



A LEGAL AND INSTITUTIONAL FRAMEWORK FOR NATURAL RESOURCES MANAGEMENT

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

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A LEGAL AND INSTITUTIONAL FRAMEWORK FOR
NATURAL RESOURCES MANAGEMENT

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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome, 1975

First printing 1975
Second printing 1983

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M-00
ISBN 92-5-101982-7

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FOREWORD

The many problems raised by the management of natural resources are receiving ever greater attention from both governments and international organisations. This concern stems from various causes, chief among them being the fact that some natural resources are both quantitatively and qualitatively limited. Other causes are the increasing opportunities for their exploitation thanks to technological progress, the realization of their inter-dependency and the need to adopt an interdisciplinary approach in their regard. The cumulative effect of all these causes is further compounded with population growth, leading to increased demand for resources and to concern for environment protection.

As from 1969, FAO has established an Inter-Departmental Working Group on Natural Resources and the Human Environment in order to secure the development and coordination of resources activities and policy formulation within the Secretariat as well as cooperation with other UN agencies and international organizations. Following the Stockholm 1972 UN Conference on Human Environment, the FAO Conference established a programme framework entitled "Natural Resources for Food and Agriculture", with a view to bringing into a coherent whole the many activities of the organization in the field of natural resources conservation and environment protection.

Within the context of this programme, the adequacy of existing legal-institutional frameworks for ensuring the rational management of natural resources is particularly relevant.

In this connexion, it is worth noting that early in 1974, the Government of Colombia requested FAO's assistance in the drafting of a "National Code of Renewable Natural Resources and Environment Protection". A team of consultants was organized and dispatched to the field (as part of the FAO/UNDP Wildland Management and Environmental Conservation Programme for Latin America), in order to assist the staff of the Instituto de Desarrollo de los Recursos Naturales Renovables (INSERENA) in the formulation of the draft. The Code was promulgated on 18 December 1974*. The FAO/UNIP team, led by Professor Guillermo J. Cano of Argentina, included three specialists in the law of inland and marine fisheries, forest resources and national parks administration.

The Colombian Code constitutes the first attempt at establishing a single and integrated legal-institutional basis for the rational management of a country's natural resources in relation to the environment. In addition, the legal principles governing international - or "shared" - natural resources as postulated in the 1972 Stockholm Declaration on the Human Environment have found in this Code their first legislative affirmation.

* Decree No. 2811 of 1974, Diario Oficial, Vol. 111 No. 34243, 27 January 1975, p. 145.

Given the considerable interest that this experience is bound to generate and the novelty of the theories of natural resources law, Professor Cano was asked to prepare this outline expounding the juridical basis which was applied not only in this particular mission, but in the development of which he has been instrumental ever since he drafted the Natural Resources Code for the Jujuy Province of Argentina in 1959. The opinions in the way of legal theory expressed are, of course, the author's own and in no way commit FAO.

The document also includes an Annex I where the author presents a possible classification of natural resources. This classification is mainly aimed at a legal audience since more specialized classifications have been evolved concurrently by FAO and other UN organizations, such as that for the Soil Map of the World. It was felt, however, that the classification presented by the author in the Annex has the merit of both comprehensiveness and simplicity for the non technical specialist, and should therefore be made available as a useful complement to the study.

Edouard Saouma
Chairman
Inter-Departmental Working Group on
Natural Resources and the Human Environment

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INTRODUCTION

1. The time has now come for the whole complex of natural resources to be treated as a common and integrated whole and as a constituent element, along with others, of the human environment. Such a unified approach applies not only to the management of these resources but also to the relevant legislation and to the organization of those institutions whose task it will be to administer them.
2. While the need to proceed with their common management has in large measure been understood and effectively followed by technicians, naturalists and a number of natural resource administrators, it has yet not until now been accorded the same status among lawyers.
3. The purpose of the present study is to review the fundamental principles of this new theory, with reference to both natural resources legislation and administration. A final chapter identifies international resources - or "shared" resources - and the international effects of their use at the national level. The Stockholm Declaration of 1972 represented the first statement of certain juridical principles relating to shared resources.
4. An attempt has been made (Annex I) to give an exhaustive enumeration of the various categories of natural resources which make up this specific context. In this way, the reader may be able to comprehend the content and the vastness of the subject dealt with in the first two chapters. There is also given a list of beneficial uses and of the harmful effects associated with each category. Finally, mention is made of those properties which make it worthwhile taking into consideration the respective category of resources from an economic as well as a juridical standpoint.
5. In Table 1, Column X identifies natural resources of interest to agriculture, which, therefore, fall within the functional competence of FAO. Nor are other natural resources ignored. However, under the theory developed in this study - that it is necessary to consider all natural resources, whether agricultural or not, as an integrated whole - the very reference to nonagricultural resources amounts to a recognition of the fundamental conceptual basis of such a theory.
6. The Government of Colombia requested the assistance of FAO in the drafting of a "National Code of the Environment and Renewable Natural Resources" (non-renewable natural resources were explicitly excluded therefrom by legislative mandate: Law No. 23 of 1973). In order to meet this request, FAO fielded a mission of consultants which the author of the present study had the privilege of coordinating. The draft was formulated by the staff of the Instituto de Desarrollo de los Recursos Naturales Renovables (INDERENA) of the Government of Colombia with the assistance of this mission. The basic principles expounded in this study as to the common legal treatment to apply not only to all renewable natural resources but beyond these, to the human environment as well, served as a doctrinal basis in the formulation of this draft Code. The outline of the draft appears as Annex II. This will enable the reader to have an idea of its content and of the methodology followed.
7. For the first time to our knowledge, in legislative history, the common treatment of the human environment along with natural resources has been put to the test. Now, natural resources are but one element making up the human environment, in which other

elements, which are extraneous to natural resources, can be found. But the theory of the interdependence of natural resources can be extended to those other elements. Considerations such as these justify the step taken by the Government of Colombia in integrating into a single Code the rules governing natural resources and other elements of the environment.

8. In drafting this study, the author has also made use of unpublished material he prepared for the Federal Investment Council of Argentina, and in connexion with his participation as Chief Delegate of Argentina in the first session of the U.N. Natural Resources Committee in February 1971.

CHAPTER I

NATURAL RESOURCES LAW

1. Evolution of the role of law and legislation in the field of natural resources

1. Law and legislation governing natural resources have generally evolved in the wake of the situations created by technical development. Perhaps as long as the field of action of laws was the regulation of relations between persons, the development of legislation kept pace with that of needs, and sometimes even influenced human conduct.

2. But when law and legislation had in addition to deal with the persons-goods relationship, it usually lagged behind. This may be partly due to the fact that in this second aspect the legal problem ceased to be a purely juridical question, becoming an inter-disciplinary one. Legal experts are not effective enough to deal with this type of problem by themselves, and need the aid of other scientific and technical experts. This has been seldom understood by those who have been responsible for the education of lawyers, leading to a result that is even worse: scientists and technicians with no legal knowledge sometimes undertake to write laws while lacking the foundations of legal science.

3. With respect to the evolution of legislation relating to natural resources, further reference will be found in Chapter II, paragraph 2 below with respect to institutions, of which laws are a part and, at the same time, the instrument» As has already been stated elsewhere ^{1/}, "...the legal norms governing the ownership and use of natural resources and human relations with respect to these resources developed throughout the centuries, from the earliest stages of social organisation, but did so in relation to each resource separately as man needed to make use thereof". Thus, land legislation was the first to be established and witnessed the greatest evolution, both through civil law as well as through laws regulating public lands and "zoning" for the use of private lands. When man needed to make use of other natural resources, generating thereby conflicts of individual interests, new legal systems were developed. Thus, there appeared successively laws on water, mining, forestry, fishing, and energy, soon followed by those relating to the protection of wildlife, to national parks and reserves, to artificial weather modification and air pollution and, most recently, those governing the resources of the sea. It should be made clear that the terms "laws" and "legal systems" are used here in the broadest sense, encompassing all kinds of national and local laws, regulation and by-laws as well as international agreements.

4. It should be noted that - as has equally occurred with administrative institutions - laws originally did not even comprehend the whole of a particular category of resources, but regulated the different uses thereof as the need arose. Thus, rather than Water Codes, laws on irrigation or on domestic use of water, or on navigation were enacted, and instead of mining codes there were laws on pits, or on ore extraction, or on oil.

^{1/} Guillermo J. Cano. El derecho, las instituciones y los recursos naturales in the review Recursos Hidricos (Buenos Aires), Vol. 1, No 3 (July 1970) p. 41 and ff. See also, Guillermo J. Cano - Problemas institucionales y legales del desarrollo de los recursos naturales (especialmente hidricos) en las zonas axidas de Latino-amèrica, in Jurisprudencia Argentina (Buenos Aires, 2 February 1965).

5. The pace of the evolution of these various legal systems (each applying to a different natural resource) varied with the resource they covered and with the extent of its utilisation by man. For this reason land laws, for example, were! more comprehensive. appeared earlier and dealt with their subject matter in greater depth than those on forestry or fishing with,as a result, an uneven development of the corresponding legal systems. The extent of the use of each category of natural resources explains and justifies such an original disparity.

6 As shown in paragraphs 1 and 2 above, another characteristic of these laws was that, around the beginning of the twentieth century, they concerned more relationships between persons (with respect to resources) than between man and natural resources. That is, they contained few or no rules on how man should manage natural resources but regulated essentially conflicts of interests between individuals in relation to such resources.

7. In non-socialist countries, the history of laws on natural resources reflects to some extent the transfer of the collective or public use thereof, in favour of individual and exclusive private use rights. The term "use right" has been deliberately preferred to that of "ownership" of resources, because, even in those cases where the State retains the power of public or eminent domain on certain natural resources (waters, mines), it grants, through concessions or licenses, rights to their exclusive utilisation by individuals.

2. Integration of legislation relating to each category of resource

8. In the first decade of the present century, Gifford Pinchot developed the theory of the interdependence between natural resources and between their various uses. Pinchot, who was a forestry engineer (and later became Governor of Pennsylvania (USA)) relates ^{1/} how one day, while riding through the woods under his custody, he thought about the relationship between forests, rivers and inland navigation; between hydroelectric power and flood control; between soil and erosion} between coal, oil and other minerals; between fishing and hunting and between many other possible uses of natural resources. "All these problems" Pinchot says "had not occurred to me. What has all that to do with forestry and forestry with all that? They are not separate problems. My work has led me to establish contact with them, but what is the basic connection between all of them? Suddenly it crossed my mind that there is a unity in all this complexity, that the whole problem lies in the relation of one resource to others; that it does not consist of a series of different, independent and opposing questions, each on la separate island as we are in the habit of thinking, but instead there is only one problem with many facets. Viewed in this new light, all these separate problems merged and {revealed a single great and central problem, that of the use of Nature for the benefit of man."

9. This theory provided the basis for the Conservation Movement, and even for extensive legislative activity in both the national and international spheres. Such an interaction constitutes physical phenomena the significance whereof has recently intensified because of population growth and of constantly emerging new techniques. ;These have quantitatively and qualitatively intensified use conflicts between some resources and others, or between different uses of a particular resource. These conflicts necessarily reflect in the corresponding legislation. As was pointed out earlier, laws which at first regulated separately, in isolated sections, the different uses of a particular resource (as in the case of water laws) or the different natural resources began, under the pressure of events, to govern all these matters in a comprehensive and coordinated way.

^{1/} Gifford Pinchot, Breaking new grounds (Harcourt Brace, New York, 1947).

10. Thus, several countries have now promulgated water codes embracing or replacing all formerly separate laws on irrigation, drinking water supply, navigation, etc. Other countries have adopted mining codes consolidating laws which dealt separately with different minerals. There are now also laws on air pollution which cover all the different causes thereof as well as laws on energy which include all its various sources of production. Such a tendency towards the integration of natural resources laws should be encouraged

as it leads to their better utilisation 1/.

