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USING LEGAL PRINCIPLES TO PROMOTE THE "HEALTH" OF AN ECOSYSTEM

Martin H. Belsky*

I. INTRODUCTION

In the United States' and throughout the world, traditional justifications and policies to protect the environment are under challenge. No longer will political leaders accept the old "command and control" method of regulation. Deregulation and flexibility are, for example, the catch-phrases of the new Republican Contract with America. No longer acceptable are the programs and laws that provided for different rules as to activities depending on whether they affected human health, water quality, resource conservation, air quality, land use, or the oceans or coasts. Rather the call is for "one-stop shopping" based on a

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4. CONTRACT WITH AMERICA 131-35 (Ed Gillespie & Bob Schellhas eds., 1995); see also NEWT Gingrich, TO RENEW AMERICA 197 (1995).
holistic approach to the environment and protection of resources.\(^5\)

One response to this change in the legal and political environment
is to wring hands and call for even tougher protective measures, like
making any destruction of the environment a new crime of "ecocide."\(^6\)
A more productive alternative is to look at the real world from both a
scientific and pragmatic perspective. This is the premise of the ecosys-
tem management model\(^7\) designed to protect ecosystem health.\(^8\)

Dr. David J. Rapport, in explaining the concept of "ecosystem
health," has indicated that scientists and policymakers must focus on
"real-world problems," develop more systematic methods for "diagno-
sis, prognosis, and rehabilitation of ecosystems," and seek a "more
integrated understanding" of the relationship between biology, socio-
economic processes and "adaptive public policy."\(^9\) This article will
explore how evolving legal principles can promote the health of the
ecosystem by forcing a comprehensive approach to policy, research,
and management. I will first give an overview of the ecosystem man-
agement, policy, and research model, which I have described in more
detail in earlier articles.\(^10\) I will then describe how recent events have
reaffirmed the policymakers' support for this evolving doctrine, both at
the national level\(^11\) and at the international level, as shown in new
rules providing for sustainable development and protection of biological
diversity.\(^12\)

\(^5\) See Margaret Kriz, A New Shade Of Green, 1995 NAT'L J. 661, 662.
\(^6\) Ludwik A. Teclaff, Beyond Restoration-The Case of Ecocide, 34 NAT. RESOURCES J. 933 (1994).
\(^8\) David J. Rapport, Ecosystem Health: What's In a Name, 1 ECOSYSTEM HEALTH 1 (1995).
\(^9\) Id.
\(^12\) Suzanne Iudicello & Margaret Lytle, Marine Biodiversity and International Law: Instruments and Institutions that can be Used to Conserve Marine Biological Diversity Internationally, 8 TUL. ENVTL. L.J. 123, 124-25 (1994) (explaining the concept of ecosystem diversi-
II. THE ECOSYSTEM MODEL

The "ecosystem model" seeks to force policymakers to apply scientific truisms about the environment to the study and management of resources and the environment under domestic and international law and policy. One "simple, scientific definition" of ecosystem sees nature as a kind of "super-organism," consisting of many "communities" in a specific physical environment. In those communities "living organisms and their non-living (abiotic) environment are inseparably interrelated and interact with each other." That community is, in short, an "ecosystem."

To scientists, conservation and management are flip sides of the same coin. The key is to identify the ecosystem. After that, the scientist should study the interactions in that ecosystem, the effects of change in one aspect of the system on another, and then should finally allow the governing of that system to be controlled by flexible and changing policies based on the information received, not rigid rules. Of course, while these concepts seem totally sensible and obvious, public policy is not always based on logic. In fact, until quite recently, resource and environmental management were premised on concepts in direct opposition to the ecosystem model.

In the 19th century and even in the first three-quarters of the 20th century, land, water and resources were generally considered "property" to be owned and used. Thus, in some nations, like the United States, the community ordinarily had no right to property and the individual controlled and managed use. Only if the government paid the fair value of the property could public policy determine the most appropriate uses. In other nation-states, where the government exercised more control over property and resources, the emphasis was still on development. The implications of activities on the larger ecological mosaic could not be anywhere as important as economic growth.

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15. See generally Thomson, supra note 11, at 43-44.


17. See U.S. CONST. amend. V ("nor shall private property be taken for public use without just compensation").

This national authority was not subject to external constraints. Under international law, each nation-state had total control over its resources. No international or multi-national community was to interfere. Any property not directly under the control of a nation-state was considered *res nullius*, property that could be used by any citizen of any state without external hindrance.¹⁹

In the early 20th century, leaders of some nation-states, particularly the United States, considered the need to conserve and protect land and resources for recreational and aesthetic use.²⁰ Their response, however, was a very limited one. In some situations, certain types of property were to be reserved for special, noncommercial purposes. All other property could be used as the owners saw fit unless specific harm could be shown.²¹

The mid-20th century saw three dramatic changes that affected policies about resource and environmental management. First, at the international level, the United States, soon followed by other nations, made unilateral claims to ocean space and resources, as evidenced by President Truman’s declarations on fishing rights in the high seas, continental shelf jurisdiction and resource ownership.²² These proclamations were then codified in international agreements.²³ Next, with the introduction of nuclear warfare, there were also some new concerns about protection of the environment and the rights of future generations.²⁴ Yet, these new territorial claims and ecological concerns led to only a few changes in policy. Non-intervention in the rights of property owners was still the rule and government would step in only on an issue-by-issue, “as needed” basis.²⁵ The third change occurred

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²⁴. See Teccliff, supra note 6, at 936-37.

