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## Changing Role of Natural Resources, The

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## The Changing Role of Natural Resources

The best way of preparing for the future is to understand what is happening today. This is clearly true in the field of natural resources. We are caught up today in a series of changes which are fundamentally transforming the role of natural resources in our society, the economics of their production and use and the ways in which we must value and manage them.

These changes include:

- the substantial reduction in the materials and energy used in the production of a wide and growing range of manufactured products;
- the increasing availability of synthetic alternatives to many basic commodities;
- the dramatic advances in the biological sciences which are creating a dramatic potential for improvements in productivity and quality of many existing products and the creation of new ones;
- the escalating environmental and social impacts of natural resource development and utilization and the heightened awareness of people to them;
- the intrinsically international nature of the economic, environmental, technological and physical conditions which bear on the development and use of natural resources.

Some of these changes are already manifest in the persistence of low commodity prices despite an upturn in industrial production, in the depressed economic condition of regions highly dependent on natural resources in contrast with the dynamic economies of the regions with a strong high technology industrial base, the explosion of research and investment in the bio-genetic field, escalating the tendencies towards protectionism, as we have seen recently in the forest products field, and the need to reconcile virtually all resource development projects with their potential environmental and social impacts.

The World Commission on Environment and Development, established by the General Assembly of the United Nations to examine issues affecting the environment and related prospects for economic development in the perspective of the year 2000 and beyond, will complete its work and make its report this year. But the evidence placed before the Commission already makes it clear that environmental and natural resource issues will be in the center of the world's agenda during the next century. The issues

will range from climate change, to destruction of forests and vegetal cover, large scale loss and degradation of soils, accelerating extinction of endangered species of plants and animals, water supply and water quality and the management of the international commons including the oceans, the Antarctic and outer space. All of these issues require recognition of the fundamentally systemic nature of the relationship between natural resource development, environmental impacts and economic growth.

Like all of the seminal processes which have accompanied human progress, these changes create both new problems and new opportunities. But most of all, they give rise to the need for a fundamental change in our basic approach to the management and use of natural resources. This in turn will require basic changes in the education, professional orientation and career paths of all those engaged in the natural resources field.

Natural resources will continue to have a prime role in our economy and resource scarcities are not totally a thing of the past. There is every prospect, for example, of another oil crunch within the next two decades. We have now entered an era in which the principal source of added value and comparative advantage in our economy derives from the application of human intelligence and knowledge through technology, management, design and marketing. This, together with the imperative of dealing with the environmental and social impacts, dictates a much broader and more systemic approach to resource development and use than has been traditional in the resource industries.

The cause and effect systems which determine the economic prospects and viability of natural resources, both renewable and nonrenewable, are becoming much more complex and deeply integrated with the dynamic processes which are shaping the nature and direction of society as a whole. Also, they almost transcend national boundaries and can only be dealt with effectively by international cooperation.

Thus, those who manage and depend on natural resources must become much more skilled in understanding and dealing with the large cause and effect systems which are shaping their opportunities and their constraints. They must be prepared to cooperate with their counterparts in other countries as well as other disciplines and sectors. They must be far more adept at using technological, design, and marketing know-how to add value to the commodities they produce. For the natural resource industries must also become "high tech" to remain viable and competitive.

No issue better illustrates the systemic nature of resource development than water. Virtually everything about water is systemic, from nature's water cycle to the multiplicity of ways in which water interacts with human activities, in almost every sphere from agriculture, urban and industrial development, recreation and energy and, of course, environmental quality. The linkages are complex and, while the institutions which

have evolved to deal with them, provide some of the earliest and best examples of cooperative resource management, they are still primitive and inadequate in relation to the new dimensions of systemic cooperation and management water issues will require in future. To a growing degree these will require more effective institutions for international cooperation. This is evidenced by the recent accident in Basel, Switzerland which contaminated the Rhine River with severe impacts on downstream countries, as well as the increasing number of issues in which the U.S. must cooperate with its neighbors, both Canada and Mexico, to ensure effective management and equitable use of transboundary waters.

Energy issues have also become much more systemic and international in character. Changes in oil production rates in the OPEC countries largely determine overall energy prices and affect the viability and development prospects of virtually all alternatives sources. Technological developments which enable ceramics and plastics to be substituted for metals, as for example the use of fiber-optics to replace copper in communications cables, produce major and sometimes rapid shifts in markets for metals. These are often translated into severe economic and social disruption in the regions, and in some cases entire nations, which are dependent on the affected resources. The genetic engineering techniques which produced the Green Revolution in Asia have resulted in surpluses of food grains in areas which were previously dependent on imports. They portend an even greater revolution in agriculture which could cause further profound economic and social changes.

The systems which govern the viability of each resource are, of course, distinctive in themselves; but they are to a high degree open systems, overlapping and interacting with other systems. The capacity to understand these systems and to manage the factors which determine performance within them will be the principal requirement for those making their careers in natural resource development. It requires that the whole series of individual skills ranging from those of the scientist, the researcher, the engineer and the diplomat to those of the product managers, the operators and most of all the senior executives and policymakers, must be geared to carrying out their functions with a knowledge of, and as part of, the overall systems within which they will be operating.

The changes which are producing this fundamentally new situation are already well underway and the changes are moving rapidly. More rapidly, in fact, than our capacity to deal with them. This poses a monumental challenge to all of those in positions of leadership in the natural resources field. But it is a particular challenge to educators and to those whose support they require. For educators must be on the leading edge of these changes, preparing the new generation of natural resource professionals for the much broader and more complex, but also more exciting, role

they must play in the future, inculcating both the attitudes and the skills they will require to deal with this new set of challenges. But education of the professionals will not be enough. Policymakers and the public must also be educated to understand the new dimensions of natural resource development and how they interact with and affect the goals of society as a whole and its capacity to achieve those goals. This may not be an easy time for those involved in natural resource; but it clearly is the most exciting and challenging time we have ever faced.

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