11. There has been at the same time a gradual transfer from the merely contemplative role of the State towards the use of natural resources to one of active intervention, not only in the control of individual uses but in the State itself taking over the utilisation of certain resources. This was due to several factors:

a) the need to provide for resources conservation - in the sense of an efficient use thereof, and not of the creation of sacrosanct taboos - especially for the benefit of future generations;

b) the need, in the public interest, to set priorities for the use of certain resources or among different uses of a particular resource. The problem of priorities is a political one and should be dealt with at that level; it requires legal provisions guaranteeing the due consideration of all interests and rights involved and assuring priority to those of greatest public interest;

c) the optimum use of natural resources of immediate interest to the State in its capacity of social trustee since a demand for resources greater than the available supply requires better use and promotes a wider economic circulation. This is obvious in the case of water resources in arid regions 2/ or in that of certain mines the exploitation whereof is difficult. Sometimes the interest of the user appears to be only mediate and, on some occasions because greater responsibilities are imposed upon the individual, is conflicting with the public interest. This problem constitutes however another determining factor for a more direct intervention by the State in the control of individual natural resources uses. Occasionally, such an intervention expresses itself by the imposition of reservations as temporary prohibitions on the utilization of certain resources by individual users (hunting, fishing, mineral, land, water, etc, reservations);

d) the direct exploitation by the State of certain resources - occasionally involving prohibition of their exploitation by private parties - which, sometimes, reflects a political necessity (that of preserving elements essential to the exercise of sovereignty), sometimes the fact that the size or type of the required activity exceeds the economic potential of the private sector, or else, the need to ascertain the effective provision of public services which cannot be suspended without serious detriment to the community.

12. These factors are producing a substantial change in the content of natural resources legislation, for, while legislation was formerly confined - as already stated - to regulating relations between persons (with respect to natural resources), it is now to regulate as well relations; 1) between the government and the users of these resources; 2) between persons and resources in establishing how the former should use the latter; and 3) the internal activity of the government itself (regulations leading to the adoption of policies).

1/ For an analysis of this tendency, see Dante A. Caponera "Towards a new methodological approach in environmental law", in Natural Resources Journal, vol. 12, No, 2 (April 1972; edited by the University of New Mexico Law School.

2/ Guillermo J. Gano, Problemas institucionales y legales del desarrollo de los recursos naturales (especialmente hidricos) en las zonas aridas de Latino-america in jurisprudencia Argentina (Buenos Aires, 2 February 1965).

3. Toward the systematic codification of natural resources legislation

13. In the light of all these factors, it has now become advisable to "codify" the legal regime of natural resources because of the equalizing evolution to which the different resources legislation have been subject in the present century, under the pressure of technical development, particularly in the field of integrated and coordinated resources use planning.

14. To "codify" means however something much broader than to "compile". It is not only a matter of putting together all the laws on natural resources in, one volume, but of integrating them into a harmonious whole on the basis of a common methodology. It is true that the technical problems of exploitation for each category of resources require specific legal norms which vary accordingly. Nevertheless, it is possible as well to establish general rules or principles common to all resources and which at the same time contemplate the problem of the interaction - and of corresponding legal relationships - between the different categories of resources and between their different uses.

15. There are at present legal institutions regulated differently for each category of resource which could be unified for the benefit of the clarity of law and for the effectiveness of corresponding government activities. This applies in particular to

- 1) the procedure under which individuals can acquire the right to use natural resources;
- 2) a uniform regime for reservations which are now subject to different regulations in the case of each category of resource although the conceptual philosophy is identical;
- 3) the way of establishing priorities among uses and resources; 4) the rules aiming at resources conservation; and 5) the policy rules for the integrated management of natural resources as a whole.

16. Recently, few authors from different countries advocated the codification of the legal regime for natural resources in this sense 1/. One of them, the author of the present study is an Argentinian lawyer; the other is a Venezuelan forest engineer and the third, an Italian lawyer. This demonstrates a consensus of opinion from different scientific standpoints as well as from different countries. The Nicaraguan Law on Exploitation of Natural Goods (Decree 316, 17 April 1936) and the draft Code on Renewable Natural Resources prepared at the request of the Colombian Government by Mr. L. Rios Aponte in 1970 reflect more or less the same philosophy.

17. The Saviour and Catholic Universities, and the State University of Buenos Aires have created in their law schools in 1961, 1962 and 1970 respectively chairs for a "Legal Regime of Natural Resources" course which, on the basis of a common methodology, cover research and teaching on legislation relating to land, water, mineral, forest, plant and wildlife, atmospheric, energetic and recreational resources, and where an attempt is made at establishing legal principles common to all these natural resources.

18. The United Nations Committee on Natural Resources (First Session, 1971) requested the Secretary-General to prepare a study on "legal and institutional problems relating to natural resources as a whole, including the administration and modernization of the legal framework, with the object of assuring nations a better control over their natural resources".

1/ Ricardo Gondelles Amengual, "Consideraciones sobre politicas de los recursos naturales renovables" (Caracas 1960); Guillermo J. Cano "Proyecto de Código de los Recursos Naturales para la Provincia de Jujuy" (Mendoza, 1959). See also D.A. Caponera "Towards a new methodological approach in environmental law", *op. cit.*

4. Natural resources a. a part of the environment

19. As stated in a study on Argentinian environmental law 1/, the human environment is composed of three categories of elements:

a) the natural environment, constituted by the natural resources (as defined in Annex I), including the effect of negative natural elements (natural disasters);

b) the created environment, that is things or institutions created by man;

c) the induced environment, that is the products of agriculture, stock breeding, pisciculture, forestry, etc., which are induced and not created by man. (See Annex I, para. 2.)

20. Natural resources constitute tout one of all the elements of the environment which, however, are interdependent. It follows that the statements made at paragraphs 8 to 16 above do support the requirement of integrating natural resources law into environmental law 2/. Conversely, general legal principles applicable to the environment are equally valid for natural resources. It is such a thesis that led the Colombian Government to consolidate its legislation on the environment and natural resources into a single Code as shown in Annex II.

5. Permanent sovereignty over natural resources

21. In compliance with General Assembly Resolution 1729 (XVI) of 19 December 1961, the Secretary-General published a study compiling and summarizing the constitutional and legislative norms in the countries which had contributed to the survey made at that time in this field 3/. The study examined the legal provisions relating to the right of foreign corporations or individuals to the ownership and utilisation of national natural resources, and current international agreements in this respect.

22. Subsequently, and in conformity with General Assembly Resolution 2386 (XXIII), the Secretary-General produced on 14 September 1970 another report 4/ updating the information contained in the original study. The Introduction to this document states that: "Sovereignty over natural resources is inherent in the quality of statehood and is part and parcel of territorial sovereignty - that is, the power of a State to exercise supreme authority over all persons and things within its territory"5/. Sovereignty over natural resources, which is essential to economic independence, is functionally linked to political independence, and consolidation of the former inevitably strengthens the latter. Since it excludes allegiance or subordination to any authority, sovereignty over natural resources implies complete freedom of action for a State in determining the use of these resources. The principle of that freedom of action has been authoritatively expressed and reaffirmed, in conformity with the spirit and principles of the Charter of the United Nations, in

1/ Guillermo J. Cano, "Introducción al derecho ambiental argentino", in rev. La Ley (Buenos Aires, 8 April 1974).

2/ Dante A. Caponera, "La protezione dell'ambientes; Considerazioni e orientamenti giuridico-istituzionali?", in La Comunità internazionale, Fasc. 2, Rome, Italy, 1971.

3/ United Nations, I. The status of permanent sovereignty over natural wealth and resources; study by the Secretariat. II. Report of the Commission on permanent sovereignty over natural resources, New York, 1962.

4/ United Nations, Permanent sovereignty over natural resources - The exercise of permanent sovereignty over natural resources and the use of foreign capital and technology for their exploitation - Report of the Secretary General, doc. A/8058 (14 September 1970).

5/ See, Oppenheim's International Law, 8th edition, vol. I, H. Lauterpacht, ed.(New York, David McKay, Co., Inc., 1955, p. 286.

General Assembly Resolutions 523 (VI) of 12 January 1952, 626 (VII) of 21 December 1952, 1314 (XIII) of 12 December 1958, 1515 (XV) of 15 December 1960, 1803 (XVII) of 14 December 1962 and 2158 (XXI) of 25 November 1966, and in General Principle Three 1/, adopted at the first session of the United Nations Conference on Trade and Development,

The General Assembly has not contented itself with affirming the principle of State sovereignty over natural resources in abstracto as a legal concept; it has consistently placed that principle in an economic and social context and, in operative paragraph 1 of General Assembly Resolution 1803 (XVII), it declared that the "right of peoples and nations to permanent sovereignty over their natural wealth and resources must be exercised in the interest of their national development and of the well-being of the people of the State concerned".

Viewed in that context, the concept of sovereignty over natural resources acquires a dynamic connotation, encompassing not only the formal rights of possession of those resources and freedom to decide on the manner in which they shall be exploited and marketed, but also the capability to exploit and market them so that the people of the State concerned may benefit effectively from them.

23. The representative who, on behalf of the sponsors, introduced the draft resolution which subsequently became General Assembly Resolution 2158 (XXI), observed on that occasion that: "None of the provisions should be construed as expressing hostility to foreign investment in the exploitation of natural resources; foreign capital was needed, and, in fact, welcomed. The developing countries were, however, concerned to secure greater control of and safeguards for the exploitation and marketing of their natural resources... True international cooperation in that connection could be achieved only if the justice of those countries' claim to an increased share in the administration, advantages and profits derived from exploitation was admitted...The developing countries also considered that, in return for the profits developed countries derived from their natural resources, the latter countries should...help them to overcome their technological backwardness by training national personnel for work relating to natural resources," 2/

1/ Proceedings of the United Nations Conference on Trade and Development, vol. I, Final Act and Report, United Nations Publication. Sales No.: 64.11.B. 11. p. 10.

2/ See, Official Records of the General Assembly. Twenty-First Session. Second Committee. 1050th meeting, para. 2.

CHAPTER II

NATURAL RESOURCES ADMINISTRATION AT THE NATIONAL LEVEL

1. The administrative process

24. Natural resources management, or administration as used here, means the action of man aiming at their utilization or at his protection against their harmful effects, including all successive steps from the exploration and inventory thereof to their ultimate re-use or restoration after use. Such an action can be performed by government agencies, by individuals, or by their groupings which constitute bodies of a lesser degree or scope of organization than government.

25. Looking at facts back in history, it will be observed that the first uses of the various natural resources were exercised by individuals or non-governmental types of associations ^{1/}. More recently, the emergence of government action is noticeable in this field, at first only to control and regulate individual uses, later in the direct exploitation of natural resources.

26. Government-controlled or not, natural resources management may or may not be rational. In most cases it has not been, nor is it now, as it is based on individual or group interests without regard to the overall national interest. To be effective, this administrative process must meet two requirements: a) it must cover all steps and activities required for policy implementation, and b) it must consider the relationships between the resource to be managed, other natural resources and the environment.

27. With respect to the first of these requirements, the various steps in policy implementation will be briefly described here, however not in detail but as a whole.

A. Inventory, exploration and monitoring of existing resources

28. It may seem a truism to say that the first and essential step in such an administrative process requires a knowledge of the resource concerned. Nevertheless, many countries reveal a history full of examples of hydraulic works which are either useless or unnecessarily costly because they were constructed without the necessary basic data, of mineral deposits in which large sums of money were invested without a prior knowledge of existing reserves, or of power plants having remained without adequate markets, or of irrigation works which have failed as a consequence of poor soils the nature of which had not been previously investigated.

29. The information-gathering process should be undertaken before, during as well as after a resource is being exploited. Before, to be able to design projects and to evaluate their technical and economic feasibility; during, in order to secure an appropriate management of the works or of related operations; and after, so as to provide informations on the degree of resource conservation and degradation and on the inter-relationship thereof with other natural resources and the environment. This ultimate step is known as monitoring the state of resource conservation.

1/ See, for instance, in the case of water for irrigation, the customary water users' administration in D.A. Caponera, "Water Laws in Moslem Countries", PAD Irrigation and Drainage Paper 20/1, Rome, 1973.

30. Such an activity begins with the exploration, survey or prospecting of the resource, whether invisible as in the case of minerals and geothermic resources, or visible as in the case of slopes capable of producing hydroelectric power or of soil, flora and fauna. It is followed by mensuration and inventory-taking, and concludes with evaluation. The latter may be either physical, in referring to the quantity and quality of the resource (analysis of water, minerals, soils, etc.), or economic, in determining whether the resource is economically profitable in relation to the purpose for which it is intended to be used.