²⁵. See Kenton R. Miller, The Earth’s Living Terrestrial Resources: Managing Their Con-
in the 1950s and early 1960s and focused on the importance of science in a post-Sputnik world.26

The last third of the 20th Century reacted to these changes with a new political atmosphere more responsive to calls for protection of the environment and our resources. Warnings, previously unheeded, now struck sympathetic nerves. In the late 1960s, Hardin in his *Tragedy of the Commons*27 warned that if individuals, and individual nations, did not take a broader look at the cumulative impacts of their acts, there would be no resources about which to be selfish. Rachel Carson in her *Silent Spring*28 pointed out the risks of unfettered use of pesticides. A spill in Santa Barbara highlighted the risks of inadequate pollution controls.29 These events, when combined with a continuing interest and reliance on science, led to the first wave of the “environmental movement.”30

New rules and new agencies, both nationally and internationally, were established.31 Still, problems were dealt with on an “as needed” basis. Individual resources were governed by separate laws and agencies.32 Moreover, there was a "mid-course correction" in the 1970s, then a “redirection” in the early 1980s, that sought to bring “reality” back into environmental control.33

In the “real world,” the new leadership suggested, the society that produced and did the most was the most powerful and successful. Moreover, there was no need for excessive concern about overuse. Science, technology, and individual initiative would find new sources of energy, resources, and even living space.34

Scientists, however, still continued to call for a holistic approach to our environment. They urged a geographically comprehensive and critter-based approach to our environment. They urged, in short, an
This paper will argue that the scientific call to a realistic approach to nature, when combined with recent developments at the national and international level, makes the ecosystem model politically and legally practical and useful.

There are several examples of areas where the ecosystem model, premised on a pattern of relationships between species and activities affecting those species, can be found. One area of increasing government and other interest is the application of the model to our forests. Another, of course, involves protection of wildlife and particularly endangered species, where control must be based on the entire total environment and habitat of the critters. The remainder of this article, building upon earlier ones, will look at marine ecosystems, which some have termed the best example of large ecosystems.

If there exists a rule of law that prefers, or even mandates, an ecosystem model of research and management, this holistic framework could lead to a more cooperative study, more dependence of the regulators on the information gained from that study, more multispecies fisheries plans, more intersections of the rules that govern pollution, manage fisheries, and control the development of non-living resources. Moreover, the ecosystem model could mandate coordination, in the United States, between federal and state agencies, and internationally between nation-states, and between those nation-states and international agencies.


38. See Kenneth Sherman & Lewis Alexander, Preface, in Variability and Management, supra note 35, at xxv-xxvi; see, e.g., Per Ove Eikeland, Distributional Aspects of Multispecies Management: The Barents Sea Large Marine Ecosystem, Marine Policy, July, 1993, at 256, 266; Smith, supra note 7, at 141, 142.

39. Martin H. Belsky, Legal Regimes for Management of Large Marine Ecosystems and Their Component Resources, in Large Marine Ecosystems: Stress, Mitigation and Sustainability 227, 229-32 (Kenneth Sherman et al. eds., 1993).
III. THE EVOLUTION OF THE MARINE ECOSYSTEM MODEL

Until thirty years ago, nation-states of the world did not look at the oceans as an area of environmental concern. Domestically, the issue was maximum exploitation of resources. Legally, the concerns were preservation of each country's sovereign rights and promotion of the freedom of the high seas, including maintenance of the freedom of navigation. Rather than considering the cumulative impacts of the activities of all ocean users and the interactions among living resources in the oceans, government leaders focused on the individual nation's rights and on an ad hoc response to problems.

The United States was a good example of this nation-state practice. Responsibility for offshore activities and resources were divided geographically between the state and federal governments. Different and separate agencies in coastal states and different and separate agencies in the federal government had responsibility, if there were any rules at all, for activities in different geographic regions; for exploitation of different species of living resources, and often for different exploiters, depending on whether they were commercial or recreational; for exploitation of different types of non-living resources; for control of pollution in the air, in the water, or from the coastal lands; and for aesthetic impacts and recreation and tourism. If there were any international impacts, still other federal agencies would be involved, often with numerous foreign state agencies.

The international community supported minimal legal rules. Environmental risks and conservation of resources were just not major concerns. Multi-national action, or even cooperation, was viewed as a potential threat to national sovereign rights. In fact, most of the ocean space was under no state or international control.

41. MALCOLM SHAW, INTERNATIONAL LAW 293-94 (2d ed. 1986).
42. Belsky 1985, supra note 10, at 742.
43. See Murphy & Belsky, supra note 29, at 299-300.
49. See H. Gary Knight, International Fisheries Management: A Background Paper, in
had the right to set up rules for its coasts and a small area or marginal
sea adjacent to its coasts. Activities conducted beyond this "territorial
sea" were rarely regulated; but when they were, restrictions were on
a voluntary basis, either through cooperative agreements or by control
of each nation over its nationals or vessels.

