the system of land use. Although burning cannot be condemned out of hand, uncontrolled fires are yet another destructive factor which also pollutes the air and water. Lastly, the destruction caused by the abusive use of renewable natural resources jeopardizes the existence of the wild fauna and flora, together with their genetic resources which are so valuable for the environment.

91. Although Latin American agriculture is mainly at an under-developed stage, the region does not escape the consequences of the new techniques of modern agriculture. For example, extending the land under irrigation, despite its advantages, has caused salinization in the lower valley of the Negro and Sali rivers in Argentina, and the transversal rivers in North Chile.

92. The use of chemical fertilizers or controlling agents is not without danger to the environment, and unclean irrigation water affects agricultural production, impairing health through the consumption of polluted products. In Latin America the quality of irrigation water is likely to deteriorate, owing to pollution with heavy metals and the use of the sewage water. The presence of solid matter in irrigation water has both advantages (fertilization of agricultural land) and disadvantages (silting up of canals).

93. Inadequate irrigation water management has harmed the environment through salinization and stagnation to such an extent that farmers have even been forced to abandon once productive land.

94. The use of insecticides in the cotton plantation of Peru and Central America has resulted in the emergence of insect pests with built-in resistance and has made it necessary to use insecticides in ever larger doses and much more frequently, until the point of economic non-viability is reached.

95. Single-crop farming, in addition to being excessively dependent on a few export products, is always at the mercy of a massive outbreak of some pest or disease, and this risk would be minimized were crops to be rotated. The history of the banana crop, which was affected by the Panama disease in the 1940s, may well be repeated now with the coffee rust. As crop cultivation has become more up-to-date dand improved strains have replaced all the varied local strains, susceptibility to massive attack is heightened because genetic material is less varied.

/96. Livestock

96. Livestock production in Latin America basically depends on natural pastures. Even in such a predominantly livestock area as the River Plate basin, which comprises all Paraguay and Uruguay, the south of Brazil and the Pampa, Mesopotamia and Chaco regions of Argentina, meat production from extensive stock-breeding, based on natural pastures, is greater than that of intensive stock-breeding in the pampa area, without taking into account all the heifers supplied to the pampa for fattening.

97. A look at Latin America's livestock and forage supply shows that it is now no longer possible to raise the number of head of cattle by using "unlimited" natural pastures; future increases in production will mainly have to come from more intensive use of natural and improved pastures. There are already cases in which extensive stock-breeding occupies marginal areas that could be better used for forestry production, for example the quebracho regions in Argentina where forest regeneration is prevented by grazing.

98. Livestock diseases, such as foot-and-mouth disease, mastitis and parasite infections, have a direct effect on production, and lose the producer an estimated 20 per cent of his income. Certain diseases have repercussions on domestic and external markets, and some of the pathogenic diseases are communicable to man. Brucellosis, in particular, is common among producers and their families, butchers and other persons handling unsterilised products from infected animals; the same is true with other diseases, tuberculosis for example. Poisoning caused by foodstuffs of animal origin is frequently due to contamination with animal pathogens, some of which are resistant to the antibiotics added to animal fodder in uncontrolled amounts.

99. Forest resources, although occupying third place in the value of production, are first as regards surface occupied. Wood production is an extractive activity and is often accompanied by the destruction of the forest in order to clear land for crop-farming or stock-breeding, with the consequent deterioration of soil and water resources. The very delicate balance of the tropical jungle is particularly affected by this phenomenon; because the area it covers is so great, it is easy to assume that resources are abundant in the jungle; but primitive methods of exploitation and lack of knowledge about the use of tropical woods are serious obstacles to the

/proper use

proper use of tropical woods are serious obstacles to the proper use of such resources. The destruction of forests, under-utilization of the wood extracted and dependence on natural regeneration are the main reasons behind the low level of output. Plantations for industrial purposes and the control and management of natural forests are not common in the region, although they are essential for the future development of industry. The processing of forest products is still in its initial stages, since the major part of production is exported in the form of roundwood; sawmills and other forest industries have not yet moved together into large complexes, and hence the threat of pollution on a massive scale does not yet arise.

100. Woodland fauna are exploited on a very limited scale in Latin America, although constituting a very important resource for the indigenous peoples of the Amazon jungle. Hunting for sport is not very common, and shooting is usually on a commercial scale as in the hunting of the capybara and similar rodents in the plains of Colombia and Venezuela. Given the fact that tourism is generally not greatly developed, natural reserves are mainly of scientific interest only, although there are some exceptions that show the public is interested in natural areas if they are easily accessible, as for example the forest of Pittier park near Maracay in Venezuela or Nahuel Huapi park in the Argentina Andes.

101. Latin America's fisheries resources comprise the cold-water fishing grounds in the Humboldt current (Chile and Peru) and the Falkland Island current (Argentina, Uruguay and the south of Brazil), and areas where the water is tropical and subtropical. The oxygenation level of cold water is such that phytoplankton and zooplankton thrive, these being essential food for fish. The highest fishery output in the world is achieved in these waters. Warmer waters are not so productive, but the absence of large shoals is made up for by the existence of crustaceans and pelagic species such as tunny-fish and sea bream, which have a high value on the international market. Production in inland waters is very small compared with that in sea water, even though because of their size, water basins constitute a very important water reserve.

102. Fishing areas in Latin America can be classified into: (a) areas close achieving the maximum balanced catch (anchoveta fishing off the coast of Peru and northern Chile, and shrimp fishing off Ecuador and Central America;

/(b) areas

(b) areas where fishing is developing and catches of pelagic species are growing (sardines and anchoveta for bait in the Pacific, between Baja California in Mexico, the Gulf of Panama and the Galapagos Islands; and sardines and anchoita in Venezuela and Brazil, from Rio de Janeiro southwards); areas where fishing is intensive but output is below the potential level (mainly the continental shelves of Brazil and Argentina fishing for such demersal species as hake, croaker, weakfish, etc.); and (d) areas with potential fisheries resources (the Argentine continental shelf of the coast of Patagonia and Tierra del Fuego, the sourthern coast and island region of Chile, the north-east coast of Brazil and the entire continental shelf of Latin America at depths between 200 and 600 metres).

103. Except for the coast of Peru and northern Chile, fishing in Latin America is extensive or semi-extensive and unorganized, with output levels below the existing potential.

104. Apart from the deterioration of the environment caused by agriculture, it is also worth while considering how man's other activities affect agriculture. For example, water pollution by industry affects fishing output, both in the sea and in rivers and lakes. Similarly, hydroelectric energy production based on dams also affects fishing, in addition to flooding large agricultural areas and affecting the entire ecological balance of regions. Emissions of gases, especially gases containing sulphur, affect the growth of vegetation and sometimes make farming impossible in certain areas. Furthermore, certain activities, such as trade, transport and education determine the use that is made of available resources and the level of technology used in agriculture.

105. Some of the most well-known examples of this phenomenon are fluctuations in the production of grain and meat resulting from changes in relative market prices or the use of land suitable for crop-farming for stock-breeding because access is difficult. The fact that certain export crops are produced is often due more to the existence of guaranteed markets than to environmental limitations that prohibit using the land for other purposes. The high level of technology employed in raising export crops is also the result of the supply of investment capital, which is not attracted to subsistence crop-farming.

106. All these effects can be controlled by man if he wishes to improve his environment.

/(b) Energy

(b) Energy and air pollution

107. Production, transport and the use of various forms of energy pollute the environment in different ways. Burning fuels emit toxic particles and gases which contaminate the atmosphere. In petroleum and coal extraction and refining, there is usually air and water pollution due to the emission of deleterious particles, gases and liquids. Pollution of the high seas is known to occur as a result of accidents in the production and transport of oil, waste disposal, and cleaning operations on tankers. The cooling water in thermo-electric and atomic power plants sometimes seriously affects the flora and fauna where it flows out of the plant because of its high temperature. The radiation associated with the use of atomic energy is another hazard, whose final effects are not completely known but are spread indiscriminately over vast areas.

108. Industrialized countries estimate that over three-quarters of the existing air pollution may be ascribed to the consumption of fuels, primarily in transport services, manufacturing, electric power production, and heating installations.[2/] Accordingly, air pollution is dealt with here in terms of the uses of energy, while not excluding the fact that certain pollutants deriving from agriculture (pesticides), mining and construction are also worth noting.

109. If the region is looked at first as a whole, it naturally shows a very low level of air pollution in relative terms. Considering the average density of commercial energy consumption per unit of area, and arbitrarily adopting 1.00 as the value for all the Western European countries, the indexes by regions would be 0.30 for Europe and the USSR, 0.72 for the United States and 0.05 for the rest of the world, while Latin America would register only 0.03. Moreover, the huge areas of pastures and jungle in the region do a great deal towards restoring

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2/ According to a report of the National Science Academy, transport is responsible for approximately 60 per cent of the air pollution in the United States, industry for 18.5 per cent, thermo-electric production for 12.5 per cent, and heating installations and waste disposal for 9 per cent (see Gordon Friedlander, Power, Pollution and Imperiled Environment, Institute of Electrical and Electronic Engineers, (IEEE), (November 1970)).

/the atmosphere

the atmosphere, by absorbing carbon dioxide and releasing oxygen through photosynthesis. In principle, therefore, from the air pollution standpoint, the region offers a wide margin of increase in economic activity.

110. Contrasting with this optimistic view is the concentration of air pollution problems in the major Latin American cities, such as São Paulo, Rio de Janeiro, México, Monterrey, Buenos Aires, Córdoba, Lima, Bogotá and Caracas. Air pollution in these cities would seem to come mainly from motor vehicles.

111. The motor-vehicle inventory in the region amounts to 8.8 million units (passenger cars, buses and lorries), or only 4.1 per cent of the world total. Thus, the whole of Latin America has less than one-tenth of the total number of motor vehicles in the United States, and about 70 per cent of those existing in France, the Federal Republic of Germany or the United Kingdom. Since they are concentrated in the major Latin American cities, however, they constitute a comparable factor of pollution in the region. It is worth while noting that in some countries the price of gasoline and diesel oil is so low that many owners of motor vehicles, chiefly lorries and public transport buses, pay little attention to the efficiency of fuel combustion, i.e., they fail to make regular adjustments to their vehicles in order to save fuel, and the exhausts emit veritable smoke screens which do a great deal to pollute the atmosphere.

112. The bulk of the manufacturing inventory is also concentrated in the capital cities and one or two major towns in each country, mainly owing to economic factors (availability of infrastructure, plentiful labour and market). In some cases, this concentration of industry has come about without any proper urban planning, with the result that industries which emit undesirable gases and odours are so placed that they seriously affect residential and commercial districts.