31. The collection of information is a costly and lengthy process which cannot be carried out merely for the sake of research. It requires the establishment and adoption of priorities for its implementation. Normally, such priorities should be set on the basis of a prior demand or requirement forecast for the resource, or of its geographic location.

32. Data collection should however be preceded by a compilation of all available bibliographical or other information. Often, there are informations which, because they were produced from unrelated sources, are unknown to the right person at the right time. Frequently too, part of such informations is to be found abroad (as in the case of data on international rivers). Finally, data are often found to have been duplicated, or to be incomplete. A prior study of available data would thus be of considerable help in the subsequent and indispensable field work and, in many cases, would save unnecessary expenditures. The optimum is therefore to organize data banks in which all existing information as well as that being constantly produced is duly classified and stored.

33. Field operations for the collection of data vary according to the resource involved. Some investigations have to be carried out in a single operation as in the case of soil

and solid ores; others require a continuous and long-term procedure as in the case of water resources for which the longer the period is covered, the better becomes the available information. All operations must however meet the following two requirements: a) they must be reliable, and b) they must afford a degree of comparison in order to facilitate the choice of alternatives. In both cases standards must be adopted to ensure these objectives.

34. Certain physical data, like those concerning geology, meteorology and cartography, have a multipurpose nature, that is, they can be used to plan the utilization of different resources.

35. Information collected for a specific purpose may be useful for others; for example, drilling for oil usually leads to the discovery of water. A Well organized data bank allows for an adequate and multiple use of all such data.

36. The use of satellites and of remote sensing techniques has opened up formerly unsuspected prospects in the whole information-gathering process relating to natural resources. Such prospects make it possible not only to lower corresponding costs but to extend survey operations to regions almost inaccessible at present or accessible only at excessive cost ^{1/}.

37. The natural resources inventory and evaluation process calls for a simultaneous implementation of corresponding ecological studies. Their lack has already caused serious damage to the environment because of a failure to foresee the consequences which the use of a particular resource can have on others and on the environment in general.

^{1/} See, "Use of remote sensors in earth—orbital space for the discovery, inventory, evaluation, development and conservation of earth's natural resources" by Peter Castruccio, OSAG. Background Paper 13 (April 1966); A/AC/CRP 2 (March 1970); Model of plans for a developing country to establish participation in an operational earth resources survey satellite system within the decade - Note by the Secretary General - The first satellite of the type referred to (ESR-1) was put in transpolar orbit in July 1972 by the United States.

38. All resources form part of a sphere (atmosphere, hydrosphere, lithosphere, etc.) and of a cycle. If a particular cycle is interrupted or modified by the act of man, the entire sphere is affected thereby. Rational resources management should therefore include ecological studies so that appropriate conservation measures can be taken.

39. Not only physical data can be collected. Economic, sociological, political, institutional and legislative informations are required as well; all contain basic elements for the making of final decisions on natural resources utilization.

40. Natural resources monitoring also constitutes an information-gathering activity designed to observe the state of natural resources conservation and degradation, including the condition of their reserves. Applied on a regional or national scale, it permits the observation of the interrelationship between resources and the environment and, in the event of deterioration, the timely adoption of preventive or corrective measures. The use of satellites may also be of assistance.

B. Evaluation

41. The economic appraisal of natural resources is a complex procedure. As a first step, it requires technical pre-feasibility studies to show whether the various resources development alternatives are physically feasible (on grounds of geology, structures, available reserves, nature, etc.). It should however be borne in mind that such alternatives may consist in the use of resources different from that evaluated (e.g., hydroelectrical vs. thermal power production, or the use of natural gas either as fuel or as raw material for the petrochemical industry). After the technical feasibility has been established, a second step requires the study of the cost-benefit ratio for the various projects to be considered.

42. Many factors are to be considered when making such a study. There is a growing awareness of a wide range of so-called indirect or intangible benefits (social, political, military, etc.) which may not be measurable in terms of money, but which sometimes influence decision-makers more than measurable factors 1/.

43. One of the costs which has so far been omitted from this type of analysis is that of environment degradation. Failure to take any precaution in this respect results in the need for subsequent corrective measures. Sometimes these require large investments: treatment plants for water or for smoke and gases released in the air, erosion control measures, control of floods aggravated by man, etc. Should corresponding costs have been included in the initial analyses, conclusions might often have been different. It is therefore recommended that these be taken into account in any rational natural resources management process.

44. The appraisal of natural resources according to modern criteria should also include an examination of the possibilities for their reutilization or recycling. This applies not only to renewable resources such as water, but also to non-renewable ones like minerals. This need is based upon two considerations. First, that of the growing demand for natural resources and, therefore, of the corresponding shortage in their availability which may be relieved by a second or third use thereof. This consideration is of an economic nature. The second one concerns the constant increase in the production of refuse and wastes which deteriorate the environment. Evidently, the possibility of reutilizing or recycling natural resources reduces the depletion of reserves and limits the presence of refuse and wastes.

1/ Jay W. Forrester, "Counterintuitive behaviour of social systems". Technology Review, Vol. 73, No. 3 (January 1971). Alumni Association of the Massachusetts Institute of Technology. See also Arthur Mass and David Major, "Objetivos de la política hidrica y problemas institucionales conexos", in Series de Política Hidrica No. 1, ed. by la Secretaria de Recursos Hidricos (Bs. As. 1970) p. 29 and ff.

45. Finally, it should be stressed that information concerning a resource which is not economically exploitable at present should be stored since technological development often produces new processes permitting the utilization of resources that had no previous economic use. This applies to the so-called "invisible" metals which, thanks to progress in the field of metallurgy, are becoming economically exploitable, or to saline water which solar desalinization processes may soon turn into low cost drinking water.

C. Policy-making

46. The decision-making process concerning the use of natural resource takes place at the political level. It is there that national objectives are defined and established. Obviously, motivations governing their adoption may vary in time and decisions of this type therefore require periodic review.

47. The implementation of natural resources development projects has not always been preceded by the adoption of policies. Projects have often been approved and implemented without a prior examination or appraisal against general national interest requirements and independently of any programme or plan. This is contrary to rational management since it rules out the consideration of alternative solutions, opportunity cost analyses and other factors.

48. Decisions at the political level must first take into account international interests and commitments. For example, the decision to develop an international river or postpone its development may be influenced by such considerations; that to exploit an ore deposit may be influenced by world market conditions, reserves and costs, or by the need to obtain a particular foreign currency. Strategic considerations or those arising from the international balance of power may also have relevance, even in deciding the implementation of economically unprofitable projects.

49. National policy considerations, such as the need to promote the development of one region or sector (agriculture, industry, etc.) before others must also be considered. Social factors are also of this type. A government may decide that before producing hydroelectric power for a rich, highly populated area, it has the duty to provide water for human consumption in under-developed regions.

50. Purely economic factors then come into play, such as those deriving from cost benefit analyses, or individual project financial feasibility, and thus from a choice between alternatives.

51. Lastly, investment factors are to be weighed. If capital resources, whether national or foreign, are insufficient to cover all needed projects, it is clear that priorities have to be set for the chronological implementation thereof on the basis of "opportunity costs" criteria.

52. The procedure for the adoption of the policies and the organs responsible for their implementation depend on the prevailing political institutional structure. In the preliminary stages, it is advisable to have the participation of technical experts and economists to advise the political organs with whom the ultimate policy decisions rest.

53. It is equally advisable to allow the different interest or pressure groups have the opportunity to express their views and arguments. Such interests may be geographical or sectorial. A rational policy should consider all of them and, where there are conflicts of interest, should determine corresponding preferences. But to implement projects independently from any policy and to make decisions on a case to case basis is unsound.

D. Planning

54. The planning process constitutes the tool for the implementation of a prior policy decision. This process should preferably take place at the national level; it may however be followed - or preceded - by regional and sectorial planning having different but not opposing, methods and aims. To advocate here that the planning process should integrate that for the rational management of natural resources does not purport to mean that such planning should either be compulsory or simply indicative. It does mean however that those who look no further than where they tread cannot know where they go.

55. There is a two-way intercommunication between the planning and policy-making processes; the former must provide the latter with the necessary information, and the latter must in turn refer decisions back for the planning of their implementation.

56. It is at the planning stage that maximum attention ought to be given to the interrelationships between various natural resources uses and between different resources. The essence of rational management rests therefore at this stage. A close examination of their interaction and reciprocal effects on the environment allows for 1) the adoption of sound decisions on natural resources based economic development, and 2) the forecast of harmful development effects on the environment and for the adoption of appropriate preventive measures. Such measures may involve little or no expense at the planning stage whereas once a damage has occurred, corrective measures are usually much more costly.

57. The type of planning envisaged here is not only physical, relating to structural measures (operations and works), but includes as well non-structural measures such as an adequate organisation of administrative institutions and the adoption of sound legislation. Non-structural measures like zoning or rules for watershed management can save large amounts of structural investments. One author calls these measures "multiple means" to achieve either individual or multiple purposes 1/.

58. The natural resources which, for the purposes of this study, are called international are defined and examined at Chapter III. As already suggested, the planning of their use and of protective measures against their harmful effects at the national level should include that part of the corresponding international planning in which every country participates through the bi- or multi-national machinery set up for this purpose.

59. The task of planning usually, although not necessarily, includes the implementation of pilot projects. These are to be recommended whenever possible because the experience that can be gained therefrom is useful for avoiding future errors or for the adoption of final policy decisions 2/.

60. The planning stage ends with the preparation of work projects. This task is sometimes considered to rather belong to the next, or operational stage. Where large scale works are involved, project designing should normally be carried out in stages as well. This should therefore be done within the framework of a rational management policy. Such stages are usually referred to as: 1) pre-investment or pre-project stage, including technical and economic feasibility studies and general specifications; 2) final project, or project operation or implementation stage, which includes detailed plans and specifications as well as the documentation needed to contract for the works.

1/ Gilbert White, "Strategies of American Water Resources Management" (Ann Arbor, 1969), Michigan University Prese.

2/ United Nations, Advisory Committee on the application of science and technology to development. Natural resources of developing countries: investigation, development and national utilization. New York, 1970, p. 174. UN publ. 1970 II B.2.

61. It is sometimes considered that planning should also include control of the execution or implementation of programmes and plans in order both to assure the efficiency of the executing agencies and to make the necessary revisions. Rational management should be based on flexibility and on the possibility of readjusting decisions from time to time. Constant technological progress and other factors such as unforeseeable changes in population distribution patterns, natural calamities or fluctuations in market conditions, often make it necessary to rectify the policy decisions under which the execution of programmes, plans and projects was begun.

E. Regulation and control

62. This activity comprises, first of all, the establishment of legal norms governing the use of natural resources or imposing obligations concerning the protection against resulting harmful effects (normative power).

63. There are two kinds of normative activity: legislative, limitatively, and regulatory. The first belongs to the legislature. The regulatory activity pertains to the respective executive authorities which can and usually do delegate it to dependent or autonomous organs. The executive or administrative branches of government are usually recognized the power to establish norms for law implementation, commonly known as regulations or bye-laws ("jus edicendi").

64. The regulatory power of the State appeared in the early stages of the natural resources utilization process, that is as soon as such utilization began to generate conflicts between individuals, or between individuals and the government; it rarely applied to relationships between natural resources and individuals however. Such norms constitute the means of settling conflicts between individuals or corporate bodies competing for the utilization of the same resource (preference) 1/.

65. The regulatory power is usually exercised in two ways; a) by incorporating certain natural resources into the public domain as national property in which case the government, retaining ownership, permits or allows their private use subject, however, to certain contractual or legal conditions which are contained in the norms regulating such uses;

b) by exercising "police powers" making it possible for the government to impose on users the obligation to observe certain rules in their use of things recognized as their private property. This power is less extensive than that the government reserves for itself over the use of State property.

66. Regulatory norms relating to natural resources may govern a) the way of their extraction, exploitation or utilization, and b) the transport and marketing of the products or services deriving therefrom. The first type of norms appeared in the beginning for the settlement of conflicts between individuals and later in relation to the protection of human integrity. Norms regulating mining operations, dam construction or electric cable installations are of the later type. These norms were also imposed to ensure that the exercise of individual rights of utilization would not injure others. Norms of this type concern wells for underground water extraction within "protected areas" wherein the construction of other wells is prohibited, even on third-party land, or limit the quantity of surface water that may be used.