As noted earlier, there was a renewed environmental awareness in
the late 1960s and early 1970s. Individual nation-states, like the United
States, started enacting laws to study environmental impacts, to pre-
serve the air and water, to prohibit or limit pollution, and to manage
resources wisely. This new environmental sensitivity also affected
nation-states' ocean policy.

Moreover, the new environmental awareness led to some multi-
state arrangements as to pollution, and resource conservation and man-
agement. Still, these international and transnational agreements were
neither comprehensive nor ecosystem based. They were specific, re-
acting to a particular, perceived pollution or marine species conser-

In the 1970s, environmental concerns were matched by advances
in technology that allowed development of more coastal and offshore
resources. As a result, some nation-states made even more claims
for ocean resources and detailed more stringent requirements for activi-
ies. The United States, for example, had an extensive and sophisti-
cated set of marine policies that focused on six goals: development of
resources as far out as could be legitimately claimed; protection of
ocean space; management of resources to meet competing goals of
conservation and development; service to ocean users; promotion of
marine science, education and technology; and strategic and military
use.

At the international level, competition for resources and a new
"Spaceship Earth" image of environmental interdependence resulted

THE FUTURE OF INTERNATIONAL FISHERIES MANAGEMENT 1, 1-3 (H. Gary Knight ed., 1975);
Leslie MacRae, Customary International Law and the United Nations' Law of the Sea Treaty,
51. See United States v. Flores, 289 U.S. 137 (1933); see also CHURCHILL & LOWE,
supra note 46, at 153-54.
52. See Belsky 1984, supra note 21, at 14-26.
54. See Robert Friedheim, Ocean Ecology and the World Political System, in WHO PRO-
55. Ross, supra note 26, at 36-68, 392-433.
56. See generally Robert E. Lutz, II, The Laws of Environmental Management: A Com-
57. Curlin, supra note 44, at 20-23.
58. CHURCHILL & LOWE, supra note 46, at 2-3.
59. See Kenneth E. Boulding, The Economics of the Coming Spaceship Earth, in ENVIRON-
in broader attempts at multi-state approaches. Informal and formal agreements were being drafted and implemented (1) to require assessment and monitoring of the impact of development and other activities; (2) to provide more stringent controls over marine pollution; (3) to require plans for protection of the coasts and adjacent waters; and (4) to mandate reconciliation of conflicting uses of the ocean space. 60

Because of advancing technology, nation-states saw the opportunity to exploit resources and control activities over larger ocean areas. This led to unilateral claims to hydrocarbons and living marine resources in "exclusive economic zones" as far out as 200 miles from each nation's coasts. 61 These claims, and the domestic statutes that followed these claims, were accompanied by concerns about foreign exploitation, as well as domestic over-exploitation. This led to rules, and sometimes restrictions, on development of mineral resources 62 and harvesting of both endangered and commercial species. 63

Through this process, more of the ocean space came under individual nation-state control, and thus fewer resources and activities were in international waters and unregulated. By the 1980s, it was estimated that thirty-eight percent of the oceans, over ninety percent of the potential commercially-exploitable fish stocks, and eighty-seven percent of offshore hydrocarbons existed within the collective exclusive economic zone of all nations. 64 These expanded zones also increased the number of overlapping jurisdictional claims and the potential for conflict between adjacent coastal states. Nation-states sought to conserve shared resources for their present and future citizens. They also recognized the need to minimize adverse impacts on their coasts and adjacent ocean space from activities of nearby states. 65 Cooperative action was thus essential to avoid conflicts and assure access and future use of resources. Nation-states became more willing to negotiate broader pollution


61. See MacRae, supra note 49, at 210.

62. See Murphy & Belsky, supra note 29, at 299-300.


64. Churchill & Lowe, supra note 46, at 126.

agreements, establish international environmental standards, and consider new resource management strategies.66

Extended jurisdiction made it more likely that an ecosystem, or large parts of an ecosystem, were within one nation's ocean space. Regulators began to recognize the impact of exploitation of one resource over others, and the cumulative impact of individual policies on the whole ecological mosaic.67 In reviewing their common international obligations, the nations of the world accepted a duty to cooperate in the use of resources so as to avoid harm. Multi-national agreements and policies soon focused on a shared responsibility to take a comprehensive look at the ocean space.68 In establishing joint arrangements for transboundary pollution or resource management, countries adopted requirements that considered the environmental impact of particular activities.69 Though the international rhetoric had changed and an ecosystem comprehensive approach was accepted as sound national and international policy, the issue was, and still is, whether this preferred scientific policy is effective or binding as law?