113. Because of the configuration of the land and the general atmospheric circulation in Mexico City and Santiago, Chile (which harbour large industrial centres), the lower layers of air move very little, so that a dense smog covers them for long periods. The situation is not so serious in Buenos Aires and Montevideo, where fairly frequent winds have a favourable effect.

114. National reports do not include an analysis of pollution by separate industries, mainly because such studies are still in an incipient stage; it is not possible, therefore, to obtain a clear picture of the situation in the region. It may be taken for granted, however, that in these industries, too, the use of fuels plays a significant part in air pollution. Chemical, metallurgical, and livestock and fisheries processing activities are among the most obnoxious as regards smells (Buenos Aires, Lima-Callao, Chimbote, Iquique, Arica, etc.).

115. In big cities the air is also polluted by inefficient burning of trash (mainly paper) in the incinerators of apartment buildings in densely populated areas. In cities where the winters are cold, as in the southernmost countries of Latin America (latitudes of over 30 degrees), there is additional pollution from heating installations, especially those burning coal or wood.

116. Environmental pollution caused by thermo-electric plants (smoke and high temperature of cooling water) is fairly limited in Latin America, not only because of the low per capita consumption of electric energy (450 kWh, compared with 6,500 kWh in the United States and 2,500 kWh in Western Europe), but also because more than 50 per cent of it is generated by hydroelectric plants (compared with 40 per cent in Western Europe, less than 20 per cent in the United States and 15 per cent in Eastern Europe). However, there is a certain amount of pollution of this kind in Buenos Aires, Caracas, Santo Domingo, Havana, Montevideo, México City and Santiago, Chile.

117. Atomic power plants have an advantage over the conventional thermo-electric plants as regards the emission of smoke and deleterious gases and the cleanliness of their operation. However, since their thermal efficiency is less, they release about 30 per cent more heat into the environment, and higher costs are involved in limiting the thermal pollution caused by their cooling water to tolerable proportions. Radioactivity can be kept separate from the environment and only small quantities may reach it through gaseous, liquid and solid wastes, whose radio active power is far below the natural background levels. The first atomic power plant in Latin America is expected to start operating at

/Atucha (near

Atucha (near Buenos Aires) in 1972, with a capacity of 320,000 kW. An efficient sampling service has been developed and all the appropriate security precautions have been adopted to prevent accidents and control the emissions. A plant is to be established shortly in Mexico and another in Brazil (between Rio de Janeiro and São Paulo). A more distant possibility is the establishment of an electric power and desalinization plant in north Chile.

118. Latin America's annual production of energy amounts to about 400 million tons of petroleum equivalent, comprising hydrocarbons (83 per cent), wood and other vegetable fuels (11 per cent), hydroelectricity (5 per cent) and small proportion of coal.

119. From the standpoint of the conservation of resources, petroleum production - which is mainly in the hands of the State - is carried on with the proper safeguards since it involves highly technical operations. The same observation is applicable to hydroelectric potential. In contrast, the use of wood has in many cases affected the supply of this renewable resource, since it has been exploited beyond the possibility of a natural recovery of the forest. Its use by scattered rural population groups may even have favourable effects if it helps towards forest conservation through the removal of brushwood. Where the use of wood has been intensified, especially to supply the cities, certain industries such as steelmaking, and the railways, forest areas which constituted a rich resource and an important ecological factor in protecting the soil, water and climate have been virtually devastated.

120. These remarks about wood belong under the head of the environmental effects of the utilization of energy resources. Petroleum production has, on the whole, helped to improve the surrounding environment through the construction of population centres, roads, shipping terminals, social services, etc. It is not without detrimental effects on the environment, however, some of which have already been mentioned in relation to the pollution of water by wastes and the results of accidents in operations carried on in the vicinity of water, and atmospheric pollution resulting from the use of petroleum as a source of energy for extractive and transport operations, and even the release into the atmosphere of gases which have no market in refineries or reservoirs. These situations occur

/in regions

in regions producing hydrocarbons, which are mostly found in different parts of Venezuela, the Lake Maracaibo area being the part with the most adverse environmental effects. Other important oil reservoirs in Latin America are found in the Gulf of Mexico area; on the eastern slopes of the Andes in Colombia, Peru and Bolivia; scattered in south Argentina and south Chile; and in some sedimentary beds in Brazil. The recent conclusions drawn from marine geology studies that a substantial proportion of the world's oil resources are found on the continetal shelf are also applicable to Latin America, as shown by the areas that are already in production of the north and central coast of Peru, the discoveries opposite the State of Sergipe in Brazil, and in the Gulf of Mexico, Venezuela and San Jorge (Argentina). This should alert the authorities regarding the possibilities of pollution in the coastal waters of the region.

121. Development of the energy potential of water, in addition to utilizing a renewable resource, has effectively contributed to a better knowledge and the multiple and integral use of water resources in Latin America. Admittedly, there are cases where this kind of water use has conflicted with other uses such as irrigation or navigation. There have also been effects of other kinds on the ecological balance and on environmental health conditions owing to the volume of water retained in reservoirs, such as those which are now the subject of special attention in certain reservoirs in Mexico and Brazil (disease-carrying algae, mosquitoes and snails, etc.).

(c) Water

122. Latin America has the highest average rainfall of the major regions of the world. Estimates place the annual average at 1,300 mm. which is double the average for the other continents (Africa 700 mm; Asia 640 mm; Europe 610 mm; United States 600 mm; Australia 410 mm). Given this abundance of water, which is caused by the fact that most of the region comprises moist tropical areas, it is clear that as a whole the region has a long way to go before coming up against the problems of pollution or water shortage encountered in the more industrialized areas of the world. For example, a comparison of the gross product with surface water

/flows gives

flows gives the following figures (in dollars per thousand cubic metres of water discharged into oceans and seas): Latin America 13; Australia 52; United States 293; and Western Europe 640.

123. Naturally, enough, within all this abundance - which is just a potential for the future - virtually all countries have relatively dry areas where irrigation is essential or desirable and moist areas where excess water constitutes a problem. This affects a not inconsiderable part of the population, for close to 20 per cent lives outside areas where the rainfall is between 500 mm and 2,000 mm,[3/] these being the extreme limits or aridity and humidity, although even within such areas the distribution of rainfall throughout the year may give rise to similar problems. Similarly, in highly populated areas the traditional sources of water are becoming inadequate and all the problems of pollution, to which reference has repeatedly been made, are becoming evident. Given that water plays a decisive role in the ecological balance of the environment, there is justifiable and growing concern regarding water management. Water planning has made great strides in recent years, and the most up-to-date techniques of operational analysis are being applied to water systems in the design of sets of projects and the organization of water basins. Nevertheless, even though water-basin planning pioneered the way for regional planning, there has not been enough communication between the technicians concerned with water resources and the people who make over-all economic decisions, with the result that from time to time serious problems arise with respect to water that have major effects on regional economies and on the ecological balance of large areas.

3/

Average annual rainfall (mm)	Area between isohyetal lines (%)	Population 1969 (%)	Population density (1969) (inhab/km2)
Less than 500	15.9	9.9	7.4
Between 500 and 1 000	17.1	28.0	22.0
Between 1 000 and 1 500	21.0	34.2	19.4
Between 1 500 and 2 000	18.9	17.8	9.8
Above 2 000	27.1	10.1	4.2

/124. The

124. The fact that there is no co-ordination among institutions concerned with the use and management of water in its different applications is perhaps one of the most urgent and key problems, given that water is a natural resource of such widespread use. Without losing sight of the need for an integral approach, the following sections will identify the main problems of each of the major water uses.

125. (i) Drinking water. Owing to the fact that Governments gradually became aware of the economic and social value of dring-water supply, and to international technical and financial assistance, drinking-water services expanded considerably during the 1960s, with approximately 72 per cent of the urban population 4/ (106 million inhabitant) and 16 per cent of the rural population (20 million inhabitants) now being served. This comes close to the targets laid down in the Charter of Punta del Este, for the coverage of drinking-water services, which were 70 and 50 per cent respectively. Admittedly, these figures fall to 59.5 and 9.5 per cent respectively for the population with household connexions of drinking-water, and there are enormous differences in the quality of water services ranging from cities where water is over-abundant to small towns where the installations are in such poor repair that it is not possible to have a regular supply of reasonably pure water at a suitable pressure. When facilities have to be expanded, there is generally no difficulty in obtaining the volume of water required, for it is small in comparison with other demands. Nevertheless, in many of the large cities the traditional sources are no longer adequate and it is becoming necessary to invest large sums to obtain water and to redistribute water uses in high-consumption areas. This has happened in a group of cities in the central provinces of Argentina (Santa Fé, Córdoba, La Pampa and Buenos Aires), in Bogotá, México City and Valparaiso. If water from natural sources is in short supply it is frequently contaminated with salts and harmful chemicals (arsenic, fluorine, etc.), as has happened in the central provinces of Argentina (which are supplied from groundwater sources) and in the north of Chile, principally Antofagasta.

4/ The urban population in this case is considered as the population living in settlements of more than 2,000 inhabitants.

/126. It

126. It is estimated that only 59 million inhabitants of the region have sewerage facilities, 35 per cent of the urban population and less than 2 per cent of the rural population. This has its effects on the health situation in large regions of Latin America. Most of the major cities do not have plant for treating sewage, and discharge waste into rivers and bays which creates intense foci of pollution. This is the case in México City, São Paulo and Rio de Janeiro, Montevideo, Lima and Callao, Buenos Aires, and Santiago.

127. (ii) Industry and mining. Although less information is available on this sector, there is no doubt that its water needs are growing at a high annual rate (7 to 10 per cent) and that in many countries of the region the quantities used are several times greater than those used to supply the population. Water supply is becoming an increasingly critical factor in the location of industry in the Latin American countries, and the normal environmental problems arise in those activities that require large quantities of water (pulp and paper, synthetic fibres, synthetic rubber, steel aluminium, etc.).

128. Several of the industrial uses of water are very demanding as regards the quality of certain parameters (pH, turbidity, colour, oxygen content, hardness, chemical content, corrosiveness, etc.) and virtually all discharge polluted waste water, adding their effluent, in certain highly populated cities, to the effluent from domestic waste and degrading the bays, shores and rivers used as receptacles. It should be noted, however, that the highly populated industrial cities in Latin America, with only a few exceptions, for example México City, Bogotá and Santiago, are on or near the coast and close to large rivers (Rio de Janeiro, São Paulo, Santos, Porto Alegre, Buenos Aires, Montevideo, Valparaiso, Concepción, Lima-Callao, Guayaquil, Caracas, Havana, Santo Domingo, Panamá City, etc.), which means that the region's abundant and fast-flowing rivers for the most part are unpolluted by man for virtually their entire course.