67. Later, with the advance in resources development, regulations were made with a view to their conservation, by attempting to prevent their waste or inappropriate use. This category consists of norms establishing "reserves" and prohibiting therein the exercise of certain activities in particular places or times as in the case of fish, forest or mining reserves, or of norms permitting the use of a waterway for a specific purpose (non- consumptive use) but not for others (consumptive purposes) for instance. Such norms already involve a man-natural resource relationship.

1/ See, "Law, institutions and natural resources" in U.N. document E/4636/add. 1, 3 April 1969, P. 39.

68. At present, there appear regulations which seek to preserve the environment like those intended to prevent water or atmospheric pollution and erosion. Regulations on transport or prices and tariffs do have a specific economic policy objective and are designed to influence markets, maintain reserves, or protect the constater. Not only prices but taxation and non-tariff trade harriers (such as health requirements) are used as well for these purposes.

69. The government may exercise its regulatory powers in respect of individuals, or of its own agencies when the latter engage in activities of a commercial nature when utilising natural resources or services deriving therefrom.

70. There are some intermediate forms of social organization covering a wide range of activities (cooperatives, users' associations, private firms, mixed or semi-public corporations or agencies, and State enterprises) which, needless to say, should also be subject to regulation. Usually, some of these are also delegated regulatory powers by the State, although limited to their own components.

71. As to control, it consists in the exercise and enforcement of regulatory powers. It involves the power to inspect, judge or decide and to enforce the implementation of corresponding decisions. This may be achieved by direct action, by the use of force, or through fines and even imprisonment. When, as will be seen later, the government also carries on commercial activities, that is, exploits natural resources or the services deriving therefrom, either directly or through its agencies, a conflict usually arises in as much as the government, having judgement and decision making powers, may therefore become judge and party in related lawsuits. This constitutes a departure from the system of due process of law and of the guaranteed rights of third parties.

72. For this reason, it is desirable to draw a clear dividing line between government agencies authorized to exercise regulation and control - and therefore vested with decisionmaking and law enforcement powers - and other bodies responsible for the operation of commercial-type activities which may thus become competitive with or concurrent to individual or private activities of the same nature. It is therefore right that the latter be given a guarantee of fair trial and fair competition. As a result, it is always necessary that the decision-making authority know of from the technical elements or equivalent advice necessary for passing a judgement.

F. Development

73. Development, as used in this study, means the executive or operational stage, as designated as the "entrepreneurial stage" ^{1/}, in the use of natural resources or in taking protective measures against the harmful effect thereof(such as flood control works).

74. This activity may be carried out by private individuals (or their associations) or by the government. The degree of direct government management in the development phase will be greater or lesser depending on the prevailing political philosophy. In the present century, there has certainly been an accentuation of the tendency towards direct government intervention. Sometimes, this has been determined by international political considerations (maintenance of sovereignty and ownership rights over certain natural resources of strategic importance); at other times, by economic and financial motivations (cost of works beyond private financial capacities) and, on other occasions, by internal political reasons (need to assure continuity and economy in the provision of certain public utilities).

^{1/} Yang Ch'eng Shih, "American Water Resources Administration", Bookman Association, New York, 1956, vol. 1, p. 142.

75. Whether natural resources development is carried out by private parties or by government agencies, rational management requires that, as has been stated earlier, the government agency responsible for corresponding regulation and control ensures that a) development follows government policies; b) it does not cause damage to the environment and that c) measures are taken for the conservation of the resource concerned so that the utilization thereof does not harm other natural resources.

76. As has already been mentioned, a constantly increasing phenomenon affecting the environment is the production of waste and refuse and the need to dispose thereof in a way harmless to the environment. This problem is making it increasingly necessary to pay attention to methods for reutilisation and recycling of natural resources. These methods can both reduce the amount of cumulative waste and at the same time increase the supply of some natural resources which are beginning to undergo critical shortages. This is a consideration that must be kept in mind during the development stage. Besides, it can reduce development cost by providing additional raw materials in the form of by-products cheaper than in their original or unused state (slag, glass, paper, recovered water, etc.).

G. Financing

77. No attempt is made here to examine the problem of how governments or individuals may finance their natural resources development programmes since this lies outside the purposes of the present study. In any case, the possibilities afforded by the World Bank and regional credit agencies (Interamerican, Asian, African Banks, etc.) to complement what national financial resources cannot achieve are so well known that they need not be discussed here. These financing agencies, as well as the UNDP, help to finance pre-investment studies.

78. If financing in connection with rational management of natural resources is briefly mentioned here, it is to point out that reimbursement policies for the recovery of investments made by governments or their agencies have to consider some essential factors which require to be examined. Governments may finance natural resources development projects out of their own funds, or by obtaining loans, constructing and operating works themselves and recovering such investments through taxes and rates. In this case, the immediate beneficiaries normally bear corresponding charges.

79. A rational policy means making distinctions among different sectors of users when multipurpose works are involved, since the extent of interest of each sector may vary. Generally, however, such works also affect indirect beneficiaries who, while not using them, benefit from the financing thereof. If the government subsidizes part of their cost, simply renouncing repayment of that part corresponding thereto, it is charging such a subsidy to the tax-payers as a whole who usually constitute indirect beneficiaries. This makes a management policy rational. The problem lies in measuring the level of indirect benefits.

80. Governments may also act through loans, leaving the implementation and operation of natural resource development projects to the private sector. If loans are to stimulate development, they must be granted on repayment terms commensurate with the evolution of the process aiming at the full productivity of the works. The recovery of investment should take place within a time limit making the amortization recouped from beneficiaries (in the form of taxes or loan repayment) compatible with the resulting productivity of the works. Therefore, both "grace periods" in the initial stages and systems for a progressive increase in repayment rates are recommendable.

81. As to that part of investments that makes for the protection of the environment in which the interest of users is only indirect, it can be subject to special financing which stimulates and facilitates such a protection. Special financing may consist of longer repayment terms, lower interest rates, and even partial subsidies.

H. Recovery and restoration

82. Awareness of the environment has arisen very recently when considerable damage had already been inflicted on it. It is to be hoped that, in the future, further damage will be avoided. Some natural resources are already degraded and have become unfit for utilization by man, in some cases due to human action and in others to natural phenomena (such as large swamps or degraded soil areas). Most of them are recuperable. There are only a few cases where degradation is irreversible. The final stage of the rational management process should therefore consist in the attempt to recover and restore natural resources to utilisable conditions whenever possible. Such is the purpose of draining operations, whether preventive or remedial, reforestation is an example of the latter. There are abandoned mines which can be worked again thanks to new methods which make previously uneconomic extraction processes now profitable. Remedying river and sea pollution makes it possible to reuse waters which were formerly unutilizable.

I. Some specific problems of natural resources administration

(i) Technical and managerial personnel 1/

83. The shortage of highly trained personnel for natural resources management in the various stages examined earlier intensifies proportionately with the sophistication of modern technology which places countries lacking it far behind the others. This shortage has two aspects: a) a lack of specialists in certain sectors, and b) a lack of inter disciplinary training which constitutes the very core of a modern natural resources administration. Any rational management programme must give highest priority to this problem the solution whereof is decisive in the changes of success of the programme itself.

(ii) Research

84. Research, which leads to "know-how", is an indispensable component of modern rational administration in that it determines technological progress. Even in the most highly developed countries inadequacies are found in some research fields. There are countries that do more business in exporting know-how rather than finished goods. Obviously, the cost of research, in whatever form, should be computed and charged to resources development costs. The United Nations Development Programme (UNIP) and some of the international financing agencies can also cooperate in this field. The role of universities and foundations can be directed, promoted and oriented towards this aspect of rational management. All these points are mentioned here because they are considered as basic components of rational administration of natural resources.

(iii) Assistance

85. In addition to their regulatory responsibilities and direct activities as operator, assistance is another important tool available to governments to influence the rational management of natural resources. This takes two forms: a) technical and b) financial, or through credit. This assistance may be provided by governments directly or obtained through international organizations.

86. Technical assistance is simply the means of transferring technology from those who possess it to those who lack it until the latter manage to acquire it themselves. It is certainly an important tool of development which should be used according to established programmes and priorities. The assistance of the international organizations is usually provided only to governments and their agencies. Here, however, reference is also and especially made to the assistance governments provide to their citizens and residents. Agricultural extension is one of the most important facets of this problem. In certain cases, international assistance also reaches individuals directly.

1/ United Nations, Advisory Committee on the application of science and technology to development. Natural resources of developing countries: investigation, development and national utilization, New York, 1970, p. 174. UN publ. 1970 II B.2. op.cit. Note 2, p.13, p.141 andff.

87. Financial or credit assistance consists of both loans and, in some cases, grants and subsidies. By these means, an attempt is made to extend investment repayment or amortization terms, making investment possible even where the necessary capital has not yet been formed.

88. There are some investments which do not yield a direct return to the investor, like some of those required for the preservation of the environment or aiming at the conservation of natural resources. Through long-term loans, or even through grants and subsidies, governments can transfer those costs to wider sectors of tax-payers who benefit as well, though indirectly, from this type of investment. In any case, national methods of natural resources administration may be abortive and even fail if governments omit to provide both forms of assistance to the ultimate and direct consumer of natural resources, or of services deriving therefrom when they need it.

2. Trends in the organization of State institutions for natural resources administration

89. It is difficult, in a comparative study, to generalize on the institutions of different countries and historical precedents as factors influencing them vary widely from one country to another as well as in time. Nevertheless, a historical review allows certain trends to be identified in connection with the development stage; of each natural resource category. A brief examination of this evolution in some countries more advanced in the utilization of certain natural resources affords useful experiences, even in the case

of failures. Government institutions, that is public administrative agencies concerned in this field, will be examined before the corresponding role of the private sector.

A. Absence of administrative institutions

90. The time when man settled and began to practise agriculture marked the beginning of the individual utilization process of natural resources such as land, water, certain energetic resources (wood), and plants. With respect to other natural resources, this process began much later, as in the case of mines, wildlife and recreational resources. Although in comparing different resources it appears that they were not utilized by man to the same extent simultaneously, the process was similar: the use of natural resources initiated and developed in the first stages by individual action and initiative, without government intervention. Thus, a farmer took water from a river without asking permission from anyone, someone engaged in simple ore extraction operations, or cut wood in the same way. This means the absence of administration ("management") both on the part of governments, which did not intervene, and of the individuals who only tried to satisfy their own needs without concern for what would subsequently happen. In fact, at that time, the supply of natural resources was far greater than the demand. In the middle of the nineteenth century, South American gauchos hunted wild horses and cattle for their hides only, leaving their flesh to rot. In the twentieth century, there are still some small miners who ruin ore deposits irrevocably by letting pits fall in or become flooded after having taken out those veins with the highest ore content. Or there are farmers who let their land become waterlogged or mineralized through over-irrigation because they are unaware that such an excess is harmful.

B. Use-oriented administrative institutions

91. When the demand began to equal, and then to exceed the supply of natural resources, governments started to intervene, first to regulate and control (the use of each resource by individuals, and later to engage in such uses themselves. At that time, however, a single (or simple) use was made of each resource, as it continues to be in many places. Water, for example, can be used for human drinking supply, municipal, irrigation and industrial purposes, kinetic and electrical power production, transport (navigation, steam engines), fishing, and as medicine. Man began to undertake the uses most needed, in the order in which he needed them, however one at a time with each water source, because this was easier and cheaper, especially when the supply of water was greater than the demand. The same situation occurred in respect of the other natural resources.

92. Very soon, individual activity became inadequate, either because the cost of works and of serving increasingly numerous human communities started to exceed individual financial capacities, or because increasingly complex techniques began to outrun individual possibilities» From that time onwards, government activity came to consist not only in regulating and controlling those individual uses but also in the government providing the public with services deriving from those resources, or utilizing the same as a source of taxation revenue. Government agencies were established to deal with each use. State agencies were established to regulate and provide water for drinking and irrigation, to supply electricity, to support agriculture and forestry, to provide fuel, or support inland navigation. These agencies considered the uses, but not the resources thus utilised, and cared little for their conservation, or for whether the use they made thereof rendered them useless for different, simultaneous or subsequent uses. What has just been stated in the past tense nevertheless constitutes the present situation in many countries, a situation that works against rational natural resources administration.