IV. INTERNATIONAL LAW AND THE MARINE ECOSYSTEM MODEL

International law is not like domestic law. It can be "soft," providing guidance to policy makers, or "hard," binding and enforceable in international and domestic courts.70 The "rules" of international law develop informally. They result from explicit or implicit acknowledgement by the community of nations as shown by (1) state practice or custom; (2) acceptance as a general principle of law, and (3) international conventions.71

As noted above, in the 1970s and 1980s, nation-states started to recognize the need to coordinate separate ocean policies to assure both maximum protection of their oceans and coasts, and the future continued exploitation of the oceans resources. During this same period, states at first considered, then applied, a more general obligation to


70. See BIRNIE & BOYLE, supra note 19, at 26-31.

71. See RESTATEMENT (THIRD) OF FOREIGN RELATIONS LAW OF THE UNITED STATES § 102 (1986) [hereinafter RESTATEMENT (THIRD)].
prevent harm to their own environment and resources. They later considered and applied an obligation to the environment of other nation-states and to adjacent and shared resources. They also accepted, as binding customary law, an obligation of rational and equitable utilization of their resources. Prevention of harm and "rational and equitable use" mean that resources and uses must be studied and managed in a comprehensive manner while focusing on the large marine ecosystems in which resources exist.

International documents and resolutions, such as the Stockholm Declaration on the Human Environment and the World Charter for


73. See RESTATEMENT (THIRD), supra note 71, §§ 601-602; Gunther Handl, The Principle of "Equitable Use" as Applied to Internationally Shared Natural Resources: Its Role in Resolving Potential International Disputes over Transboundary Pollution, 14 REVUE BELGE DE DROIT INT'L 40, 44-45, 52-53 (1978); Bilder, supra note 68, at 459-60 (analyzing doctrine applicable to resource management and coastal pollution).


75. See Bilder, supra note 68, at 460-63 (discussing draft Principles of the United Nations Environmental Program); Helsinki Rules on the Uses of the Waters of International Rivers, Aug. 20, 1966, 52 I.L.A. 484.


The Declaration assumed that "to achieve [the international goal of preserving and protecting the environment], governments and peoples [must] exert common efforts for the preservation and improvement of the human environment." Id. pmbl., ¶ 7. Everything is part of an interdependent system, and pollution and resource management are inextricably intertwined. See George P. Smith II, The United Nations and the Environment: Sometimes a Great Notion? 19 TEX. INT'L L. REV. 335, 338 (1984).

Nation-states have an independent obligation to "safeguard and wisely manage," Stockholm Declaration, supra, princ. 4, 11 I.L.M. at 1418; and to "take all possible steps to prevent pollution." Id. princ. 7, 11 I.L.M. at 1418. To satisfy these obligations "to achieve a more rational management of resources and improve the environment, [nations must] adopt an integrated and coordinated approach to their development so as to ensure [compatibility] with protection of the environment." Id. princ. 13, 11 I.L.M. at 1419.

Nation-states also have a joint responsibility. States have, in accordance with the Charter of the United Nations and the principles of International Law, the sovereign right to exploit their own resources . . . and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or to areas beyond the limits of national jurisdiction." Id. princ. 21, 11 I.L.M. at 1420.

To fulfill this responsibility, they must take steps, by "cooperation through multilateral or bilateral arrangements or other appropriate means . . . to effectively control, prevent, reduce and eliminate adverse environmental effects . . . ." Id. princ. 24, 11 I.L.M. at 1420.

The basic premise then is that a cooperative approach must be based on the ecosystem model: "The natural resources of the earth including the air, water, land, flora and fauna and
Nature confirmed the evolving consensus. Treaties have explicitly included an ecosystem-based management model.

The evolution of the marine ecosystem approach from preferred policy to binding custom is demonstrated by the 1982 United Nations Convention on the Law of the Sea (UNCLOS). UNCLOS requires each nation-state to take all appropriate actions to preserve and protect the marine environment and to manage its resources based on the especially representative samples of natural ecosystems must be safeguarded for the benefit of present and future generations. Id. princ. 2, 11 I.L.M. at 1418.


Similarly, in the Convention for the Protection of the Natural Resources and Environment of the South Pacific Region, the nations of the South Pacific Region “recognized” the special ecological nature of the region and the potential threat to the “ecological equilibrium” of that region. They agreed in their domestic laws and in their international arrangements to “take all appropriate measures” to “control pollution . . . and to ensure sound environmental management and development of natural resources.” Convention for the Protection of the Natural Resources and Environment of the South Pacific Region, Nov. 25, 1986, arts. 4(1) & 5(1), 26 I.L.M. 38, 44-45. This language, though not using the exact words, is the ecosystem model. By including this language, the signatories of the South Pacific Region Convention, like those of the Antarctic Conventions assume that the ecosystem model is in accordance with international law. Id. arts. 5(1) & 5(4), 26 I.L.M. at 44-45.