129. As there are large mines in the arid and semi-arid areas of the Andes (Bolivia, Chile, Peru), production is often seriously hampered by the lack of water, even though actual consumption may not really be very high (for example, 100 m^3 per ton of fine copper in Chuquicamata, Chile).

/130. (iii)

130.(iii) Irrigation.[5] The surface area under irrigation in Latin America is estimated at almost 7.2 million hectares, which represents slightly more than 5 per cent of the area under cultivation. Irrigation is used mainly in the vast arid and semi-arid regions of Mexico, in the coastal areas of Peru, in the northern and central areas of Chile, and in the western and southern parts of Argentina. In Argentina, the irrigated area accounts for only 4 per cent of the total agricultural area but provides almost 30 per cent of the value of agricultural production. In Chile, 20 per cent of the area under cultivation has permanent irrigation and it is estimated that it generates 60 per cent of the value of agricultural production. In Mexico, irrigated areas account for 10 per cent of the total and produce around 35 per cent of the value of agricultural production. In the region as a whole over the period 1958-1968, the area under irrigation expanded at an annual rate of barely 2 per cent.

131. (iv) Hydroelectricity. In 1969, 60 per cent of the electricity generated by public services in the region came from hydroelectric plant, the same proportion as ten years earlier. These plants have a total capacity of approximately 13 million kilowatts, which is a tiny proportion (less than 3 per cent) of the region's hydroelectric potential, Latin America being among the major regions in this respect. As noted earlier in connexion with energy resources, hydroelectric development has been of great significance in improving knowledge about and the use of the region's water resources and in pointing up the need for devoting special attention to their environmental implications, particularly now that major large-scale projects are being tackled.

132. (v) Navigation. Virtually all countries in the region have traffic on their rivers, estuaries and lakes that is of considerable local significance. In the major river systems in the plains, traffic is even of national significance, as for example in the river Plate system with the Paraná-Paraguay and Uruguay rivers, which are of importance to the five countries in the Plate basin (Argentina, Bolivia, Brazil, Paraguay and

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5/ See section (a) above on agriculture, in which this topic is also discussed.

/Uruguay); the

Uruguay); the Amazon system, which mainly serves Brazil and acts as a link with the other countries in the Amazon basin; the Magdalena river in Colombia, which has great potential; and the Orinoco river which provides an outlet for sizable quantities of mining production in Venezuela.

133. The economic viability of river transport is, of course, a question that must be looked at in the context of the transport sector. As regards water resources, transport is a non-consuming water use that in most cases does not seriously interfere with other uses.

134. River transport is being affected in many places by the silting up of water courses and by changes in the direction of rivers caused by flooding. These phenomena are heightened by steady erosion in the upper reaches of water basins, and the identification of their causes requires large-scale studies, only some of which are under way.

(d) Mining and geological factors

135. The mining of mineral ores and petroleum is of capital economic importance for several countries in the region. Although the share of mining in the gross domestic product is generally not particularly significant (except in Venezuela where it is 20.4 per cent, Guyana where it is 19.8 per cent and Bolivia where it is 14.1 per cent) 6/ it does account for an extremely high proportion of certain countries' exports for example Venezuela (97 per cent), Chile (90 per cent), Bolivia (79 per cent) and Peru (51 per cent). 7/

136. Metal-bearing resources are well distributed about the region, being slightly more concentrated in the subregion of the Andes, Central America and Mexico and slighly more spread out in the subregion comprising Brazil and Guyana. The first of these subregions contains mostly copper, lead, zinc, tin and iron, the first three being sulphur-bearing ores. The most well-known large copper deposits occur in a broad strip of the Andes running from the centre of Chile to Ecuador, in the northern part of Mexico and in Panama, where potentially sizable deposits have recently been

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6/ ECLA, "Economic Survey of Latin America, 1970" (E/CN.12/868/Add.1, 27 March 1971).

7/ ECLA, "Mining in Latin America", Economic Bulletin for Latin America, vol. XIV, N° 2, second half of 1969, pp. 78-109.

/discovered. Lead

discovered. Lead and zinc is found chiefly in the Andean area of central Peru, in most of Mexico and in Central America. Tin is found virtually exclusively in the Cordillera Real region of Bolivia.

137. In the Brazil-Guyana subregion and in the Caribbean islands, the main ores are iron, bauxite, manganese and tin. Iron ore is well distributed around the area with the main deposits being in Brazil (Itabira), Venezuela (in the ore-bearing area of Cerro Bolívar-El Pao on the south bank of the Orinoco), and along Bolivia's south-eastern border with Brazil (Mutún-Urucum). The largest bauxite deposits are in Jamaica, Surinam and Guyana in a 200-kilometre wide strip following the coastline. The main proven manganese deposits are in Amapa (Brazil), the northern part of Guyana and Urucum.

138. In Latin America, the exploitation of mineral resources (extraction and primary processing) has certain deleterious effects on the environment, notably through pollution of the atmosphere with smelting gases and solid particles; pollution of water; occupational diseases; the deformation of the landscape as a result of erosion; and the loss of ore resources through poor mining practices. The degree of these effects varies considerably depending on the techniques employed in the production process and on the corrective measures taken, and hence is directly related to the economic efficiency of the exploitation of resources and to their location.

139. A problem requiring special attention with respect to sulphur-bearing ores - copper, lead, zinc - of which close to 2 million tons are mined each year (16 per cent of world production), is the emission of sulphur dioxide (SO_2) in pyrometallurgical processes. The primary adverse effect is atmospheric pollution in the immediate area of foundries, and the secondary effect, deriving from the formation of sulphuric acid, consists in the elimination of vegetation, followed in most cases by rapid erosion affecting extensive areas. Although many of the mining centres are in desert regions, this problem is already creating difficulties in several areas in Chile and Peru.

/Furthermore, it

Furthermore, it may be that in the near future recently discovered copper deposits of great potential will be exploited in areas in Panama and Ecuador, that have dense vegetation. The main problem is that in the first stage of the smelting process (reverberatory furnace) the gas produced has a low SO_2 content (less than 2 per cent) which cannot yet economically be transformed into sulphuric acid or basic sulphur (unlike the conversion stage where this is economically viable), and has to be discharged into the atmosphere.

140. Occupational diseases in mining, especially silicosis, are a serious problem in mining centres in Bolivia, Chile and Peru (according to an official report, 3 per cent of Bolivia's mining population suffers from silicosis).

141. The extraction of materials from quarries and gravel, sand and clay pits greatly affects the environment in and around most of the region's major cities. It can increase the rate of erosion and soil loss, and deform the landscape. This also happens with the excavations resulting from mining in general, and while the problem is not too serious in the Andean countries generally, it is in other areas, for example the bauxite mines in the Caribbean countries, where large areas with dense vegetation have to be cleared. Air pollution is also produced by the dust storms that rise up around the dry sterile tailings left over from ore processing.

142. Unorganized mining, which does not follow any standards for conservation, is causing irreparable damage to mining resources in the small-scale mining sector in Bolivia, Chile and Peru and in some of the mining of crystals, diamonds and semi-precious stones in Brazil.

143. All these adverse effects associated with methods of mining should not be allowed to overshadow the favourable consequences that the generation of income by mining has had on a very large proportion of the Latin American population, and the even greater effects it may have as the existing imbalances of mining production are gradually

/evened out.

evened out. The basic question is to identify the economic cost inherent in each type of mining process so as to be able to develop appropriate institutional, economic and financial policy options.

144. With respect to geological factors, seismic activity is of particular importance in the Andean countries, Central America and Mexico and its effects are particularly serious for population settlements and some industrial installations and cause sizable losses in lives and capital.

145. Even though great progress has been made in finding out the causes of earthquakes, as yet no system has been devised that can predict when they are likely to occur. The effects of seismic movements can, however, be minimized if, in addition to observing strict rules and regulations as regards construction methods, account is taken of the characteristics of the bearing soil in urban planning and zoning, on the basis of geological maps of the bearing soil. The close correlation between the type of soil and damage has been clearly demonstrated in virtually all the earthquakes that have occurred in the region. Careful thought must also be given to the location of towns and industries with respect to the secondary effects of seismic activity, for example tsunamis (Corral, Ancud and other towns were devastated by the tidal wave following the 1960 earthquakes in Chile) or landslides of rock, earth and snow (as happened in the Huascarán massif in Peru, where a landslide of mud buried the town of Yungay).

/3. Pollution

3. Pollution and disturbances of international scope

146. There are two types of problems of international scope: those affecting the whole world and those of regional concern which affect groups of adjacent countries.

147. The first type includes alterations in the balance and quality of the atmosphere, pollution of the high seas and disturbances caused by radioactivity. Although Latin America can do little to prevent or solve these problems, it should not fail to keep a sharp look out for measures that may affect it, either in the short or the long term.

148. Atmospheric pollution is no longer a localized phenomenon and affects even the rural environment, under certain air flow conditions. However, despite the massive quantities of gaseous and particulate pollutants emitted by large urban agglomerations and industrial centres, no widespread increase in pollution has been noted in areas far from those centres.[8/] It may therefore be inferred that no appreciable quantities of atmospheric pollutants reach Latin America from outside the region. However, the present means of detection do not permit any final conclusions to be reached and there may well be a certain influx of pollutants, at least in areas close to the United States.

149. These pollutants, combined with excess water vapour and the heat produced by fuels, are already having an undoubted effect on the local climates, and it is feared that they may cause more widespread changes which would impair the living conditions on the entire planet or in vast regions, including Latin America. The studies mainly highlight alterations in the balance of carbon dioxide, particles and water vapour. The disturbance in the balance of carbon dioxide may be the cause of changes in the temperature of the environment, which would greatly affect the climate and agriculture. The particles could also interfere with the transmission of heat through the atmosphere and affect the rainfall system. Water vapour could have persistent effects on high cloud, especially as a result of aircraft flights in the lower stratosphere.

8/ "Transport of pollutants in the biosphere: contamination through air supply" (document prepared by the World Meteorological Organization (WMO) for the United Nations Conference on the Human Environment).

/150. With

150. With the study of all these phenomena and those resulting from projects designed to alter the climate in order to increase rainfall in arid regions, material is being accumulated to substantiate meteorological theories which, although not proven, mean undoubted progress in weather forecasting and control. For this purpose, WMO has established an observation system and most countries, including some Latin American States, have agreed to participate. This system will comprise about ten base stations in remote places where there is clean air, and some 100 stations for recording the quality of the air in different regions.[9/]

151. As regards pollution of the high seas, besides the cases which affect certain coasts and estuaries owing also to specific causes (a notable example being the Guanabara Bay), there is undeniable evidence that Latin America is being affected by the more widespread and progressive pollution of the high seas, which, although it is partly responsible for it, is mainly attributable to shipping and the activities of industrialized countries.