C. Resource-oriented administrative institutions 1/

93. The appearance in the present century of the multipurpose uses approach is beginning to produce an institutional change: various governments have started to create ministries and agencies established in relation to specific natural resources. These bodies deal first with the resource, its optimum utilization and conservation, and afterwards with its uses. This applies to agricultural resources (including water resources), but also to others. Suburban zoning laws permit a twofold use of land, i.e., for housing and for forest reserves. A limestone deposit can be used to produce both lime and cement. A dam can be used simultaneously for flood control, production of electricity, irrigation, and maintenance of navigation. Geothermal energy can supply electricity as well as fresh water and minerals. Desalinization of sea water produces drinking water and minerals.

94. The multipurpose uses of a natural resource require that the interaction among uses and among activities carried out to control the harmful and eventual beneficial effects thereof be taken into account. If the same watercourse is first used for non-consumptive purposes and, afterwards, for consumptive ones, it is possible to enjoy the advantages of both. All these considerations are leading various governments to transform their administrative structures for natural resources management, organizing them on the basis of the particular categories of resources and not of their uses. There are many examples: for thirty years, Mexico has had a Secretariat for water resources; India, Iran, the Sudan and the USSR have water ministries. Many governments have mining, fuel and hydrocarbon or power ministries, and almost all have ministries for agriculture and forests.

95. In many countries river basins are treated as regional water resources management units and as the basis for the coordination of water uses with those of related natural resources. The recent administrative reforms in the United Kingdom and France provide for such procedures. The laws of Argentina, Mexico and the United States also provide for the creation of river basin commissions, and some have already been established. Administration by basins is a form of integrated water resource administration at the level of regions which, in the case of water resources, consist in river basins.

D. Natural resources-oriented administrative institutions 2/

96. A few governments have realized that not only are the uses of a particular natural resource interdependent but that, due to their management by man, the different natural resources influence each other. Argentina, Ecuador, Honduras, Kenya and Malawi, among others, have created ministries, departments or secretariats of State for natural resources.

1/ As to water resources, see Guillermo J. Cano, "New approaches to water resources administration in developing countries"(doc. ESA/RT Meeting 4, United Nations Inter-regional Seminar on Water Administration, New Delhi, December 1971).

2/ Dante A. Caponera, "Towards a new methodological approach in environmental law", *op.cit.* in which the author pleads for a natural resources legislation and administration as a means to ensure rational natural resources management and environment protection.

The President of the United States made such a proposal to the Congress on 25 March 1971 recommending a far-reaching reorganization of the executive branch including the creation of a Department (Ministry) of Natural Resources through the consolidation of sections from the Departments of Agriculture, State, Defence and from the Atomic Energy Commission (the first two of these departments would disappear with the reform). This information is of particular significance because it refers to one of the world's most powerful countries whose President has openly declared that such a reform is essential to give his Government an efficacy which, he felt, is presently lacking. This presidential proposal was preceded some years earlier by that of a Senator and was recommended by several commissions appointed to advise on administrative reform.

97. In October 1973, the Government of Argentina created the Secretariat of State for Natural Resources and the Environment with four under-secretariete : Renewable Resources, Water Resources, Mineral Resources, and Environment. Only cultivated agricultural resources, which are the competence of another Secretariat - for Agriculture and Livestock - and energetic resources (pertaining to the Secretariat for Power) were excluded from the new department.

98. There is thus an emerging trend to merge the management of all natural resources within a single executive body. Or, at least, this applies to the management of that category of resources (renewable resources) the interaction whereof is most marked. This system affords the best control over uses. While mentioning this trend, it does not necessarily mean that all government powers over natural resources must be in the hands of the same institution. But, at least, policy-making, planning and coordination functions and powers should be. Implementation and operation functions may well be assigned to different and separate use-oriented rather than resource-oriented agencies,

E. Environment-oriented administrative institutions

99. The final step in the process of institutional development for the administration of natural resources consists in the creation of agencies responsible for the environment. On 1 January 1970, the United States established such an agency. Except for the monitoring of environmental conditions, the making and enforcement of regulations, its powers are not yet operative. These regulations are designed to preserve environmental quality (control of air and water pollution and of garbage disposal in the sea etc.). Germany, Belgium, Japan, the United Kingdom, Sweden and Yugoslavia ^{1/} have also established such agencies.

100. It should be kept in mind that the environment includes other factors and elements which differ from natural resources. Noise, garbage production, overconcentration of population and corresponding urban problems, human diseases, and man's own social and political attitudes are factors beyond the sphere of natural resources. A special agency for the environment must therefore take these into account as well. The observation made in the preceding paragraph similarly applies to this case: an agency for the environment need not necessarily have executive functions with respect to the management of the various elements that form and influence it; but at the planning and policy decision-making stage, it is advisable that such considerations be duly taken into account.

101. What is stated here as well as in the preceding paragraph shows that such considerations constitute decisive reasons for administration in both cases to be interdisciplinary. That a technology or the corresponding science predominate in one of the government agencies referred to herein is not enough for such an agency to be effective. Ministries of public

^{1/} Peter H. Sand, "Legal Systems for Environment Protection; Japan, Sweden, United States", FAO, Legislative Studies No. 4, Rome 1972; UN Economic Commission for Europe, Symposium on Problems relating to the Environment, New York, 1971, Sales No. E.71. II.E.6, Guillermo J. Cano. "Introducción al problema de la preservación del medio ambiente", Buenos Aires, 1973.

works were established only because engineering was the technique common to all of them and almost the only one used. Today, many sciences and techniques must be put to work by the staff of the agencies administering natural resources. As White recommends, multiple means must be sought for a single purpose.

3. The role of the private individual and enterprise in natural resources management

102. As already stated, the private sector, whether working through individuals or their associations, has also a management responsibility in the development of natural resources, not only in the stage in which governments do not intervene in the administration thereof but also during those stages where they do. The awareness on the part of the private sector for the need to be concerned with natural resources conservation and with preventing their use from causing harm to the environment is not only a question of ethical responsibility -towards the present and, above all, future generations - but also one of interest. When the bell tolls for one human being, it tolls for all mankind. Whoever releases toxic gases in the atmosphere should know that he is poisoning himself, no matter how much money he saves by doing so.

103. Among the regulations governments usually issue on the use of natural resources, many laws impose correct management rules on private users. They appear particularly in mining laws, in which the use of surface water is a major consideration, and in those regulating drilling for underground water extraction. They usually prescribe conditions of a technical as well as economic nature, limiting production or, on the contrary, setting minimum production levels, for example. Where government action is lacking, the absence thereof doubles the responsibility of enterprises and individuals.

104. Some associations of natural resource users are of a private, non-governmental type like certain consortiums of underground water users or irrigation cooperatives. Others enjoy certain government powers, like those for the irrigation "canals" of Mendoza in Argentina. Some large profit-making enterprises are entirely private; some are mixed; and there are others which, while wholly State-owned, operate in the form of private enterprises. All these organizations, when their purpose is to exploit or make use of natural resources, assume responsibility in the rational management thereof.

4. The role of universities, foundations, and other scientific and technical research organizations

105. Universities - both State and private - and other non-profit-making organizations mainly devoted to either scientific and technical research as well as to the preparation and training of managerial personnel, cannot be omitted from this brief description of those institutions having a role to play in natural resources management. As already mentioned, the importance of research in stimulating technological progress in this field refers not only to the task of preventing harmful effects on the environment but also to effectively developing more appropriate methods for a greater and more efficient utilization of natural resources.

5. International administrative institutions

106. There are multinational organizations or inter—governmental institutional mechanisms relating to natural resources like those established for hurricane warning activities in the North Pacific or those dealing with the Antarctic. Even PAD, and the other organizations of the United Nations family (UN, UNESCO, WHO, IBRD, IAEA) are basically organizations having responsibilities in natural resources administration within an international framework. Discussions are currently held on the way to administer the resources of the sea and the sea bed outside the limits of national territorial jurisdiction.

107. Regional governmental organizations like the Organisation of American States and their corresponding financing institutions (Interamerican, Asian, and African Development Banks, etc.) are also working on specific aspects of natural resources administration, particularly in the technical and financial assistance fields.

108. There are many hi- or multi-national agencies which have been established to administer international basins or waterworks therein 1/.

109. Finally, mention ought to be made of the action of non-governmental international bodies that contribute to world progress in the field of natural resources utilization and, among them, the International Law Association (London) with its permanent Committee on International Water Resources Law which, in 1966, adopted the well known Helsinki Rules; the International Association for Water Law (Rome); the International Union for Nature Conservancy (IUCN); the International Council for Environmental Law.

1/ See UNITAR, "Corporaciones publicas multinacionales para el desarrollo y la integración de la America Latina". Mexico. 1972. Fondo de Cultura Economica, and p. 274, in particular.

CHAPTER III

NATURAL RESOURCES WITHIN THE INTERNATIONAL FRAMEWORK

1. International Natural Resources

110. Certain natural resources are international by virtue of their physical nature. As a physical fact, their "internationality", which is also economically significant, transcends the field of law. It resides in the impossibility of dividing these resources to confine them within national boundaries* From the viewpoint expressed here, as long as man can control the conservation and use of natural resources for his benefit or defend himself against their harmful effects by keeping them within national boundaries - whether space, sea, or underground - such resources can be defined as national or domestic. Another determining factor of internationality relates to the possibility that the use, or failure to use an international natural resource in one country may have considerable harmful effects in other countries sharing that resource.

111. The presence of international natural resources produces the need for human activities of the same type and within the same framework, as much in the economic and technical aspects involved in their utilization or in the defence against their harmful effects, that in corresponding legal and institutional aspects. Such activities at the same time are relevant to the human environment in that it can be considered as the common heritage of mankind as a whole. The various types of international natural resources are described herebelow.

A. The high seas, the sea bed and underlying resources

112. Beyond the limits of territorial jurisdiction claimed over the sea and the sea bed according to various criteria by countries having a sea coast, the high seas are legally considered international, although the legal situation concerning ownership and utilization of the resources of the sea bed is currently under debate.

113. So far as the mineral resources beneath the sea bed of the high seas are concerned, technology is advancing more rapidly than institutions. Its startling progress has already led to the discovery, in several seas, of large oil and natural gas deposits which are changing considerably the world picture of mineral reserves and are liable to have a considerable impact on future oil and gas prices as well as the balance of power between the respective oil producing countries. The centres of gravity of oil-based industries may shift, and this should be considered not only in the selection of substitutes and alternatives but also in relation to the possible deleterious effects such industries may have on the human environment, should they change their location. These harmful effects can result not only from air pollution by exhaust fumes, but also from the pollution of the sea, of navigable rivers and of land during the transport of crude oil. The work of IMCO in the field of sea pollution, together with various current international agreements in this respect should be noted^{1/}. The International Law Association, through its Committee on the Law of International Water Resources, has supplemented the Chapter on the pollution

^{1/} See "Existing and Proposed International Conventions for the Control of Marine Pollution and Their Relevance to the Mediterranean", Document FID;PPM/74/5, FAO, Rome, February 1974, for a brief review of international agreements for the control of marine pollution at both the global and regional levels.

of international rivers contained in the Helsinki Rules (1966) with a further Chapter on the pollution of international coastal waters and inland seas.

114. Thor Heyerdahl's expedition (1969 and 1970) 1/ found enormous oil slicks from the wash of oil tankers on the high seas on the route from Africa to America, Some scientists fear that these slicks could cause climatological changes by preventing: evaporation and could also affect fish resources. The use of the sea for the disposal not only of garbage but also of radioactive and toxic substances which - even when carefully packaged - involved a risk of container deterioration in the long run, is increasingly arousing fears concerning possible effects on fish resources as well as potential dangers from the consumption of polluted fish. The problem calls for concerted international action. In 1970, high levels of mercury, which is toxic for human beings, were found in the livers of Arctic seals. According to some biologists, the increased littering of the continental shelf with garbage consisting partly of plastics and various insoluble substances can eventually produce substantial changes in marine plant and animal life or considerably affect the supply of fish resources,

B, International inland water resources

115. Three issues concerning international water resources should be considered: a) weather modification capable of having international effects, b) international surface water resources, and c) international underground water resources.