80. Specifically, nation-states have a general “obligation to protect and preserve the marine environment.” UNCLOS, supra note 79, art. 192, 21 I.L.M. at 1308. They have a specific obligation to minimize and control pollution. Id. arts. 194, 207, 210, 21 I.L.M. at 1308, 1310;
interdependence of species. The Convention requires nation-states to integrate these ocean policies into their own laws and to act collectively, as well as individually. The Convention itself states that its


81. The Convention specifically includes an obligation to manage fisheries on an ecosystem model — in order to avoid over-exploitation, to adequately consider the environmental impacts on habitats, and to sufficiently consider the interrelationships of species; see generally UNCLOS, supra note 79, art. 61, 21 I.L.M. at 1281 (discussing exclusive economic zones); id. art. 63, 21 I.L.M. at 1282 (discussing shared stocks); id. art. 64, 21 I.L.M. at 1282 (discussing highly migratory species); id. art. 65, 21 I.L.M. at 1282 (discussing marine mammals); id. art. 66, 21 I.L.M. at 1282 (discussing anadromous stocks); id. art. 67, 21 I.L.M. at 1283 (discussing catadromous species); id. arts. 117-20, 21 I.L.M. at 1291 (discussing high seas).

Even the specific management principles of the Convention provide for a comprehensive ecosystem approach. Specifically, the provisions for management of the living resources of the sea adopt the “maximum sustainable yield” standard, but say that this standard has to be qualified by “other relevant environmental and economic factors” and to take into account, the “interdependence of stocks.” See, e.g., id. art. 61(3), 21 I.L.M. at 1281. In addition, nation-states, in managing specific resources, must “take into consideration the effects of species associated with or dependent upon harvested species with a view to maintaining or restoring populations of such associated or dependent species above levels at which their reproduction may become seriously threatened.” Id. art. 61(4), 21 I.L.M. at 1281. Finally, the Convention requires nation-states to include in pollution measures all those necessary “to protect and preserve rare or fragile ecosystems as well as the habitat of depleted, threatened or endangered species and other forms of marine life.” Id. art. 194(5), 21 I.L.M. at 1308.

82. UNCLOS mandates that its provisions are to be implemented in domestic laws and in bilateral and multilateral treaties and other cooperative arrangements. See generally id. arts. 117-18, 21 I.L.M. at 1291 (discussing the obligation for fishing); id. arts. 194, 197, 21 I.L.M. at 1308 (discussing the general obligation for pollution control); id. arts. 207, 213, 21 I.L.M. at 1310-11 (discussing the obligation for pollution from land-based sources); id. arts. 210, 216, 21 I.L.M. at 1310, 1312 (discussing dumping); id. arts. 211, 217-220, 21 I.L.M. at 1312-13 (discussing vessel pollution).

Specifically, the rules are to be applied by a state to activities in its ports, its coastal areas, and its exclusive economic zone. A state must also control the activities of its nationals and vessels in all ocean areas. Id. art. 218, 21 I.L.M. at 1312-13 (discussing ports); id. art. 220, 21 I.L.M. at 1313 (discussing coasts); id. art. 56, 21 I.L.M. at 1280 (discussing exclusive economic zones); id. art. 94, 21 I.L.M. at 1287-88 (discussing the obligation of flag state for vessels on the high seas); id. arts. 211, 217, 21 I.L.M. at 1310-11, 1312 (discussing enforcement of standards by flag states against vessels); id. arts. 117-18, 21 I.L.M. at 1291 (discussing the obligation over nationals for fishing). For a provision-by-provision analysis of the relevant articles of the Convention applicable to these requirements, see Louis B. Sohn, Implications of the Law of the Sea Convention Regarding the Protection and Preservation of the Marine Environment, in LAW OF THE SEA INSTITUTE, THE DEVELOPING ORDER OF THE OCEANS 103, 106-08 (Robert B. Krueger & Stefan A. Riesenfeld eds., 1984).

provisions are intended to be read as a whole.\textsuperscript{84} These elements mean that the treaty mandates the "ecosystem approach." Moreover, the Convention is binding, either as treaty obligation\textsuperscript{85} or as accepted custom.\textsuperscript{86}

Finally, the recent Rio or Earth Summit, formally called the United Nations Conference on Environment and Development (UNCED), committed nations to a new legal regime for land as well as marine areas, integrating resource management, protection of the environment, and future economic growth.\textsuperscript{87} The international community then confirmed international acceptance of the ecosystem model in its Declaration on Environment and Development\textsuperscript{88} in Agenda 21,\textsuperscript{89} and in vari-

\textsuperscript{84} UNCLOS, \textit{supra} note 79, pmbl., 21 I.L.M. at 1271 (stating: "The States Parties to this Convention, . . . conscious that the problems of ocean space are closely interrelated and need to be considered as a whole, . . . ").


\textsuperscript{86} The nations of the world, by their consensus on the provisions on the treaty, have codified and progressively developed the ecosystem mandate. UNCLOS, \textit{supra} note 79, pmbl., ¶ 7, 21 I.L.M. at 1271 (listing the law of the sea provisions dealing with environmental protection and resource management and thus the comprehensive approach). See Barbara Kwaitkowski, \textit{Conservation and Optimum Utilization of Living Resources, in Law of the Sea Institute, supra} note 60, at 245, 246-47 (describing the proceedings of the 20th Annual Conference of the Law of the Sea Institute, July 21-24, 1986). Consensus indicates that states intended to create legally binding principles and rules and thus the provisions concerning fisheries are hardening into custom. \textsc{Restatement (Third), supra} note 71, pt. V, at 5; see, e.g., \textit{id.} §§ 502, 514 cmts. f & i, 521 cmts. c & e, 603-604.