152. Pollution is mainly due to municipal, industrial and agricultural wastes which are carried to the sea by the rivers and the atmosphere; discharges from and accidents to ships; under-sea mining activities; radioactive wastes; and military operations. While the first group accounts for the largest share of pollution, discharges from ships are the most widespread. These pollutants include: petroleum (not less than 10 million of the 2,200 million tons produced in 1970 are estimated to have gone into the sea), organic and inorganic chemical wastes discharged by industry and agriculture (an estimated 50 per cent of the 200,000 tons of insecticides based on chlorinated hydrocarbons reach the sea), solids in suspension, and the heat of cooling water in thermo-electric plants.

153. Oceanographic studies and observations are barely being initiated in Latin America, so it is impossible to make even a rough appraisal of the situation on the basis of the available information. It is known,

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9/ "Identification and evaluation on climate" (document prepared by WMO for the United Nations Conference on the Human Environment).

/however, that

however, that the pollutants which are a source of concern to the whole world are reaching its coasts and shipping routes. The area most affected because of the density of its maritime traffic and the concentration of industry is the Caribbean and the Gulf of Mexico; since they are tropical seas, they are more vulnerable to the ecological imbalances caused by external agents.

154. The United Nations has been actively concerned with this matter. Not less than five organizations (UNESCO, FAO, WHO, WMO, IAEA and IMCO) are paying direct attention to it and will co-operate in a Group of Experts on Scientific Aspects of Sea Pollution. The Secretary-General of the United Nations has consulted the Member States regarding the desirability of drawing up a treaty or treaties on the matter and, within the framework of the Stockholm Conference, an intergovernmental group of experts is working on the next steps to be taken. Moreover, at least two other world meetings will be held on the subject in the next two years: the meeting of the Intergovernmental Maritime Consultative Organization (IMCO) in 1973 and the United Nations Conference on Maritime Law (also tentatively scheduled for 1973).

155. As regards radioactive pollution, most of the potentially contaminating residues are produced in power generating plants.[10/] The radioactivity discharged into the atmosphere rapidly diminishes as it spreads out, but it can cover considerable distances before it is extinguished. It moves less in the sea, particularly in deep waters, and still less in subterranean water.

156. The total installed capacity of nuclear power plants all over the world is approximately 19,000 MW, and is expected to grow to about 320,000 MW by 1980, and possibly 1,600,000 MW by 1990. Although there are well-known methods of controlling the radioactivity emitted by this

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10/ This relates to the peaceful uses of nuclear energy. See "Identicación y control de contaminantes y perturbaciones de vasta significación internacional con especial referencia a las actividades nucleares" (document prepared jointly by IAEA and WHO for the United Nations Conference on the Human Environment).

/industry's wastes,

industry's wastes, the problem is to select safe sites which will give them time to become inactive. Therefore, in view of the enormous expansion predicted for this industry, the concern for the control and observation of possible contamination is perfectly justified, particularly as the possibility of accidents must also be taken into account.

157. The International Atomic Energy Agency (IAEA) has been concerning itself with the question of safety from radioactive contamination and has sponsored studies, agreements and regulations which have helped to develop this industry. The International Committee on Radiological Protection (an independent group of recognized international experts) has recommended tolerances to basic radiation, which have been supported by the World Health Organization and accepted in agreements of the International Labour Organisation on protection for workers. International regulations have extended to all phases of the industry, especially transport and waste disposal. Countries and international and regional organizations have incorporated these basic recommendations in legal provisions and work guides.

158. The supervision of waste disposal requires a system of international co-operation which will make it possible to record these operations and their effects.

159. The Latin American countries have been measuring nuclear radiation, mainly by means of rainwater samples, in co-ordination with IAEA's world observation activities, and have ascertained that although the levels of environmental radiation are still far below the regulation tolerances, they have increased with the nuclear trials, which gives justifiable grounds for concern. Of particular interest is Argentina's experience in the construction of the nuclear power plant at Atucha, and that of countries such as Brazil and Mexico which are initiating projects of a similar kind.

160. As regards pollution and disturbances in Latin America, measurements made in industrialized countries reveal that if atmospheric pollution over a big city is 100, the index in rural areas some tens of kilometres away from the centre would often be about 40. If the accidental or controlled burning of plant cover is added to the focal points of urban

/and industrial

and industrial contamination, air pollution may spread considerably and affect border areas, which is often the case in Latin America, although it has not yet assumed serious proportions.

161. A more important factor is the environmental deterioration which can take place in more than one country when it affects international hydrographic basins or border areas with resources linked by the natural system. Nearly all the Latin American countries share important rivers with bordering States; therefore, any water, plant cover and soil management practices that are adopted in the respective basins constitute in one way or another a common problem which requires international co-operation.

162. Fishing is another type of natural resource whose protection is of regional interest. In coastal border areas there is no doubt that fishing and everything that affects it is a common problem of the countries concerned, which must be solved by means of co-operative criteria and regulations. One of the most important cases because of the scale of the operations involved is anchoveta fishing (the basis of the important fish meal industry) in the Chile-Peru area. The mobility of certain marine species such as tuna and other bigger fishes is such that their conservation involves agreements among several countries, of which there are some examples in the region.

163. The study of the behaviour of marine resources in the light of possible pollution and over-fishing is vitally important in order to establish rational bases for their exploitation and protection. Great strides have been made in this direction, particularly by those countries which have achieved most progress in their fishing industry; but much still remains to be done in this field, in which studies are costly and take a long time. Consideration of this problem is specially important if it is considered that a sizable number of Latin American countries uphold the principle of sovereignty up to 200 miles from their coasts.

164. The above observations on pollution and disturbances of international scope account for the interest of the Latin American countries in reinforcing their information systems so as to keep fully abreast of the situations that may affect them. Since they are complex situations which

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require the attention of qualified experts and the direct costs may be high, the importance which this information may have for the countries concerned and the feasibility of obtaining it with the resources at hand should be evaluated in order to avoid overlapping and duplication of efforts, particularly as the need for information may come from abroad and respond to different priorities.

165. Co-operation in matters of more localized regional interest, such as those relating to the protection of international hydrographic basins and border areas, fisheries resources, and possible atmospheric pollution in large regions, would be somewhat easier, since Latin American specialists have been exchanging information about it for some time, either with a view to solving specific problems, or in institutionalized form through subregional co-operation systems, joint committees, hydrographic basin committees, etc.

III. THE ENVIRONMENT IN NATIONAL DEVELOPMENT POLICY

1. National, regional and local planning

166. After the Second World War, development planning changed radically in content and scope in developing countries. One of the trends observable in Latin America is the incorporation of different variables not previously considered and the growing importance attached to the co-ordination of policy decisions in all sectors of production. Thus, planning techniques, which in the early 1950s were aimed exclusively at stimulating the under-developed economies and achieving industrialization combined with a certain degree of agricultural development, became an instrument embracing the whole process of economic and social change.

167. The problems of co-ordinating economic and social decisions within the context of a development plan have brought to light various shortcomings of planning theory, inasmuch as this theory derives almost entirely from a body of economic theory that has resulted from the analysis of cyclical fluctuations, summarized in macroeconomic terms and expressed in Keynesian language. The need to mobilize more resources and make better use of the available manpower in order to accumulate capital in an efficient way and at the same time take care of increasing social claims has determined conditions in which planning is converted into an experimental instrument of development policy.

168. Latin America has gained considerable experience in regional economic planning over the past twenty years, but in most countries it has involved improvised activities often designed to promote economic development in one area of a country, whose backward state is considered to be an urgent national problem.

169. It is at this level of planning that environmental problems can best be brought into focus. Although, because of their scope, some aspects of environmental conservation such as pollution of the high seas and national water policy, fall within the competence of national planning, it is also true that, as the areas covered by planning are demarcated, the problems of preserving the environment are more precisely

/defined. Thus,

defined. Thus, for example, planning regions are often defined on the basis of a certain combination of economic and social factors and geographical and ecological factors. For instance, in defining the Venezuelan llanos, North-east Brazil and the Guayas delta as planning regions, the reciprocal relations between the nature of the environment and the content and goals of regional planning become very clear. The same is the case in the Amazon and River Plate basin areas, although they are of interest to several countries.

170. The combination of problems of resource conservation and problems of improving the environment and planning its future balance influence the criteria used in formulating development programmes for a whole country. This same line of reasoning is applicable to planning for subregions. Many of the subregional development programmes which have been established and implemented in the Latin American countries centre on a basic infrastructure project, such as a hydroelectric dam, which determines the future development prospects of the area considered. The combination of power generation with farming and agricultural processing activities is a form of regional development of interest to most Latin American countries, precisely because of the abundant water resources found in the region.

171. If the sphere of action of planning is limited to a city or a metropolitan area, the environmental planning problems brought about by technological changes deriving from development may stand out more clearly, because recent development in Latin America has centred on industrialization concentrated in a few cities. In this case, the relationship between the techniques introduced and changes in the environment assumes more immediate significance and raises some vital economic problems in maintaining the growth rate of several Latin American countries.

172. There are certain aspects of environmental deterioration in urban areas which cannot be associated, except indirectly, with any particular investment, e.g., air pollution, and the policy governing the use of

/water and

water and the preservation of green areas. In another sense, however, if consideration is given to the relationship between each new investment and environmental conditions, environmental conservation could be defined in economic terms and could probably jeopardize the competitive capacity of Latin American enterprises in the world market. Thus, in approaching the question from the standpoint of the evaluation of investment projects and considering the conservation costs involved, the problem arises of reconciling the interests of the company and the country concerned in ensuring an acceptable level of efficiency without detriment to the environment.

173. The formulation and analysis of projects should be governed by a set of rules, including some relating to the environment, to ensure compatibility between economic investment aims and the interest, of the community. If such rules are lacking or inadequate, entrepreneurs or project-makers may use their own judgement regarding environmental problems, and naturally give much more weight to profit considerations in each investment. Moreover, care would have to be taken to see that regulations established for quite different conditions in developed countries are not transferred to developing countries by means of external financing clauses, without necessarily coinciding with the criteria chosen by each Latin American country.

174. The effects of environmental projects may be divided into three categories:

175. (a) Alterations which directly affect production capacity, such as the effects on its own inputs and other factors of production. These cases would represent poor management of renewable natural resources, unsatisfactory soil use, ecological changes, toxic effects on the workers' health, etc., which all have a direct impact on the firm's efficiency.

176. (b) Alterations which do not jeopardize the company's production capacity during the implementation of the project and may even benefit it, but which involve a social cost that in many cases may be added to the economic and social evaluation of the project considered as part of an investment programme.