(a) Atmospheric water resources

116. Should technology continue to progress in this connection, we shall soon face the following problems:

1) rain-making in one country involuntarily causing rainfall in another which may or may not want it, and where the effects whereof may even be harmful;

2) a country may induce precipitation within its territory from clouds which naturally pursue their course and discharge over another country, thus altering rainfall distribution and surface water supply;

3) a country needing rain by cloud—seeding requires that corresponding works be carried out in a neighbouring country.

Problems of this type are both technical and legal and should be kept in mind when designing the rational management of these resources. It has been suggested that the United Nations system should have a role to play in connection with the international effects of weather modification processes 2/.

(b) International surface water resources

117. In December 1970, the United Nations General Assembly adopted Resolution 2669 (XXV) aimed at accelerating the procedure for the formulation and codification of the legal norms governing the use and development of international river basins. The Helsinki Rules, adopted in 1966 by the International Law Association 3/, marked a definite step forward in this direction; this should however definitely be followed-up by more detailed research work.

1/ See "Shock at Sea" in Time Magazine, New York, 15 August 1969; cf. Heyerdahl's report to the UN, 4 November 1970, Doc. E/5003, 7 May 1971, Annex II.

2/ See "Atmospheric Water Resources for Agriculture - Law and Policy of Weather Control Operations (preliminary study)", FAO paper by P. Sand, 1971; also "Legal Structures for International Supervision of Weather Techniques" by R.L. Moses and J.N. Corbridge, in Water for Peace, Washington 1967, Vol. 2, p. 410.

3/ United Nations, "Integrated River Basin Development", Doc. E/3066/rev.1, New York, 1970, Annex VII.

118. The Interamerican Conference of Rio de Janeiro (1965) voted to call a special conference to discuss an interamerican river agreement. The agenda and date of the meeting are to be decided by the OAS Council,

119. The legal regulation of the use of international rivers constitutes by nature an interdisciplinary problem. It involves international water law, the sciences and techniques of water resources development planning, hydrology, the various branches of engineering, economics, and public administration. It is noteworthy that, through its Committee on International Water Resources Law, the International Law Association is carrying on the task of extending the provisions of the Helsinki Rules and that one of its working groups is responsible for matters relating to relationships between water and other natural resources. The way the treatment of this subject has been set forth ^{1/} leads to the rational management of all natural resources in any particular international drainage basin taken as an integrated whole, not limiting management problems to that of water alone. This constitutes the previously mentioned "multiple means" concept developed by Gilbert White ^{2/}.

120. The effects of international artificial lakes (storage dams) can be either positive or negative. Apart from their direct purposes, their positive effects include beneficial climatological modifications and the creation of recreational resources. Their negative effects include the flooding of habitable land, the displacement of populations and, sometimes, changes in downstream ecology, stream flow and navigation. A reduction of flow below natural minimum rates causes an increase of pollution by reducing the self-purifying power of the discharge. It also increases sedimentation by raising the sediment load which affects navigation and aggravates flooding by retarding the runoff. It is well known that the Aswan dam in Egypt, by eliminating the normal yearly floods forming lagoons in the Nile delta, is causing its recession due to the erosion of the sea which, before the construction of the dam, was contained by those lagoons. This constitutes an unforeseen ecological effect downstream of a dam built on an international river.

(c) International underground water resources

121. The construction of the Alsace canal in France, parallel to and fed from the Rhine, affected the level of underground water tables on the other side in Germany. Tunisia, in North Africa, taps aquifers the recharge sites whereof lie outside its territory of Tunisia. The technical need for combined underground and surface water management leads to a necessity of concerted action at the international level as well, as evidenced in the case of the Logon, river and Lake Chad in Africa.

C. Mineral and geothermal resources

The following international mineral and geothermal resources need to be considered:

(i) oil and natural gas

122. The case of mineral deposits lying on both sides of an international boundary arises sometimes. When solid ores are involved, there are no special legal problems, since extraction can be carried out separately in both countries, although in this case such a solution may become uneconomic. However, in the case of oil and natural gas deposits where a physical separation of the resource is impossible, extraction by one country can obviously affect the reserves of the neighbouring country. This happens not only in connection with deposits worked from mainland areas, but also with those underlying both the territorial waters of more than one country and contiguous international rivers. In such cases, concerted bilateral action and appropriate technical and legal norms are necessary not only for extracting operations and for an appropriate management of the reserves, but also to avoid the polluting effects of mining. The international transport of oil products, even though originating from purely national sources, can also have negative effects on the environment or present a corresponding danger.

^{1/} International Law Association, Report of the 53rd Conference, Buenos Aires, 1968, p. 531.

^{2/} See Gilbert White, op. cit.

(ii) Geothermal resources

123. Where such resources are found on both sides of a political frontier, they would constitute international resources and should be extracted jointly. The artificial recharge of international geothermal resources can also create international problems. Finally, there might be cases where condensed and used steam could be released into international watercourse or could for reasons of topography run off towards another country and, depending on their mineral content, create water or soil contamination problems of an international character.

D, Energetic resources

124. Besides what has been stated previously with respect to the use of endogenous steam for power generation, it should also be borne in mind that power can be produced from international sources, both in the case of hydroelectric plants on international rivers and from oil or natural gas existing in the conditions outlined in para. 122 above. Whether of national or international origin, the transmission of electricity and the transport of oil, gas and their derivatives by international transmission lines or pipelines do so well create technical and legal problems of an international character, thus requiring the consent of the governments concerned.

E. Atmospheric resources and the air space

125. The well-known considerations relating to national or municipal air pollution equally apply within the international context.

126. The remote sensing techniques used from aircrafts or satellites and those connected with their use for natural resources reconnaissance, measurement and surveillance of the state of conservation thereof are advancing rapidly. The first satellite used for this purpose (ERS-1) was launched in July 1972. It should be noted that reference is not only made here to the taking of photographs and to the use of satellite-based remote sensors, but to earth-based stations as well - those for hydrological measurements, for example - which can automatically transmit, by radio waves and without operators, physical data traced several times a day and retransmitted to earth stations by satellites for processing. This method can not only lower the cost of natural resource reconnaissance, measurement and evaluation, but considerably accelerate a process which is slow when operated from earth, and even extend it to regions that are difficult or costly to reach by land ^{1/} It is however the very nature of the physical elements used for this process and its mode of operation that makes it international, first, because only six countries have been able to put satellites into earth orbit until now, and of technical and financial reasons. Secondly, because the orbit of satellites is necessarily international in the sense that it cannot be confined to tracts of air space in which one country only exercises sovereignty. This means that an adequate legal and institutional machinery ought to be found for the use and development of those elements, both at the national and international levels. The possibilities this method affords for the development of the world's natural resources are however enormous and beyond anything suspected so far,

127. Neither can a reference to the use of satellites for mass education through television be omitted since it involves the use of a natural resource — outer space — in the field of which UNDP is implementing its first project,

F. Genetic and scenic resources

128. This heading covers several subjects: first, that of fisheries in international sea, lake and river waters which, through water pollution, are influenced by the management of other natural resources } secondly, that of migratory birds subject to international

1/ See UNESCO, doc. A/7291, Intergovernmental Conference of Experts on the Scientific Basis for National Use and Conservation of the Resources of the Biosphere, Annex, Recommendations No. 4, 6, 8, 14.

agreements for their protection, but where against man may also need to protect himself through measures of an international character; and, thirdly, international scenic resources. These are international to the extent that they are shared by more than one country, as in the case of the Iguazu Falls (Argentina-Brazil) and those of the Niagara (Canada- United States).

129. Finally, although the establishment of national parks and reserves - at which the provisions of an existing Interamerican Convention are currently aiming - can only be carried out on a national basis, such an activity has international implications. It consists in the creation of sanctuaries where, for the benefit of mankind, animal and plant species in danger of extinction are to be preserved on the basis of the concept that such species constitute the heritage of mankind as a whole.

2. International Impact of National Natural Resources Use.

130. Some national activities produce international effects, like those pertaining to the atmosphere, the high seas and even to certain other national natural resources such as certain drainage basins or oil and gas deposits. This situation requires technical remedies, but also the establishment of legal norms and the working out of appropriate institutional formulae for their control. The concept of absolute and unlimited sovereignty is no longer valid in any field, as it is subject to regulation and to the ius cogens. The purely national use of national natural resources does sometimes however have international repercussions. Examples are a) the well-known Trail Smelter case in which an arbitral tribunal ruled that the release, by Canada, of smoke (from ore processing) in the atmosphere was harming agriculture in the United States; b) wholly national rivers may pollute the high seas, harming the international community; c) negligence in the management of a national forest may cause fires that spread to a neighbouring country; d) animal and plant diseases may cross national frontiers. There are various international agreements relating to the international policing of plant and animal health.

131. Principles such as those of neighbourliness, international solidarity, non-abusive use of the law, and others oblige every country to take necessary precautions in the management of its purely national resources so as not to cause harm to other countries. This constitutes the substance of Principle 21 of the Stockholm Declaration (1972).

3. International Natural Resources Policy

A. Geography

132. The first problem deserving policy formulation arises from the world geographic distribution of natural resources as well as their markets. Although man might influence the location of the latter, he can do nothing to correct that of the former, except in organizing low cost transport for both raw materials and semi-processed or finished goods. This is why this important economic aspect acquires special significance in this respect.

133. Consequently, it seems plausible to stimulate possibilities for an increased industrial pre-processing of mineral resources in the places where deposits are located and to deal with long distance transport of water and power resources. Institutional means may be found to lessen the disadvantages suffered, due to the present organization of maritime transport, by countries for which natural resources markets are distant and which lack efficient fleets. From a technological standpoint however, recent experiences show that barge-carrier ships or the long distance transport of solid ores by pipelines can help reduce such disadvantages ^{1/}.

1/ See UNITAR, Ríos y canales navegables internacionales. Informe sobre el Simposio realizado en Buenos Aires, December 1971.

B. World markets

134. Some natural resources, such as water and recreational resources, minerals used for construction, and land can only be used in situ or at comparatively short distances. Their markets are therefore local or national. Others, however, like metals and fuel ores, agricultural and forest products, in as much as their price can absorb transport costs, have continental or worldwide markets. Such markets are often manipulated by those having deciding power over prices and over the exploration and availability of reserves. This "deciding power" derives from many factors, ranging from a monopoly of technology or of the supply of financial resources to that of transport means. The governments of many developing countries are adopting measures to assure the full exercise of their power of decision, this without disturbing the participation of foreign capital and technology in the sectors and places where they realize the role the latter can play without interfering with the exercise of their own deciding power. This type of policy is meant to reestablish world market balances while improving purely national ones.

C. The transfer of technology

135. Undoubtedly, technological progress in the exploitation of natural resources is achieved by some peoples thanks to their own efforts. It has its just price which must be paid, but it should not constitute an instrument of domination. (Gun and rocket imperialism ought not to be replaced by that of computers or robots. Both must cease in their West-to-East and North-to-South course. No one has a right to benefit gratis by what someone else produces; nevertheless, a rather frequent illusion makes some people wish so nowadays. There is a subtle ethical difference between obtaining a fair price for one's own, and using the factors of deciding power as tools of subjugation. Cain's subterfuge "ADD I my brother's guardian?" is no longer valid in this World. We all are mutually responsible in universal brotherhood.

136. The absorption, by industrialized countries, of technicians and talent from economically underdeveloped but culturally advanced countries accentuates technological imperialism.

D. Capital flow

137. Some countries transfer financial resources to others which lack them in order to exploit their natural resources. Such capital has a fair price which ought to include compensation for the risk involved, but which has to be paid. Sometimes, however, exporters of capital supplement their investment needs with the internal savings of the countries whereof they exploit the resources. When - as usually happens - the price thereof is not paid at the same rate as that of the imported capital, the situation becomes unjust.

138. The export of non-renewable natural resources from their countries of origin involves that of capital as well since, as part of the Nation's property, these are thus irrevocably lost. Where the export price, plus transport and distribution posts, plus the related industrial processing added-value, is markedly lower than the final selling price, then there is obviously an export of uncompensated or inadequately paid capital. The recovery of deciding power over these elements (prices and capital flow) by developing countries is a high political goal that contributes to the happiness of their peoples as well as to the search for that balance, the absence whereof produces immeasurable tensions in mankind, both among individuals and Nations.