There are now sufficient signatures to have the treaty enter into force. See Ted McDorman, \textit{The Entry into Force of the 1982 LOS Convention and the Article 76 Outer Continental Shelf Regime}, 10 INT'L J. MAR. & COASTAL L. 165 (1994). Until recently, however, the United States refused to sign the treaty and the United States has not yet ratified it. See Lawrence Juda, \textit{The 1982 UN Convention on the Law of the Sea Enters into Force: Changing Prospects for American Ratification}, MARINE AFFAIRS NEWSLETTER (University of Rhode Island), 1995, at 1-2. Still, even the United States has, almost from the initial signing of the Treaty, accepted the provisions, except for those on deep seabed mining, tuna, and dispute settlement, as stating present customary international law. See President's Statement on United States Ocean Policy, Accompanying His Proclamation Establishing an Exclusive Economic Zone, 19 WEEKLY COMP. PRES. DOC. 383 (Mar. 14, 1983), \textit{reprinted in} 22 I.L.M. 461; Malone, \textit{Who Needs the Sea Treaty?}, 45 FOREIGN AFFAIRS 44, 59-61; see also \textsc{Restatement (Third), supra} note 71, pt. V, introductory note at 5.

\textsuperscript{87} See Biliana Cicin-Sain, \textit{Sustainable Development and Integrated Coastal Management, 21 Ocean & Coastal Mgt. 11 (1993).}


\textsuperscript{89} \textit{Agenda 21, Annex II to the Report of the United Nations Conference on Environment}
ous proposed treaties.90

V. THE RIO SUMMIT

The Rio Summit was intended to provide a new legal framework for international environmental law. Maurice Strong, Secretary-General of the United Nations Conference on Environment and Development, did in fact indicate that, as a result of the Conference, the United Nations General Assembly designated the 1990s as the decade of environmental law.91

The new framework is the ecosystem model, and customary international law is moving toward acceptance of that principle. Secretary-General Strong indicated the impact of the Rio Summit. It is not necessary, he indicated, to wait until all nation-states are ready to commit themselves to a new set of policies and commitments. A core set of representative nations can commit themselves and thus “move the process.” The 172 nation-states who met at the Rio Summit can be this core.92

The representatives have “moved the process” by making certain doctrines explicit:

1. when nation-states develop resources, they must include environmental protection in their planning.93
2. adopting the precautionary principle, the international community and its member states agreed to act with caution to prevent serious or irreversible damage from occurring as a result of particular activities.94
3. nation-states, both on their own and collectively, must do all that is possible to “conserve, protect and restore the health and integrity of the Earth’s

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92. Id.
93. Rio Declaration, supra note 88, prin. 4, at 118.
4. to do this, nation-states must regulate biological resources through protection of ecosystems.96

The nations of the Rio Summit also established a plan for future action — Agenda 21. The premise of Agenda 21 is that we must establish a "global partnership for sustainable development."97 Chapters of Agenda 21 dealing with land resources, forests, mountains, agricultural lands, biological diversity, marine and freshwater resources, all detail the need and requirement of "sustainable development" and application of the "precautionary principle."98

These concepts are codifications and applications of the ecosystem model. They detail the international consensus that economic development and environmental protection are inseparable; that we must act today to preserve the future; and that we must consider the applicable ecological context of our activities and decisions.99 In applying these

95. Rio Declaration, supra note 88, princ. 7, at 119.
96. Environment Programme Convention on Biological Diversity, supra note 90, arts. 2 & 8, at 85; Framework Convention on Climate Change, supra note 90, art. 4, at 64-66; Forest Principles, supra note 90, princ. 2, at 112; see, e.g., David M. Bodansky, International Law and the Protection of Biological Diversity, 28 VAND. J. TRANSNAT'L L. 623, 629 (1995).
97. Agenda 21, supra note 89, pmbl., para. 1.6, at 130.
98. See generally Agenda 21, supra note 89.
—The basis for action to protect the atmosphere must focus on properties of the atmosphere and “of the affected ecosystems.” Id. ¶ 9.6, at 215.
—Planning and management of land resources must be premised on an understanding that such resources are “organized in ecosystems” id. ¶ 10.1, at 223; that “it is desirable to plan and manage all uses in an integrated manner” id. ¶ 10.3, at 224; and that it is essential that government decision-makers act to facilitate an integrated approach that looks at the whole ecosystem id. ¶ 10.7, at 225.
—Combatting deforestation must similarly be based on a new management approach that deals with "sustainable development of all forest ecosystems . . . ." Id. ¶ 11.14(a), at 233-34.
—Special action is required to “manage fragile ecosystems” by “combating desertification and drought” id. ¶¶ 12.1-.4, at 244-45; and by taking special care of mountain ecosystems id. ¶¶ 13.1-.8, at 259-61.
—Similarly, special care is necessary to promote sustainable agriculture and rural development by a cautionary approach to fragile ecosystems. Id. ¶ 14.25, at 271.
—To preserve biological diversity premised on survival in ecosystems, research into the functioning of ecosystems and “effective national action and international cooperation” for protection of ecosystems is required. Id. ¶¶ 15.3, 15.5, at 288, 289-90.
—Protection of freshwater resources must recognize its integral nature as part of the ecosystem id. ¶ 18.8, at 335; and the need for holistic, ecosystem-based management. Id. paras. 18.36-.38, at 342.
concepts to marine resources, Agenda 21 stresses that protection and "sustainable development" of the marine and coastal environment and its resources require "approaches that are integrated in content and are precautionary and anticipatory in ambit," and that balance all uses. Since the Rio Summit, other agreements and analyses have confirmed that an ecosystem model is moving from a position of good policy initiative to one of a preferred and mandated use.