177. (c) Alterations which have favourable effects since they derive from projects aimed at preserving the environment or at correcting the existing imbalances.

178. All these considerations may be included among the criteria for adopting investment decisions at both the regional and the urban level. Some may also be useful in the preparation of sectoral programmes.

179. Neither must it be forgotten that the preservation of the environment involves an element of cost which should no doubt be taken into account in international financing schemes, so as to avoid diminishing the efficiency of the Latin American economies in their present stage of development.

180. Environmental criteria could be incorporated in the various levels of planning by means of the so-called "operational systems" that have been used successfully in Latin America in recent times. They comprise a group of bodies with the proper chain of authority and structure to undertake and control activities that are compatible and have the same regional, sectoral and national goals. Their objectives usually cut horizontally across the traditional sectors of planning and thus unite functions which are generally performed separately. Conservation of the environment offers a typical field of application for these systems, with the fewest possible changes in the existing institutional structure, thus avoiding the establishment of onerous or inoperative bodies like many which have started operating in new fields with scarce technical personnel.

181. The institutional form which these systems will have in practice would vary according to the conditions in each country. Some countries,

/such as

such as Chile, are setting up advisory inter-ministerial committees, while others are already assigning executive responsibilities to certain ministries which must operate in a co-ordinated fashion (such as Mexico).

2. Policy of human settlements and natural resources

182. There is a general awareness among the authorities operating in different sectors of economic activity, concerning environmental problems in the region, and the public is also beginning to be conscious of them. They have been dealt with in one way or another in the processes of planning and operational action. The idea is not to prepare new spectacular programmes but rather to combine what hitherto have been somewhat scattered projects in a homogeneous whole that will help to keep a more active watch over the relationship between man and his environment in Latin America, taking advantage of the new criteria which are emerging in the matter and the opportunity to take part in the world movement.

183. The appropriate policy can be based only on an interpretation of these problems as the expression of the region's under-development, in all the stages found in the different countries. It should be remembered that this implies a persistent duality, since the conflicts between man and his environment stem from the opulence of the more developed sector, and strata on the one hand, and the poverty of the neediest sectors on the other. These problems derive from the prevailing economic and social structures, and until these are harmonized, no really satisfactory solution can be expected. However, much can be done to ease the pressures in the near future until the structural defects are remedied. Possibly the most useful way would be to organize the institutional structure along such lines as to be able to co-ordinate the action to be taken once the policy has been clearly defined. Some guiding principles are given below, although the available information and the research performed to date permit only very preliminary thoughts and suggestions.

/(a) Settlement

(a) Settlement patterns

184. Since the human environment problem is associated with the existence of a stratified international society, with national societies whose internal stratification involves marked differences and with the existence of sharp regional disparities, it would seem that the policies should be aimed at taking care of all these levels. A common factor of these policies would be to reduce the inequalities involved in this stratification with a view, on the international plane, to strengthening the region's resistance to the greater dependence which may be implicit in trade and the transfer of technology and, on the national plane, to increasing the opportunities of the population strata and regions with are least able to protect themselves from environmental deterioration.

185. At the national level, the protection of human settlements would have to be based essentially on a more harmonious land distribution which would at the same time ease the pressures resulting from indiscriminate urban growth and provide the rural worker with a better chance of being assimilated into a more dignified way of economic and social life. If he had more incentives to development, he would be less likely to leave the countryside and thus add to the congestion in the cities.

186. A first conclusion inferred from the search for lines of policy in these social issues is the difficulty of making up this urban-rural unit and gaining a real understanding of its operation in terms of the development of the human environment. It should be recognized that the investigations undertaken prior to this study, although brief, suggest rich fields of research and the need for considerably more basic information, without which there is little more that can be said.

187. (i) In the urban environment. Since most of the urban problems described above have resulted from accelerated urbanization, concentrated in the capital cities and a few major towns, it would seem that a first policy measure should be to establish the "rational size" of cities. Although there is no direct relation between size and environmental problems, the latter are undoubtedly more serious in the larger

/Latin American

Latin American cities which have grown precipitately, with the resulting pressure on infrastructural services. This is, of course, common knowledge and has been a source of concern for the specialists involved in urban planning: economists, sociologists, architects, engineers, health officers, etc. There has been much speculation about the need for new dynamic poles which, besides easing the pressures in the great cities, would constitute centres for utilizing new natural resources in the interior, thereby contributing towards national and subregional integration.

188. In fact, this forms part of the large-scale strategy for the use of physical space in Latin America. In the urban habitat proper, it should be supplemented by over-all urban planning. Consideration of the environment could help greatly towards achieving this objective, which has been pursued unsuccessfully in the past.

189. Of the many fronts on which such planning could be tackled simultaneously, it would seem appropriate for the Latin American countries to pay primary attention to the problems of urban marginality, which contributes greatly to the general environmental deterioration and affects the poorest and most defenceless population groups.

190. Other fronts could include: the restructuring of consumption patterns in more affluent sectors, of industrial development, and of the utilization of space and its infrastructural services. As regards the first point, environmental policy could be based on the criteria and instruments which are being developed by the more industrialized countries, since the problems and their origin are the same in both cases. Measures would have to be devised to penalize those responsible for environmental deterioration, so that their consumption patterns are gradually reconciled with the protection of the environment without detriment to third parties.

191. Separate measures would have to be adopted in restructuring large-scale industry, whose costs cannot be transferred to society through a process of environmental deterioration, but only strictly in the sense of a social contribution (through income, employment, services).

192. The policy governing the use of urban space would be the most difficult because it involves the heaviest financial burden for the State,

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when it involves reserving areas for public use and extending services such as drinking water, sewerage, transport, etc., which the State has to finance.

193. The last great front on which to attack the urban problem is housing, a subject about which a great deal has been written and whose importance need not be stressed here. Environmental conditions for housing programmes are well known to architects and town planners; but even with the co-operation of other specialists it has not been possible to form a clear picture of the needs so as to determine the necessary means. The establishment of parameters for evaluating the condition of housing centres, with the help of the new criteria for improving the environment, would constitute a positive contribution towards solving this serious problem, which affects not only the poverty belts around the cities but also relatively neglected central sectors which have turned into slums.

194. (ii) In the rural environment. The wide range of geographical conditions, climates and quality of soil, or in a word the ecology of the rural environment in Latin American countries, makes it difficult and perhaps unwise to generalize. However, even at the risk of a certain degree of superficiality - some common features are pointed out in the hope that this will help the various countries in the difficult task of establishing a policy which will make it easier for the rural worker to live in his environment.

195. There are three systems of agricultural production in Latin America: the fairly industrialized modern farm, the latifundio with its connotation of under-utilization of resources, and the medium-sized farm and minifundio, which cover the whole range from acceptable levels of living to extreme poverty. Practically all these systems of farming involve marked social inequalities, and the basic premise of environmental policy would have to be to correct them. To raise the social level of the most poverty-stricken groups is the crux of the environmental problem, since poverty is the principal cause of environmental deterioration in rural areas. In establishing the set of measures to be adopted, account would have to be taken of the types of farming mentioned above.

196. On the large modern enterprises - sugar, banana and coffee plantations, breeding livestock farms, forests, etc. - the worker's living conditions are better than in any other sector of Latin American agriculture, although a great deal could be done towards a more equitable distribution of the production benefits. There are still cases, especially in farming activities of long standing, where technical progress brings real benefits only to the owners of the capital. A tax policy with proper social controls could do much to correct the defects in these enterprises.

197. The social inequalities associated with the latifundio and the minifundio, to say nothing of the waste of the natural resource concerned, are well known. The only way to correct them more rapidly is through land tenure reforms, which have been considered in virtually all the contexts typical of rural Latin America and are in greater or lesser degree materializing in several countries of the region. There is no doubt that an analysis of the results of this experience provides valuable guidance for a process which is irreversibly spreading. From the ecological standpoint, it would be particularly interesting to assess the possible compatibility between the speed requiered by social change and the ability of the rural physical environment to adapt to it. As regards community types of farming which are being tried out at present, it would be as well to study in greater depth the environmental component of social relationships, since this subject covers very specific social factors which vary greatly from one region to another - such as the idiosyncrasies of the rural worker - and a similar variety and complexity of functions of the physical environment.

198. To help open up possibilities for the rural worker, a sound step would be to facilitate his mobility towards less densely populated areas. This is being done through land settlement policies, and here again a knowledge of the relationship between man and his environment could help towards a happy solution between directed land settlement - which has led to so many failures in the region, such as the various projects carried out in Bolivia, Peru, Ecuador, Colombia, Central America, etc. - and spontaneous land settlement, in which the poineer has also remained defenceless and the natural resource has consequently been seriously

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affected, of which there are innumerable examples in countries which are still bringing more land under cultivation (mainly in tropical regions).
The failure of land settlement projects is mainlay attributable to a lack of knowledge not only of the rural worker's character and attitudes, but also of the behaviour of natural factors, all of which adds up to ignorance of the rural environment.

199. A common denominator of these environmental policies in rural areas is the need to consider the provision of material aid to the rural worker who has to rely essentially on his own resources. The lack of services such as drinking water, electricity, transport, etc., and the pressure of the expectations which have been aroused by communication media, can be met only with policies and facilities suited to every circumstance. Undoubtedly, the trend is towards the relative concentration of settlements (shanty town, village, community, etc.) where the above-mentioned services and greater spiritual and cultural incentives can be provided. However, as stated in the previous chapter, it would seem that this is not a welfare problem but a form of rural interpretation of national social promotion policies. This immediately suggests an eminently ecological task, which has also formed part of Latin America's agricultural policy in some degree, but has been neither fully understood nor applied.

200. The great challenge would therefore be to extend the existing knowledge about this matter and translate it into operative formulas.

(b) Natural resources

201. Natural resources will continue to play a key role in Latin America's development in the future. More rational use of land and water, the exploitation of new resources (forestry, mining, energy, tourism, etc.), and the linking up of regions that are currently backward because they lack transport facilities and of dynamic urban centres will help to solve key development problems. Increased agricultural production for the domestic market with greater social participation by the farm-worker should help to keep workers on the land until they can be absorbed by industry and also to reduce dependency on external markets. The exploitation of new exportable resources should also help to reduce dependency on external factors.

202. Action with respect to natural resources will have to go hand in hand with measures to correct environmental degradation of the kind described in the preceding chapter. Together with protecting the air and water as vital resources of the urban environment, such measures will constitute the natural resources component of environmental policy, some of whose main features are described below.