E. Degradation of the environment

139. To prevent the degradation of the environment constitutes an ethical obligation, not only for the present but towards our posterity. Such a prevention involves a cost, and therefore a price. Perhaps, until the population explosion and technological progress were gradually reaching a critical situation, little or no attention was paid to this problem which has now become of primary importance. When the question of the degradation of the environment relates to the exploitation of natural resources, the first philosophic-political problem that emerges is that of who should carry the cost of its preservation, this, apart from cases involving responsibility for degradation due to irrational resources management where it is obvious that the damage ought to be compensated by he who caused it.

140. With regard to international resources as well as to national ones having international repercussions, the United Nations Conference on the Human Environment (Stockholm, June 1972) included on its agenda together with technology and other items, that of the basic principles of a new branch of international law, that encompassing the international environment and the corresponding rights and obligations of the civilised Nations. These extend to all the resources considered as international and to the uses thereof having international repercussions.

141. On 16 June 1972, the Stockholm Conference approved a Declaration of Principles on the Human Environment ^{1/} Referring to natural resources, Principle 21 states "States have...the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States...". This statement sanctions what has been outlined here as a principle of international law.

^{1/} United Nations, Doc. A/CONF. 48/14, 5 July 1972.

ANNEX I

CLASSIFICATION AND DEFINITION OF NATURAL RESOURCES

1. Natural resources categories

The term "natural resources" is used to define physical natural goods, as opposed to those made by man (which are termed "cultural resources").

In a broad sense, they include:

1. Space and its content: air, atmosphere, gases, mineral particles, different kinds of waves, winds;
2. Energy: from various sources such as solar, nuclear, aeolian, hydraulic, geothermal, tidal, thermal (mineral or plant);
3. Land and topography, including slopes capable of generating energy. Some consider the latter as an independent natural resource distinct from land itself. Land is referred to here as a non-agricultural resource distinct from soil. (Topography constitutes a quality of land resources.)
4. Panoramic or scenic resources: i.e., places the particular beauty of which makes them suited for recreational uses "and aesthetic enjoyment;
5. Soil (for agriculture or livestock use);
6. Mineral deposits: solid, liquid and gaseous.

Biological resources, which include the following two categories:

7. Plant wildlife, both land and aquatic;
8. Animal wildlife, land, aquatic, amphibious and aerial (birds), including bacteria, insects and other primary forms of animal life (protist);
9. Non-maritime water resources: i.e., water in its different forms - liquid, solid (ice, snow), or gaseous (steam, clouds) - wherever found: on the surface (rivers, lakes, etc.), underground, in the atmosphere;
10. The sea and seabed: including sea water and its content (both biological and mineral), the seabed and its subsoil with its mineral content;
11. Geothermal resources: endogenous steam and hot water produced naturally inside the earth as a result of the passage thereof through natural thermic sources.

2. Definitions

Natural scientists (biologists, zoologists, botanists, agronomists, geologists, etc.) use the term "natural resources" in its broad meaning which includes all those resources mentioned above.

However, political scientists and economists use this term in a much narrower sense, defining natural resources limitatively by a functional criterion as those which have not been the object of transformation by human action and are "suited to the satisfaction of human needs"^{1/}, excluding as "irrelevant natural elements" those not affording utilization. For Zimmerman, both are "natural goods", a category including natural resources and "irrelevant elements".

Since the present study was prepared within an economic, political and juridical framework, the narrower definition has been adopted.

Some authors consider man a natural resource included in the fauna category. Others have attempted a distinction, defining man as a natural resource insofar as he is an animal being, but falling outside this qualification insofar as he is an intelligent being. Religious and philosophical convictions lead to a rejection of this criterion in favour of the statement that, as essential elements of social and economic life, there are four main categories of resources:

- a. Human resources, the study of which, in economic terms, pertains to sociology and demography. The consideration of natural factors such as the influence of climate on man, which directly affect him, should however not be disregarded.
- b. Natural resources, as have been defined above.
- c. Cultural resources, which are those created or transformed by human action. These may be abstract (institutions, credit, money, etc.) or concrete. Among the latter, are all the products resulting from man's transformation of natural resources (manufactured goods).
- d. Induced resources, which result from the artificial cultivation of natural resources: agricultural, fish and forest products, products of livestock raised by man, etc.

According to Zimmerman's definition, "irrelevant natural elements" are therefore not "natural resources" in economic terms.

Such "irrelevant elements" include, for example, former natural resources as in the case of natural goods no longer useful to man like a mine which has been exhausted or has become unworkable, or of natural goods which have never been useful to man like certain plant or animal species having no practical use.

These affirmations lead to two others: the designation of natural resources is always subject to further revision as, for instance, technological progress makes it possible for formerly useless goods to find a useful purpose; or, conversely, as formerly useful goods have lost their practical purpose just because of technological progress.

Economically speaking, natural resources are able to produce both beneficial and harmful effects to man.

Thus, water is useful as a supply for man, agriculture and industry, but causes also floods and salinization or supports the spread of epidemics and animal diseases.

Although negatively, harmful effects are important as well and ought to be taken into account in economic planning. Sometimes they result from beneficial uses. In this connection, Zimmerman demonstrates that the concept of "natural resources" is inseparable from that of "natural resistances". The latter constitute the physical obstacles of nature which man must overcome to achieve the exploitation of natural resources. This definition should include as well the harmful effects of natural resources since their prevention or abatement requires expenditures having weight in the economic balance.

^{1/} Erich Zimmerman, Recursos e industrias del Mundo, Ponce de Cultura Economica, Mexico, 1957, P. 24.

In this study, an attempt has been made to examine both natural resources and resistances, since the latter - including harmful effects - influence the yield and availability of the former. Wild animals, for instance, constitute a harmful plague affecting the output of agriculture or man,

3. Other elements of nature; natural disasters

There are other economically useful elements of nature, such as the various waves and rays which, throughout the airspace, can be used for telecommunications and even, it is now suggested, for conducting energy. As factors influencing the air space, these should be considered when relating policies are discussed. Insofar as they are man-made however, they constitute cultural resources extraneous to the scope of the present study.

In mythology, fire is one of the basic natural elements. But as an effect and form of the use of fuel resources (mineral or plants), it would seem appropriate to include it therein, even in the case of spontaneous combustion. The endogenous fire and heat of Earth have not yet been exploited by man, except indirectly as a factor of geothermic resources production.

Technology is already making it possible to use the thermic sources of the Earth's centre, either in connection with the generation of natural steam or otherwise.

There are also other elements of nature which, from an economic standpoint, cannot be disregarded although they may not be defined as natural resources. It should be remembered in this connection that the world suffers from the effects of a wide range of seismic regions. Earth tremors and volcanic eruptions are natural phenomena which produce economically measurable harmful effects and therefore deserve attention in the context of this study in that they require an earthquake prevention or eruption warning policy. Earth tremors have generally been dealt with as a purely municipal problem.

Earthquakes are becoming predictable sufficiently in advance so that a timely warning can enable populations to escape their effects. Corresponding investigations being carried out in Japan are making considerable progress. Technical security norms for the construction of buildings and works in seismic areas can also help greatly to prevent damage to life and property. All these questions lie beyond the technical and financial capacities of municipalities.

This is a field calling for policy formulation and implementation.

Tornados, hurricanes and cyclones arise occasionally in many areas of the world and, in some of them, at regular seasonal intervals. Policies similar to those mentioned for seismic phenomena should also be adopted in the areas suffering therefrom, i.e., advance warning systems and security specifications for buildings,

4. Classification

Table 1 "Natural resources and their properties", lists and describes natural resources according to:

- a. Physical form: material or non-material (such as energy or wind);
- b. Durability: the traditional classification distinguishes only between renewable (fluent or fungible) and non—renewable contained resources. It is further extended here to the distinction between perenial and intermittent resources. This is economically significant in relation to the opportunity of their exploitation and as to whether it is necessary to adopt policies for their conservation or not. Nonrenewable resources are exhausted permanently through exploitation, although their exhaustion term may vary considerably. Some of them may be subject to reutilization (scrap, slag from blast-furnaces) which prolongs their "life" or availability, although not to the extent of modifying their classification.

- c. Form of use: some resources can be used in their original natural state or condition. Others, however (wind, solar energy for the production of electricity, water power, etc.), require a prior tapping, adaptation or transformation process by man.

Energy, the transport of goods or persons, and telecommunications are basic factors in modern economy. It is therefore important to see which natural resources are suitable for these activities.

- d. Potential suitability for energy: in itself »energy is a primary natural resource as in the case of solar energy producing photo-synthesis in plants. In the other cases, however, it results from the combination, combined use or transformation of other resources through human action. Column VI lists the other natural resources used for generating energy;
- e. Potential suitability for transport: Column VII indicates the natural resources which can be utilized for transport;
- f. Potential suitability for telecommunications: see Column VIII;
- g. Primary or composite resources: some natural resources (composites) result from the integration of primary ones. These are classified in Column IX according to this criterion, indicating for composites the combination from which they derive.
- h. Agricultural resources: Column X gives an indication of those natural resources used in agriculture.

Table 2 shows the principal uses of natural resources (Column III) as well as harmful effects resulting from their use (Column IV). This list attempts only at providing examples; it is not exhaustive.

TABLE 1. NATURAL RESOURCES AND THEIR PROPERTIES 1/

I No.	II Resources	III	IV Durability				VI	VII	VIII	IX Origin	X
			P	R	A	I					
1	SPACE AND ITS CONTENT	i									
1a	- space	i	x			N	-	+	-	S	
1b	- air (atmosphere)	i	x			N	-	+	-	S	
1c	- mineral content	m	x			T	-	-	-	S-C 1d+6	
1d	- wind	i	x		x	T	+	+	+	S	
1e	- climate(temp.+1d+9)	i	x			N	-	-	-	S	
1f	- Hertz waves	i	x			T	+	-	+	S	
2	ENERGY (photosynthesis heat, electricity)	(i	x			Na/	+	-	+	S	
2a	- solar	(i	x			Tb/	+	-	+	C	
2b	- nuclear	i			x	T	+	+	+	C 6b+2	
2c	- wind	i			x	T	+	+	+	C	
2d	- hydraulic	i	x			T	+	+	+	C 3+9	
2e	- tidal	i	x			T	+	+	i+	C 3+9	
2f	- thermal (mineral)	i			x	T	+	+	+	C 6a+2	
2g	- thermal (plant)	i			x	T	+	+	+	C 7a+2	
3	LAND AND TOPOGRAPHY	m	x			N	-	+	-	S	
3a	- non-agricultural land	m	x			N	-	+	-	S	
3b	- topography	m			Xg/	N	-	+	-	S	
3o	- slopes	m	x			T	+	+	+	S	
4	SCENIC RESOURCES	i			Xc/	N	-	-	-	S-C 1e+5+7+9	
5	AGRICULTURAL LAND (soil)	m			Xc/	T	-	-	-	C 5+1e+7+8+9	
6	MINERALS	m			X	T	+	+	+	C 7X1e	
6a	- fuels (solid and liquid)	m			X	T	+	+	+	C 7X1e+6a	
6a	- fuels (gazeous)	i			x	T	+	+	+	C 7+1e+6a	
6b	- nuclear	m			x	T	+	+	+	S	
6c	- other	m			x	T	-	-	-	S	
7	PLANTS	m			x	T				C (5a+1e	
7a	- wood producing	m			x	T	+	+	+	C (+1b+2a	
7b	- other	m			x	T	-	-	-	C (+8	
8	ANIMALS	m			x						
8a	- draft or riding	m			x	T	+	+	-	(7+1c+1b	
8b	- other, terrestrial or aerial	m			x	T	-	-	-	C(
8c	- fish	m			x	N	-	-	-	C 7+9	
9	WATER	m			x						
9a	- surface	m			x	w	+	+	-	S	
9b	- underground	m			x	T	-	-	-	S	
9c	- atmospheric	m				Tf/	-	-	-	S	
10	THE SEA AND SEABED	m			x						
10a	- sea water	m			x		+				
10b	- ocean floor and subsoil	m			x	T	-	-	-	S	
11	GEOHERMAL	m			x	T	+	-		C	

1/ For symbols used in this Table see following Note.