VI. BIODIVERSITY; SUSTAINABLE DEVELOPMENT; NATION PRACTICE; AND THE ECOSYSTEM MODEL

The new environmental "buzz words" today are "biological diversity" and "sustainable development." The term "biological diversity" can be defined as the "variability among living organisms from all sources [and] the ecological complexes of which they are part." Preservation of "biological diversity" requires a geographically based approach to the variety of species and their habitat. This is, of course, a definition of ecosystem management. The mandate to protect biodiversity can be found in some nation-state laws, such as the Endangered Species Act in the United States or the Public Trust Doctrine in common law countries. It can now also be found in specific language in Agenda 21 and in a new Treaty on Biological Diversity.

Scientists recognize that ecosystems are the "top of the hierarchy"
to explain and protect diversity. In short, species protection is a surrogate for ecosystem protection. Any mandate to preserve species diversity requires protection of the ecosystem and intelligent management of that ecosystem. Agenda 21 specifically notes that biological diversity is premised on survival in ecosystems and, therefore, research into the functioning of ecosystems, along with effective national action and international cooperation for the protection of ecosystems, is required.

The new United Nations Convention on Biological Diversity describes the requirement to conserve ecosystems and natural habitats. It mandates that each Party is to "rehabilitate and restore degraded ecosystems" through "plans or other management strategies." This new international requirement confirms the mandate as to marine ecosystems found in customary international law and the Law of the Sea Convention. Though discussions of biodiversity have focused on land-based ecosystems, it is clear that the rules apply to both land-based and marine ecosystems.

"Sustainable development" is a level of activity that "equitably meet[s] developmental and environmental needs of present and future generations." "Sustainable development" thus requires both protection and use, i.e. management. That management must be the one that responds the best to the interconnections of nature — the existence of ecosystems.

The renewed international emphasis on ecosystems has been matched by attention in the United States. Vice President Gore has called on all environmental agencies to "ensure a sustainable economy and a sustainable environment through ecosystem management." Republican Senator Mark Hatfield has introduced a proposed Ecosystem Management Act. The Forest Service has incorporated ecosystem

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110. Agenda 21, supra note 89, ¶ 15.3, at 288.
111. Id. ¶ 15.5, at 289.
112. Environment Programme Convention on Biological Diversity, supra note 90, art. 2, at 83-84.
113. Id. art. 8, at 85-86.
116. See generally George Francis, Ecosystem Management, 33 Nat. Resources J. 315 (1993); see Agenda 21, supra note 89, ¶¶ 10.3, 17.5, at 224, 308 (defining an integrated approach for sustainable development).
management into their public lands policies.\textsuperscript{117} NOAA has incorporated it into its marine policies.\textsuperscript{118} The ecosystem model is now the preferred choice of American policymakers and accepted policy. It is now also, at least presumptively, binding law.

VII. APPLYING THE ECOSYSTEM MODEL AND MANDATE

The ecosystem model, of course, relates to comprehensive, ecosystem based management. Acceptance of the ecosystem model for management means acceptance for research as well. Management is not possible without adequate information about the ecosystem, impacts of activities and rules on the ecosystem, and changes in the ecosystem over time. Thus, the model also includes a mandate for basic science, assessment and monitoring to support comprehensive ecosystem regulation.\textsuperscript{119}

Just as international law has evolved to require an ecosystem management model, it also has evolved to require the collection of information for assessment and monitoring, and that collection must be premised on an ecosystem model.\textsuperscript{120} Adequate regulatory controls on activities and limitations on pollution must first be based on assessment of the present status of the marine environment. Changes to that environment must then be monitored. A continual evaluation of current information must be tied into periodic revision of restrictions.\textsuperscript{121}

These concepts have been codified specifically for marine policy in the United Nations Convention on the Law of the Sea (UNCLOS), and then more generally reaffirmed by the international community at the Rio Summit. UNCLOS establishes a "framework for the effective conservation and management of the marine environment . . . [which] has the consent and support of the organized world community."\textsuperscript{122}

\textsuperscript{117} Thomson, supra note 11, at 42.

\textsuperscript{118} See John Byrne, Large Marine Ecosystems and the Future of Ocean Studies: A Perspective, in Variability and Management, supra note 35, at 299, 300. See generally Kenneth Sherman, Sustainability of Resources in Large Marine Ecosystems, in Food Chains, Yields, Models, and Management of Large Marine Ecosystems 1 (Kenneth Sherman et al. eds., 1991).