203. (i) Agriculture. The main aim of an agricultural policy is to suit production to needs in a manner compatible with the conservation of agricultural resources. Increases in production can come from expanding the cultivated area or from intensifying land use. Expansion of the cultivated area brings with it all the environmental problems associated with land settlement, irrigation and flood control, etc., mentioned earlier. More intensive land use involves modernizing agriculture, not simply mechanizing it, and sometimes even without mechanization at all.

204. In order to achieve increases in production by means of intensive agriculture, the basic resources of the soil, pastures and forests have to be extracted in a more rational manner by speeding up the normal cycle of the ecosystem and using appropriate and strategic inputs to derive greater benefits in the form of production increments.

205. The damage caused by uncontrolled soil use takes the form of erosion, salinization, alcalinization, floods, etc., which, as noted earlier, constitute very serious problems in Latin America. Hence, Governments should recognize the importance of such resources and promote proper conservation, management and use of land and water, including strengthening applied research programmes and demonstration programmes, and should assign high priority to programmes and projects for the conservation of soil and water within their agricultural development programmes.

206. Soil and water conservation has implications for all aspects of agriculture. Estimates indicate that by 1985 the area under irrigation in Latin America will have increased by approximately 50 per cent. This will involve a large amount of investment in the collection and use of surface and ground water and in drainage and flood control. In irrigated areas, production could be increased considerably if water management were improved by providing suitable training for the agents working directly

/with irrigation

with irrigation workers. Experience shows that training is also necessary to ensure the success of agrarian reform programmes, which are becoming more and more important in Latin America. Such training programmes should promote a proper understanding of the interrelationships between the management and use of water resources and the environment as a whole, bearing in mind the different phases of the hydrological cycle in the atmosphere, the surface of the soil, and the subsoil. This kind of integral approach is essential over the long term.

207. Another aspect of the modernization of crop-farming and stock-breeding is the use of inputs, such as fertilizers, pesticides and herbicides, which restore elements to the environment or reduce the natural obstacles to achieving maximum production. Disease control also has repercussions on the cleanliness of the human environment. Chapter II referred to certain problems relating to the use of such inputs, especially pesticides. Although their use is not so widespread in Latin America as in the developed countries, where problems have reached crisis proportions, they may well reach this stage very rapidly. Techniques are already being used to prevent certain problems, including the biological control of pests and weeds. A policy for modernizing agriculture should take account of these advances, so as to be able to prevent pollution of the environment without holding back the development of agriculture.

208. Policies to promote stock-breeding also have to consider action on two fronts: protecting the basic resource, namely pastures, and introducing controlled techniques to step up livestock output. The techniques for properly managing natural pastures are well known and all that is needed in this respect is to make users aware of them.

209. Disease control will take on new dimensions if national control and even eradication campaigns are instituted, instead of leaving decisions up to the individual farm-owner.

210. The problems of disposing of the wastes from the processing industries, particularly slaughter-houses and cold-storage plants, are closely linked to the question of water pollution.

211. Policies to promote the development of forest resources should aim at achieving better use of available resources. Reforestation of forests

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that have been destroyed, although technically feasible and essential, will not be an urgent priority in most cases, except where necessary for the protection of water basins. On the other hand, destruction of forest resources could be prevented by promoting greater awareness of land use, organizing systems for fire prevention and improved organization of forest resources. In tropical forests, with all their great variety of species, it will be necessary to step up studies on the possible uses of the different types of wood, in order to derive greater advantage from them. With proper forestry management and better use of the wood extracted, forest production could be stepped up considerably, but this again involves developing the forest infrastructure and the official and private agencies concerned. As long as the forest industry was basically extractive, there was no need for a great amount of technical knowledge, but as the tempo of activity has quickened and with the new emphasis on sustained productivity, the need for technical controls to guide its development is becoming increasingly essential. The problems of disposing of the waste from the processing of forest products fall mainly under the head of pollution of the atmosphere and water.

212. With respect to the trends of forestry development, a certain amount of progress may be anticipated, particularly as regards the establishment of integrated industries to process all the different species of hardwood forests, and the expansion of artificial forests, chiefly of softwood species. It is unfortunately not likely, however, that there will be any radical change as regards the destruction of forests. For this to happen, there would have to be a rapid change in attitude on the part of all concerned, from the authorities right down to the general public, based on a greater awareness of the problem posed for the preservation of the environment by the rapid disappearance of the forest cover protecting soils and regulating the water regime.

213. Very closely linked to forest resources are natural parks, woodland fauna and nature as a source of recreation for man. In actual fact, given all the many benefits that come from the forest, and from vegetation in general, there is need for development policy to take account of their many uses. In other words, regional development planning should

/bear in

bear in mind the different possible uses of the soil-water-vegetation complex and endeavour to achieve a balance between the various demands and benefits that emerge out of the development of each element. National priorities and traditional local priorities will have their say as regards the emphasis of the approach and the selection made among different uses of the environment in the development of human activity. In implementing a development policy, advantage should be taken of all the contributions that the human environment can make, both physical and economic as well as intellectual and social.

214. With respect to fishing, while most Latin American countries are seeking to promote the fisheries industry, it is only recently that some have recognized the urgent need to match their fisheries development policies with conservation policies based on scientific research. Apart from the exceptions mentioned in chapter II, the fisheries industry in the region is far from achieving its potential, and as a result major problems of over-fishing have not yet come to the fore.

215. In addition to simple conservation, man can and must endeavour to assist nature, either by sowing new species in rivers and lakes or by using of modern aquicultural techniques. This kind of activity is still in its very early stages in Latin America, with notable efforts being made by Argentina, Brazil, Chile, Colombia, Mexico, Peru and Uruguay. One interesting experiment is being conducted by the Brazilian Foundation for Sea Studies (FEMAR), which is fertilizing sea water in the Cabo Frío area near Río de Janeiro by pumping up water from the lower depths, which is rich in nutrient salts, and heating it so that it stays close to the surface.

216. (ii) Energy and air pollution. Since Latin America has highly populated and industrialized cities that already have environments unsuitable for their inhabitants, and at the same time has vast tracts of lands free from pollution, it would be worth while analysing and evaluating measures complementary to the policies mentioned earlier that would discourage the spread of large urban concentrations and promote the

/creation of

creation of development centres in the uninhabited areas in the interior of the continent.[11/]

217. Thus, Latin America's great wealth of natural resources, including its favourable position as regards lack of environmental pollution, could provide it with an advantage that might accelerate its economic and social development, if it accepted - within pre-established limits and in selected areas - the installation of industries that are undesirable in the developed countries because they involve a high degree of pollution (the more advanced stages of metal processing - steel, aluminium, copper, zinc and other plants - chemical and petrochemical plants, pulp, paper and paperboard plants, etc.).

218. Owing to the region's rapid economic and social progress, which involves offering well-paid work to a population that is rapidly increasing, it will have to pay a price, which might well take the form, at least in part, of a certain level of atmospheric pollution and the pollution of some water courses. Latin America has ample room in its industrial development for a number of polluting activities without reaching the level of environmental degradation attained for example in Japan, the United Kingdom, the Federal Republic of Germany, France, and some regions of the United States and the USSR.

219. It should be remembered that, while industrialization imposes a cost in the pollution inherent in development (and this is evident only in a very few Latin American cities), it does at the same time pay for the elimination of the undesirable environmental conditions common to underdeveloped countries, which are the majority in the region. For example, the rural inhabitants of tropical areas that move to the industrial development centres do breathe an air that is less pure and they do live in a much more noisy and crowded environment than formerly; but they improve their situation considerably in other respects that are also connected with the environment, for example, they are no longer attacked by animal predators, they are less vulnerable to mosquitos and insects (which often carry tropical diseases), they cease to drink water carrying

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11/ In the sparsely populated areas, however, there are other unsuitable environmental conditions, such as animal predators, insects, disease vectors, reptiles, parasites, lack of health and sanitation services, education, communications, etc.

/intestinal parasites,

intestinal parasites, they have education and public health services available to them, their diet is much more balanced, they enjoy electric light, radio and television, etc.

220. Clearly, if there is a choice of technologies for achieving the same objective, ceteris paribus preference will go to the one that pollutes the least. The problem arises when considering how much to pay for the preservation of the environment, given a certain range of options. And the answer depends, inter alia, on the degree of final pollution, which in its turn depends on how much pollution the new activity generates and on the initial level of pollution. Given the very favourable level of this latter parameter in Latin America, additional development advantages might be forthcoming, bearing in mind the information considered.

221. The fact that the opportunity cost of capital is higher in the region than in the industrialized countries also points in the same direction. Because Latin America operates at a higher rate of conversion to present worth, future profits absorb a smaller share of present worth. In other words, given the higher cost of capital in the region, investment in preserving the environment for the future is dearer than in the developed countries, all other things being equal.

222. The following paragraphs discuss some procedures that might be used, with varying degrees of success, to reduce the amount of pollution associated with the production and consumption of energy and give rough orders of magnitude for the corresponding costs. These figures, it should be noted, are of a preliminary nature because more and more is being found out about the problems involved every day.

223. There appear to be three possible solutions for reducing emissions of sulphur dioxide: using fuel with a low sulphur content; extracting the sulphur from the fuel before combustion; and trapping the sulphur after combustion. A working group which met under the sponsorship of the National Engineering Academy of the United States in February 1970, has discarded the third possibility for the moment.

224. While commercial natural gas generally has a low sulphur content, petroleum and coal containing less than 1 per cent sulphur (by weight)

/are in

are in short supply and cost more.[12/] Venezuela has built a large installation to reduce the sulphur content of its petroleum in order to meet United States standards. The petroleum produced in other countries of the region is estimated to have a low sulphur content.

225. The cost of devices to control environmental pollution depends on the quality of the fuel used and the standards to be met. With electricity generation in the United States, it is estimated that average costs per kWh will have risen by between 10 and 20 per cent by 1990, based on the standards and criteria currently prevailing, on the assumption that the share of nuclear power will rise to 50 per cent (from its current level of 4.3 per cent) and that of conventional hydroelectric power will fall from 80 to 42 per cent.[13/]

226. In order to control the emission of particles from the chimneys of new thermoelectric power stations, the devices expected to be installed (filters, electrostatic precipitators, etc.) are expected to increase investment per kW of generating capacity by between 3 and 5 per cent.[14/] Installing the same devices in older power stations would cost much more.

227. Despite the categorical conclusion of the group of experts mentioned above, those who are researching into different ways of cutting down the emission of SO_2 by thermoelectric power stations consider that the cost of such devices would raise investment per kW of generating capacity by between 7 and 23 per cent. To ensure efficient control of combustion, it is assumed that CO emission would be kept within tolerable limits. Two-stage combustion, using special devices, could reduce nitrogen oxide formation by as much as 50 per cent.