NOTE

COLUMN III	Physical state: j immaterial; m material
"	IV P perrenial; R renewable; A non-renewable; I intermittent (or periodic)
"	V (N resources utilisable without previous tapping or transformation process;
"	(T resouroes utilisable only after prior tapping or transformation process
"	VI + contains energetic elements; - does not contain energetic elements
"	VII + contains transport elements; - does not contain transport elements
"	VIII: + contains telecommunications elements; - does not contain telecommunications elements
"	IX S primary or original resource; C composite resource deriving from the integration of others indicated by numbers referring to Column I
"	X + contains agricultural elements; - does not contain agricultural elements

a/ producing photosynthesis without human action; b/ man produced power by transforming solar energy; c/ permanent resources liable to destruction by human action; d/ drinking, recreational, transport, fishing and medicinal uses; e/ agricultural, industrial and power uses; f/ subject to artificial rain or hail-making, etc.; g/ topography liable to irrevocable deterioration.

TABLE 2. NATURAL RESOURCES: USES AND HARMFUL EFFECTS

I No .a/	II Resources	III Beneficial uses	IV Harmful effects
1	<u>SPACE AND ITS CONTENT</u>		
1a	- space	- transport - building - reception of industrial and household gases - animal and bird life	- disturbing noises - loss of light - pollution - transmission of diseases
1b	- air (atmosphere)	- human life - animal life - plant life - industry	
1c	- mineral content	- chemical fertilisers and products	- pollution
1d	- wind	- aeolian power - plant life	- tornados - aeolian erosion, soil erosion
1e	- climate	- human life - animal life - plant life - scenic resources (see item 4)	- human diseases - animal diseases - plant diseases - transport problems
1f	- Hertz waves	- telecommunications	
2	<u>ENERGY</u> (photosynthesis, heat, electricity)	- plant, animal and human life	
2a	- solar	- salt water distillation - electricity supply and satellites for tele-communications	
2b	- nuclear	- electricity supply for domestic, rural, urban, industrial and transport uses	- air and water pollution
2c	- wind	- domestic electricity supply - electricity for tele-communications - water pumping for agricultural uses - operation of industrial machinery (kinetic) - navigation	- damages from cyclones and tornados

a/ Numbers correspond to those in Table 1., Column I.

I	II	III	IV
2d 2e 2f 2g	- hydraulic - tidal - thermic (mineral) - thermic (plant)	(- operation of industrial machinery (kinetic) (- electricity production for domestic, municipal, agricultural, industrial, transport, telecommunications and mining uses	- excludes uses of water for consumption - air pollution - depletes mineral deposits and forest
3 3a 3b	<u>LAND AND TOPOGRAPHY</u> - non-agricultural land - topography	(- population settlement (- establishment of industries (- establishment of roads, communications facilities and airports	- air and water pollution - excludes agricultural and livestock uses
3c	- slopes and drops	- produce hydraulic power	- excludes other water uses
4	<u>SCENIC</u>	- parks and natural reserves for protection of nature and wildlife and for human recreation - bathing establishments and other places of human recreation	- excludes reserved natural resources exploitation
5	<u>AGRICULTURAL LAND</u>	- agriculture, food and clothing - natural forest development - livestock raising for food, clothing, transport and animal power - forest cultivation for housing, clothing and power (wood and plant carbon)	- erosion - sedimentation of rivers - exhaustion of productivity - floods - degradation - salinization
6 6a	<u>MINERALS</u> - fuel	- generation of electricity for the uses indicated under 2 above - petrochemical industry - thermal energy for domestic, agricultural, industrial and transport uses	- excludes land use - air pollution
6b	- nuclear	- medicinal use - generation of thermic and electric energy for uses indicated under 2 above - military use	- air and water pollution - depletion of reserves - destruction of mankind

I	II	III	IV
6c	- other	- fertilisers and related agricultural inputs - housing, food, clothing, transport and agriculture based industries	- air and water pollution - depletion of reserves
7 7a	<u>PLANTS</u> - wood production (forests)	- forest exploitation for housing, clothing, thermic energy, food and - soil and water conservation	- erosion - reduction of water resources and alteration of hydraulic regime
7b	- others: <u>pastures</u>	- livestock raising for food, clothing and animal power	- aeolian erosion - exhaustion of reserves
	<u>agricultural</u>	- human and animal feeding and clothing	- erosion - sedimentation of rivers - depletion of reserves - transmission of epidemics
	<u>aquatic</u>	- human and animal nutrition - medicinal uses	- hinderance of navigation
8 8a	<u>ANIMALS</u> - draft or riding	- agriculture or mining - transport - animal power (water extraction, mills)	
8b	- others: terrestrial, aerial or amphibious	- human and animal feeding, clothing - conservation of species - tourism	- aeolian erosion - transmission of epidemics
8c	- fish breeding	- human and animal feeding, industry	
9 9a	<u>WATER</u> - surface	- human drinking, household and municipal uses h - animal watering - agriculture - industry - power production - transport - recreation - fish breeding - medicinal and thermal	- erosion - salinization - degradation - floods - pollution - sedimentation - eutrophication - pollution - transmission of diseases

I	II	III	IV
9b	- underground	- human drinking, domestic and municipal uses - animal watering - agriculture - industry - recreation - fish breeding - medicinal and thermal uses	- pollution - degradation - transmission of diseases
9c	- atmospheric <u>clouds</u> <u>moisture</u> <u>hail</u>	- artificial rain making - agriculture and protection against hail	- frost - damage to agriculture
10	<u>THE SEA AND SEABED</u>	- transport	
10a	sea water	- recreation - tidal energy - mineral content - biological content, including fish and algae for food	- pollution - coastal erosion
10b	- the ocean floor and subsoil	- mineral content - biological content	- pollution
11	<u>GEOHERMAL</u>	- production of energy - production of minerals - production of fresh water	- pollution (if separable salt content is present)

ANNEX II

NATIONAL CODE ON RENEWABLE NATURAL RESOURCES AND THE PROTECTION OF THE ENVIRONMENT 1/

PRELIMINARY TITLE SOLE CHAPTER

BOOK ONE

THE ENVIRONMENT

- PART I DEFINITION AND GENERAL RULES OP ENVIRONMENTAL POLICY
- PART II ENVIRONMENTAL MATTERS OP INTERNATIONAL INTEREST OR WITH INTERNATIONAL IMPLICATIONS
- PART III MEANS FOR THE IMPLEMENTATION OF ENVIRONMENTAL POLICY

- Title I - Economic incentives
- Title II - Education; the use of mass media; the National Environment Service
- Title III - Environmental charges
- Title IV - Environmental information system
- Title V - State financing of environment-related facilities and public works
- Title VI - Environmental impact statements
- Title VII - Zoning
- Title VIII - Environmental emergencies

- PART IV ENVIRONMENT CONSERVATION RULES RELATING TO OTHER THAN NATURAL RESOURCES

- Title I - Chemicals and toxic and radioactive substances
- Title II - Noise
- Title III - Waste
- Title IV - Environmental impact of non-renewable natural resources
- Title V - Human and animal health

BOOK TWO

OWNERSHIP. USE AND ENVIRONMENTAL IMPACT OF RENEWABLE NATURAL RESOURCES

- PART I RULES APPLICABLE TO ALL NATURAL RESOURCES

- Title I - Ownership of renewable natural resources
- Title II - Administrative action relating to renewable natural resources
- Title III - Reservation of renewable natural resources
- Title IV - Priorities
- Title V - Procedures for acquiring use rights in respect of publicly owned renewable natural resources

Chapter I General

Chapter II Use rights acquired ipso iure

Chapter III Permits

Chapter IV Concessions

1/ Enacted by Decree No. 2811 of the President of the Republic of Colombia, 18 December 1974.

Title VI	- <u>Register, inventory and mapping of rights over renewable resource.</u>
Chapter I	Register and inventory
Chapter II	Mapping
Title VII	- <u>Restrictions, and limitations, for social purposes or for reasons of public utility, on private ownership and on the use of renewable natural resources</u>
Chapter I	Restrictions, limitations and servitudes
Chapter II	Acquisition of property for the protection of natural resources
PART II	THE ATMOSPHERE AND AIRSPACE
PART III	NONMARITIME WATERS
Title I	- <u>General</u>
Chapter I	<u>1/</u>
Chapter II	Ownership of water, watercourses and bodies of water and their beds and adjacent areas
Title II	- <u>Modes of acquiring water use rights</u>
Chapter I	Ipso iure acquisition of use rights
Chapter II	Concessions
Section I	Requirement. Duration
Section II	Priorities in the grant of concessions
Section III	Characteristics and conditions governing the grant of concessions
Section IV	Grant procedures
Chapter III	Other modes of acquiring water use rights
Title III	- <u>Use and possession of the beds and adjacent areas of water-courses and bodies of water</u>
Chapter I	Use
Chapter II	Possession
TITLE IV	- <u>Servitudes</u>
Chapter I	General
Chapter II	Passage of water conduits
Chapter III	Drainage
Chapter IV	Dams and dam abutments
Chapter V	Way leave for the transport of water and the watering of livestock
Chapter VI	Use of embankments

1/ Ed. Note: No chapter heading given. Chapter deals with definitions

Title V	-	<u>Waterworks</u>
Title VI	-	<u>Water use, conservation and preservation</u>
	Chapter I	General
	Chapter II	Pollution prevention and control
	Chapter III	Special uses
	Section I	Mining
	Section II	Rainwater
Title VII	-	<u>Groundwater</u>
Title VIII	-	<u>Administration of water and watercourses</u>
	Sole Chapter	Powers of the administrative authority
Title IX	-	<u>Taxes</u>
Title X	-	<u>Water users' associations</u>
Title XI	-	<u>Penalties</u>
PART IV		THE SEA AND THE SEA-BED
PART V		PRIMARY SOURCES OF ENERGY
PART VI		GEOHERMAL RESOURCES
PART VII		THE UNDERGROUND AND SOILS
Title I	-	<u>Agricultural land</u>
	Chapter I	General Principles
	Chapter II	Powers of the administrative authority
	Chapter III	Land use and soil conservation
Title II	-	<u>Non-agricultural land use</u>
	Chapter I	Urban, housing and industrial uses
	Chapter II	Transport : airports, roads and railways
PART VIII		TERRESTRIAL FLORA
Title I	-	<u>Conservation and protection of flora</u>
Title II	-	<u>Wild flora</u>
	Chapter I	Definition and powers
	Chapter II	Administration and management
Title III	-	<u>Forests</u>
	Chapter I	Forest reserves
	Chapter II	Logging
	Chapter III	Forest industries
	Chapter IV	Reforestation

	Chapter V	Technical assistance to forestry
	Chapter VI	Forestry research
	Chapter VII	Marketing of forest products
Title IV	-	<u>Forest protection</u>
PART IX		TERRESTRIAL FAUNA
Title I	-	<u>Wildlife and hunting</u>
	Chapter I	General
	Chapter II	Classification and definitions
	Chapter III	Powers of the administrative authority
	Chapter IV	Prohibitions
PART X		AQUATIC LIVING RESOURCES
Title I	-	<u>Aquatic fauna and flora; fisheries</u>
	Chapter I	General
	Chapter II	Classification and definitions
	Chapter III	Powers of the administrative authority
	Chapter IV	Fisheries
	Chapter V	Control; Supervision
	Chapter VI	Prohibitions
	Chapter VII	Penalties
Title II	-	<u>Aquaculture and fisheries promotion</u>
PART XI		SANITARY PROTECTION OF FLORA AND FAUNA
PART XII		SCENIC RESOURCES AND THEIR PROTECTION
PART XIII		PROCEDURES FOR THE MANAGEMENT OF RENEWABLE NATURAL RESOURCES
Title I	-	<u>Police powers in respect of renewable natural resources</u>
	Chapter I	Officials
	Chapter II	Collaboration of the police
Title II	-	<u>Special management areas</u>
	Chapter I	General
	Chapter II	Special Integrated Management Districts; recreation areas
	Chapter III	Drainage basins
	Section I	Definition and powers of the administrative authority
	Section II	Drainage basin management
	Section III	Financing of basin management plans
	Section IV	Collaboration of users

Chapter IV	Soil conservation districts
Chapter V	National Parks System
Section I	Constituent elements. Definition and purposes of the System
Section II	Administration and use
Section III	Powers of the administrative authority
Section IV	Prohibitions

Title III - Users organizations and environment protection associations

Chapter I	Penalties
Chapter II	Entry into force [18'December 1974]