\textsuperscript{120} For a detailed description of the evolution of the customary rule mandating an ecosystem model for research, assessment, and monitoring, see Belsky 1989, supra note 10, at 464-68.


\textsuperscript{122} Douglas M. Johnston, Conservation and Management of the Marine Environment:
That framework provides for an ecosystem approach to marine management. That framework also requires assessment and monitoring to implement that ecosystem approach. Nation-states in their exclusive economic zone are to acquire "the best scientific evidence" to assure "proper conservation and management measures" for living marine resources. This evidence must include analysis of the effects of harvesting on related species.\footnote{123}

Nation-states are to control their nationals and coordinate their activities when resources occur within more than one zone, or within a zone and in the high seas, or totally within the high seas.\footnote{124} Such coordination includes assuring that the "best scientific evidence" is obtained for conservation measures and that the interdependence of stocks are considered.\footnote{125}

These resource management mandates, applicable to domestic activities, bilateral and multilateral arrangements, and activities by nationals on the high seas,\footnote{126} are to be in accord with the general obligation of states to "protect and preserve the marine environment."\footnote{127} Thus, nation-states are to consider relevant environmental factors in their resource management assessments and decisions.\footnote{128} They are to take such measures as are necessary to preserve ecosystems and the habitat of marine life.\footnote{129} Such measures shall include environmental assessment of risks and monitoring of risks and effects.\footnote{130} Such assessment and monitoring is to be done directly by each nation-state and indirectly and cooperatively through international organizations.\footnote{131}

At the Rio Summit, nation-states indicated that the principles included in the Law of the Seas Convention apply broadly to all activi-
ties. Each nation agreed that they must individually and collectively undertake environmental impact assessment prior to all proposed activities. Nation-States also accepted the precautionary principle that limits action when there is lack of knowledge, and they recognized that sustainable development depends on gaining and sharing scientific information. In addition, through Agenda 21, the international community provided detailed requirements for the collection of information and the undertaking of scientific research for every management-related activity. Of course, as living resource management must be based on an ecosystem model, basic research and then assessment and monitoring must also focus on the whole ecological mosaic in a region — the impact of pollution and pollution controls and the impact of exploitation of one species on another.

VIII. IMPLEMENTATION-APPLYING THE ECOSYSTEM MODEL

One complaint about the ecosystem model is that “in spite of growing rhetoric about the viability of ecosystem management, there is little shared insight, [or] agreement . . . .” Moreover, “details on intergovernmental cooperation, [and] cross-sectoral management . . . remain problematic.” The legal situation is relatively straightforward. If accepted as a binding rule of international law, the ecosystem model of research assessment, and management must, by definition, be followed by a nation-state. Nation-states must integrate the principle into their own legal system, in any new bilateral or multilateral agreement, and in any formal or informal regulatory or management program.

133. *Id.* princ. 15, at 120. See *Hey*, *supra* note 99.

The requirement of ecosystem management has been termed “ecomanagement.” Environmental assessment and monitoring are accepted as a necessary “practical application of the ecomanagement system.” See Jaro Mayda, *Environmental Legislation in Developing Countries: Some Parameters and Constraints*, 12 ECOLOGY L.Q. 997, 1001, 1003 (1985).

139. *Id.* pt. V, at 5.
Enforcement is more complex. Numerous alternatives from mere protests to international tribunals are potential remedies. Moreover, in those countries where international law is automatically a part of nation-state domestic law, the mandate can be enforced in that state's courts.  

It is true, that as a practical matter, application of the model may be difficult. Still, it is not impossible. International law, and most nation-state domestic law, requires reconciliation, if at all possible, between international obligations with domestic statutory or regulatory obligations.  

Applying this doctrine to the ecosystem model, there are numerous treaties, nation-state laws, and international obligations that deal separately with environmental and resource issues. The domestic and multilateral rules grant broad discretion to each country’s regulators to interpret and apply. The ecosystem mandate says that leaders must seek a comprehensive approach to pollution and resource management — taking a look at the whole geographic area and not just the individual activities to be regulated.

IX. CONCLUSION

Let me end with my bias. To cite a recent article, I believe there are now “current significant opportunities for new natural resource management philosophies and applications . . . .” Public pressure, continuing governmental use, scientific advances, and policy discussions like those here today can insure use of the ecosystem model. The more that lawyers, scientists, and policymakers talk about use of the model, the more government leaders will allow their scientists to study it. Further, the more the model is allowed to be used by planners, managers, and government leaders, the more likely it is that this preferred policy will become a custom binding on nation-states.

140. See, e.g., The Paquette Habana, 175 U.S. 677, 700 (1900).
141. RESTATEMENT (THIRD), supra note 71, § 114; see Lauritzen v. Larson, 345 U.S. 571, 582 (1953).
142. For a full discussion of this requirement in law, see Belsky 1989, supra note 10, at 468-77.
143. Burroughs & Clark, supra note 137, at 661.