12/ Reducing the sulphur content of coal from 3 to 1.5 per cent is estimated to cost between 40 and 70 dollar cents per ton. Reducing the sulphur content of petroleum from 2.5 to 0.5 per cent is estimated to cost between 5 and 7 dollar cents per barrel (a cost penalty of between 20 and 30 per cent).

13/ United States Federal Power Commission, John Nassikas Chairman, Paper 2.1-19 The Eighth World Energy Conference - Bucharest, 1971.

14/ "Nation's First Comprehensive Report on Utilities and the Environment", in Electrical World, 1 June 1970.

/228. Thus,

228. Thus, a "reasonable" degree of control of atmospheric pollution by thermoelectric power stations could increase the generating cost per kWh by between 10 and 15 per cent, much depending on the quality of the fuel used.

229. Cooling tanks and towers (wet or dry) can be used to cut down thermal pollution by the water used in thermal power stations. A "sizable" reduction in water temperature might raise the generating cost per kWh by between 15 and 30 per cent.[15/]

230. Irrespective of how accurate these figures are, it is certain that it is cheaper to incorporate devices to control pollution in thermoelectric power stations when they are built, rather than to add them later.

231. On the basis of the standards laid down in the United States Clean Air Act (1970),[16/] some estimates suggest that the cost of motor vehicles will rise by approximately 10 per cent, the removal of nitrogen oxide compounds being the most difficult problem.

232. (iii) Water. Much of the harm that water causes man could be avoided if there was better knowledge of the hydrometeorological phenomena of each area and the hydrological characteristics of rivers. If the weather could be predicted sufficiently in advance and with a high degree of accuracy, suitable measures could be taken to prevent the damage caused by hurricanes, storms or floods. Furthermore, if better weather information were available, many activities producing goods and services could increase their efficiency appreciably. If the hydrological characteristics of a water course are known, then the authorities could prohibit the construction of housing and the location of industrial activities on those parts of the bank that are most likely to be flooded, and thus prevent the disasters that are an annual occurrence in some countries.

15/ "Cut Pollution at what Price", in Electrical World, 19 January 1970.

16/ Clean air is assumed to contain a maximum of: 9 parts of CO per million of air over an eight-hour period; 0.24 ppm of hydrocarbons over a three-hour period; 80 micrograms of sulphur oxide and 75 micrograms of particles per cubic metre of air, as an annual average; 0.05 ppm of nitrogen oxide.

/233. Furthermore,

233. Furthermore, only if there is adequate knowledge of the hydrological conditions of a river can engineering projects be undertaken that will make efficient use of the water (regulating basins, hydroelectric power stations, intakes, headraces, etc.) or prevent damage (levees, flow regulators, drainage, etc.).

234. Although in each country the emphasis in hydrometeorological studies will differ depending on the country's particular characteristics and mode of development, there is a basic minimum of research that is essential. Annual investment and costs (network of meteorological and hydrological stations and supporting national agencies) work out to roughly 1.2 to 1.5 per mil of total gross annual investment. Unfortunately, several countries in the region are far from achieving this basic minimum.[17/] It should be recalled that, unlike other natural resources which can be assessed rapidly by bringing together all the necessary technical means in a single spot at the same time, gaining information about water resources requires years of observation, since it is necessary to develop fairly extensive statistical series.

235. Greater attention to irrigation practices and drainage control, could prevent water wastage which not only raises production costs but in particular causes soil damage through the raising of the water table and saline infiltration.

236. It is only on the basis of an over-all view of water resources, their current uses and their potential within the framework of economic and social development in each country, that development can be guided so as to prevent the consequences of water pollution at a reasonable cost to the community.

237. In-depth studies, too, relating both to over-all planning and to water resources planning, should provide proper answers to such important issues as quantifying the benefits inherent in ridding bodies of water of pollution; possible alternative ways of controlling pollution and

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17/ ECLA, "La obtención y el uso de la información sobre los recursos hidráulicos en América Latina" (E/CN.12/861), September 1970.

/their costs;

their costs; the distribution of such costs among the inhabitants of a city, a region or the country as a whole; and the distribution of costs among the countries bordering on a water basin.

238. In order to improve communications between the technicians concerned with water resources and the level at which over-all economic decisions are taken, there is need to reorganize the relevant institutional structures.

239. (iv) Minerals and geological factors. The key problem in mining basic metals (Cu, Pb, Zn) is, as noted earlier, controlling the emission of SO_2 in pyrometallurgical processes.

240. Many of the more developed countries ignored the problem of SO_2 emissions in pyrometallurgical processes in the past, but this kind of pollution is now becoming so serious that the legislation being advocated will force several foundries in the United States and Japan to close down. In Latin America, the problem is still in its early stages, and hence if controls are implemented in good time, and given that research is under way into new techniques, it should be able to remain competitive. This is particularly important in view of the fact that the Andean countries have huge proven and potential reserves of basic metals that may well enter into production in the future.

241. One of the most important corrective measures to be taken is to ensure that most of the highly concentrated SO_2 emitted by the conversion process is transformed into sulphuric acid or basic sulphur; with respect to the gases emitted by reverberation ovens, until more effective systems are developed it might be required that chimneys should be built high enough to reduce pollution to a minimum; with respect to the emission of solid particles, it will be necessary to require the installation of separators to trap particles before gases are discharged into the atmosphere.

242. The effluent from ore-processing activities, if acid or basic in nature or containing harmful elements (cyanide, etc.) should be chemically treated before it is discharged; in this connexion it should be noted that virtually any type of waste water can be effectively treated at a reasonable cost. It should also be ensured that effluent contains a minimum of solids in suspension by decanting it in suitable reservoirs and using flocculents, in order to prevent silting in rivers and bays.

/243. Measures

243. Measures to prevent professional diseases (especially silicosis both in mining itself and in ore-processing, and loading and unloading, mainly consist in ensuring good ventilation and using dust masks. In addition, in order to protect the environment, thought should be given to such measures as stabilizing the surface of rewashing reservoirs, improving mined areas through reforestation or planting vegetation where climatic conditions permit, and regulating quarrying in populated areas.

244. Lastly, a realistic policy to prevent ore losses in small-scale mining operations should include, in addition to measures to conserve minerals, the provision of technical assistance by Government agencies of a kind that will maintain such operations in operation, since they constitute the only source of income in some parts of the region.

245. Progress in the collection of basic geological data on the region should provide a valuable basis for the soil specialists as regards the prevention and correction of the effects of such phenomena as erosion, earthquakes, landslides, etc.

IV. SOME INTERNATIONAL EFFECTS OF ENVIRONMENTAL PROBLEMS

1. On world trade

246. It may be assumed that the measures adopted by developed and developing countries to deal with the problems involved in preserving the balance of the environment will have direct or indirect effects on the structure and trends of world trade. It seems unlikely that considerations of this kind can affect all international trade transactions, or even that they can bring about radical changes in the structure of the operations through which developed countries keep in permanent contact with developing and semi-developed countries. However, looked at from the share of the Latin American countries in the world market, there are certain considerations which can probably be taken as a useful basis for working out some policy approaches.

247. In the first place, it should be noted that the current value of exports from the twenty Latin American States amounted to 12,190 million dollars in 1968 and 13,360 million in 1969. Although these figures are the highest values ever recorded for Latin America's sales, the annual growth rate has in general lagged behind that of world exports, and even behind that of exports from all developing countries. As a result, Latin America's share in world exports has fallen steadily during the past decades from 11.1 per cent in 1950 to only 6.7 per cent in 1960 and 4.8 per cent in 1969.

248. Among the various factors which have determined this steady downward trend is the excessive concentration of trade on a few primary products, which have had no share in the rise in sales of the more dynamic sectors of trade, i.e., manufactures. Added to this are the well-known problems of the instability of the world market for primary products and the chronic deterioration of the terms of trade, which have generally meant that the purchasing power of export is growing at a slower annual rate than their volume. Except in one or two cases, the efforts of the Latin American countries to alter the composition of their exports have not yet shown any striking results, notwithstanding the fact that in many of them the share of manufactured products in total exports has shown significant increases.

/For Latin

For Latin America as a whole the share of manufactures in total exports continues to be small, having risen from 2.5 per cent in 1955 to 3 per cent in 1960 and 7.5 per cent in 1968.[18/]

249. In view of these facts, it would be interesting for the Latin American countries to consider the circumtances in which the industrialized countries are gradually puting into practice a number of measures to reduce environmental pollution in their principal manufacturing centres and how this could alter their production costs and import policies. In both cases, international economic relations could suffer gradual pressures which might affect the balances of payment of the Latin American countries and, ultimately, their trade prospects.

250. In the light of problems of this kind, some effects of the environmental sanitation measures adopted in developed countries are identified below:

(a) Favourable effects

251. It has been estimated that the adjustments that would have to be made in the United States economy to take care of environmental sanitation problems could push up production costs by about 10 per cent. If such adjustments do not lead to additional quality requirements for Latin American products, this might result in a possible expansion of the margin of competition for Latin American industries.

252. The environmental sanitation measures adopted elsewhere could mean that raw material processing and export industries might be relocated in Latin American countries, which would raise the total value of its exports. This transfer might be a temptation to industries in developed countries which spend large amounts on controlling pollution. In some cases, added to this factor is the desire to turn to account the advantages of subcontracting, possibly to reduce labour costs. Such industries would

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18/ Exports of manufactures are considered to cover the products included in sections 5 (chemicals), 6 and 8 (miscellaneous manufactured articles, except division 68, non-ferrous metals) and 7 (machinery and transport equipment) of the Standard International Trade Classification (SITC).

/no doubt

no doubt be established in parts of Latin America where nature could take care of eliminating the pollution or wastes resulting from their manufacturing activities, and of staving off for long periods the injurious effects of pollution on mankind. The question is, however, whether nature is really eliminating pollution in less densely populated developing areas. It is well known that pollution of the high seas is practically world-wide. How long will it be before air pollution is discovered to be a universal problem and at world meetings all countries will be charged with the responsibility of protecting these common assets, i.e., the seas and the air?

253. One example of the aim to relocate pollution-causing industries in countries which are better equipped by nature to absorb such contamination is Japan's tentative suggestion that Chile should export granulated iron to that country instead of iron ore, which would raise the total value of Chilean exports of this metal.

254. Another factor which might favour Latin American trade would be the greater demand from industrialized countries for natural raw materials to replace synthetic products whose manufacture causes more pollution or which involve recycling difficulties, with serious waste disposal problems.

(b) Adverse effects

255. There are likely to be increases in the prices of Latin American imports from countries where environmental sanitation measures result in increases in production costs, which are not sufficiently compensated for by government subsidies. Such measures could thus have an adverse effect on Latin America's terms of trade.

256. A second adverse effect might be a ban on certain imports from Latin American countries which genuinely or supposedly, fail to meet the standards established as part of the environmental sanitation programmes in importing countries. What happened in the case of Argentine meat, which was excluded from the markets of industrialized countries on health grounds, could also happen in the case of other products which Latin America is currently exporting.

/257. Venezuela

257. Venezuela presents an interesting case, since the establishment by the United States of a maximum sulphur content of 1 per cent in the fuels used in urban centres is a threat to Venezuelan fuels, whose sulphur content is 2.5 per cent. Plans are afoot in Venezuela to construct a desulphurization plant, since the move to limit the sulphur content in fuels for urban areas has spread to other parts of the world, including Europe and Japan.

258. Another disadvantage could be increased customs protection in countries whose production costs have increased to comply with environmental sanitation standards. This reaction would be incompatible with the principles of GATT, but it would not be the first time that these principles have been violated. Customs duties would probably be increased for products whose manufacturing processes contaminate the environment, or for more complex products which utilize the former as inputs, and whose prices would rise accordingly.

259. It is estimated that production costs would rise by approximately 5 to 10 per cent, according to the industry and the process; this proportion would be high enough to affect world demand.

260. In a more detailed study of the subject, it would be useful to examine the present exports of products whose manufacturing processes pollute the environment in the Latin American countries, and exports of articles which are used as inputs for those products. Latin America exports large quantities of some of these commodities (pulp and paper, petroleum and petrochemical products). Processed foodstuffs, besides the danger of being excluded on quality grounds, may also be excluded because of increased customs protection when production costs in importing countries are pushed up in order to comply with environmental sanitation requirements.

261. It should be remembered that many of the processes that pollute the environment are precisely those which are needed to expand the region's industrial exports, given the existing technology in Latin America. Moreover, if Latin America takes advantage of one of the possible favourable effects of the sanitation measures which may be enforced by by developed countries (the relocation in Latin America of industries

/which cause

which cause pollution), there would be a greater danger of developed countries' stepping up their customs protection against the products of those industries.

262. Exports from countries which have adopted no pollution-control regulations and which must compete on the markets of countries which not only have adopted them but make full use of this fact in advertising their products, would find themselves at a psychological disadvantage vis-à-vis the consumer. This psychological disadvantage might give rise to opposing campaings, such as that launched by the United States against cheap labour in Japan.

2. In the transfer of technology

263. If criteria which take account of environmental problems are introduced into international economic relations, economic problems may arise in the transfer and assimilation of techniques. It must be remembered that at the present time the transfer of technology is an induced process through which developing countries receive the techniques prevailing in the activities which are transferred to them from the more advanced countries. Economic problems such as production costs and size of markets are transferred together with those techniques, and set certain limits on the economic decisions connected with their adaptation to enterprises in developing countries. Operating on relatively small markets, Latin American industry has yielded a very poor rate of return on investment, and has frequently required protection policies in its incipient stages. Hence, the tendency has been to reduce to the minimum any additional costs which may even further diminish the economic efficiency of the new sectors.

264. These economic problems should be considered in the light of the institutional structure through which the decisions making up the policy governing the transfer of technology are adopted in developing countries. The adoption of decisions of this kind with the economic decision-making criteria of enterprises undoubtedly conduces to a maximum reduction in the costs of adaptation and, therefore, to the transfer of possible adverse effects on the environment which such techniques may have in their present form. The use of criteria based on the average costs of

/a specific

a specific subsector of industry may partly solve these problems, but only in so far as the additional cost involved in adapting a technique does not jeopardize the economic efficiency of the industrial subsector as a whole.

265. Apart from these vital aspects of the transfer of technology in the "spearhead" sectors of industry, in discussing this aspect of the impact of the structure of economic relations on the environment, the transfer of technology should be considered sector by sector, so as to determine where the adaptation of foreign techniques is economically viable and where they should be used in their original form.

266. In agriculture, for example, there seems to be ample scope for developing countries to prevent the environmental deterioration already observed in other parts of the world in such respects as erosion, soil depletion, etc. The same observation is applicable to fishing, where certain advanced techniques can be selected which would in any case be more advantageous to developing countries than others which might bring about a reduction in the stock of fish. Apparently, in these cases, the choice of techniques would not affect the economic size of the enterprise using them, and would therefore not impair the economy of the least developed country.

267. The main problem seems to lie in the industrial sector, where the transfer of techniques is an interdependent process, since it is obviously difficult to keep abreast of technical progress in a sector without participating in most of the innovations that are subsequently added. This involves a chain investment process, which makes it highly improbable that the Latin American countries could establish a policy for selecting techniques that would substantially modify the structure of a given sector.

268. From all this it may be deduced that the relationship existing between the world-wide substitution of techniques and the purchase and transfer of techniques has certain repercussions on the balance of the environment, which developing countries will find it difficult to escape as they become more industrialized. The economic cost of offsetting or eliminating such effects, added to the production costs of a developing

/economy, may

economy, may seriously hamper their industrial development efforts. If developing countries intend to implement an industrial development policy with the necessary provisions to counteract the adverse effects of industrialization on the environment, they will certainly need the financial machinery to absorb the costs involved.

3. On international co-operation

269. Stress has been laid in this document on the fact that problems of the human environment in Latin America are closely bound up with under-development problems and that, to a great extent, they are largely responsible for this state. International co-operation designed to resolve these problems should therefore take special account of this fact and not depart from the United Nations broad goals and objectives for the Second Development Decade. In this respect, it should be noted that in the Strategy for the Development Decade, in addition to the targets of increasing the developing countries' gross product and achieving a more equitable income distribution, emphasis has been placed on improving the population's living conditions. The policy recommendations adopted by the General Assembly include some measures directly related to environmental problems. It may be expected that, as the authorities become more conscious of these problems and they become better known, this subject will gradually acquire more importance within the context of development strategy.

270. Among the many forms of international co-operation concerning environmental problems - some of which are already in practice, while their promotion and organization is the real purpose of the Stockholm Conference - the Latin American countries are especially interested in technical co-operation which will enable them to fill the many lacunae in knowledge that is hampering their action on the home front and their participation at a world level. The developed countries are rapidly acquiring more and more knowledge about the problems affecting the human environment and are maintaining observation systems, establishing regulations regarding indexes of the danger which these phenomena represent and adapting their institutional machinery to control them.

/Eminent figures

Eminent figures in the fields of technology and the social sciences are developing criteria and procedures for evaluating these problems and formulating policies. Developing countries, including the Latin American States, are lagging far behind them in these activities, despite the fact that, as has been pointed out in this study, their environmental problems present many critical points and could become as significant as they are in the developed countries. In the search for solutions they are inevitably influenced by the developed countries' currents of thought and experience, and this influence might distort their systems of development priorities unless it were properly channelled and accompanied at all times by the necessary information and research.

271. Fortunately, there are many international co-operation mechanisms which could guide the region in this respect.

272. The United Nations system and its specialized agencies have been working actively in this field and have agreed to give the developing countries high priority in their technical co-operation programmes. They are currently engaged in the observation and study of environmental problems on a vast international scale, which include problems affecting the region referred to in chapter II (such as the world-wide observation of atmospheric pollution carried out by WMO and of radioactivity by IAEA). Moreover, in their respective spheres of action, these agencies are carrying out valuable programmes, mainly for countries or groups of countries in the region.

273. In this international co-operation machinery for increasing what might be described as pre-investment activities with respect to environmental measures, it should be remembered that the United Nations Development Programme (UNDP) is, so to speak, the world bank in this field and is already engaged in a wide range of projects and providing different types of technical assistance in determining the region's environmental problems or in assessing the effects of its development projects on the environment, as a contribution to the study of appropriate corrective or preventive measures. For example, UNDP projects to improve meteorological systems have helped to obtain information about atmospheric pollution problems in many countries of the region, and in Chile an institute of

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region-wide scope is particularly concerned with these problems. Several other projects deal with the deterioration of water resources, by means of studies of river basins, drinking-water and sewerage systems (a large-scale project has just been approved for São Paulo), navigation, etc. Proper management of land, pastures, wild fauna and flora, and the many different environmental problems in human settlements are also receiving attention in UNDP programmes.

274. Inter-American agencies such as the Organization of American States (OAS), the Pan American Sanitary Bureau (PASB) and the Inter-American Development Bank (IDB) have carried out studies and accumulated experience through their activities connected with environmental problems (for example, the PASB system of monitoring stations to measure atmospheric pollution in over twenty Latin American cities).

275. Universities and the scientific community in the region are also exchanging information and mobilizing their efforts through personal contacts, which in this field have traditionally been flexible and constructive.

276. Nevertheless, all these international co-operation activities which have been carried out in recent years have left considerable gaps, both in the over-all view which would make it possible to arrange programmes in a particular order of priorities, and in specific fields which have been somewhat bypassed in research programmes.

277. The Latin American countries could make much more effective use of their own efforts and their scarce resources, mainly technical and scientific personnel, if international co-operation were intensified through the above-mentioned channels and through new forms of concerted action. It is not reasonable that there should be duplication of experience and research, which, as in ecology, require considerable time and careful observations in the field. Although local conditions imprint a very specific seal on the so-called ecosystems (groups of live organisms and natural factors whose interaction causes them to function fairly uniformly, in terms of which environmental problems should be considered), Latin America could step up the study of these systems in order to ascertain the effects of human action and the possibilities of influencing them

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favourably, if the work on typical situations which present themselves in groups of countries were better co-ordinated and if the tasks were so distributed as to make the most of the available resources. It is perhaps too soon to advance any ideas regarding policies for such action, but there is no doubt that a new phase in international technical co-operation would have to be designed to speed up action to clarify the state of environmental problems, for which purpose a greater exchange of information (from inside and outside the region) would seem an indispensable requisite. Regional and subregional bodies are already doing important work in this connexion and could be the point of departure for a system of operational centres for the compilation, processing and distribution of data. With this bigger reserve of knowledge, combined with the continuing comparison of experience and research plans, also on as systematic a basis as possible, the region's capacity to devise and implement its own solutions to environmental problems would be considerably strengthened.

278. The other major concern of developing countries vis-à-vis international co-operation is naturally financial aid. As noted above, the Latin American countries may, through international trade relations, find themselves faced with unfavourable situations which may involve financial losses. Moreover, the protection of their natural resources and living levels, particularly when this means joining in an international effort to avert world-wide dangers, may introduce additional financial burdens in their already tight development budgets. Therefore, it is perfectly justifiable to consider the need to obtain financing over and above that already envisaged for development, which would make it possible to deal with environmental problems without detriment to the most pressing needs. This subject has been discussed in general terms by the international agencies which channel financial assistance. They understand this new need, which gives grounds for hope that proper solutions will be found.