Washington Law Review

Volume 66 | Number 3

7-1-1991

Valuation and International Regulation of Forest Ecosystems: Propects for a Global Forest Agreement

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VALUATION AND INTERNATIONAL REGULATION OF FOREST ECOSYSTEMS: PROSPECTS FOR A GLOBAL FOREST AGREEMENT

Abstract: Deforestation poses severe environmental problems for temperate and tropical regions world-wide. An international forest agreement is necessary to protect these forests. Previous international environmental agreements provide, at best, limited protection for endangered natural resources. To conserve the world's forests, an effective forest agreement must recognize the economic value of forest ecosystems. This forest agreement should define a twofold rule of responsibility: that states have a duty to protect forests located within their borders, and that other states that benefit from forests have a legal obligation to share in conservation costs.

Deforestation is one of the world's most important environmental problems.[1] The endangered forests are both ecosystems within a global biosphere and regions of human use and enjoyment.[2] Airborne pollutants such as acid rain threaten the very survival of forests throughout much of Europe, the eastern United States and Canada.[3] Urban encroachment, over-exploitation and conversion into timber stands also threaten temperate forest ecosystems.[4]

Although international attention has focused on the need to protect tropical forests, wetlands and other ecosystems,[5] no international agreement protects northern temperate forests. By failing to recognize environmental costs and non-timber forest values, market mechanisms

1. Kairiukstis, *Forest Decline: Background to the Problem,* in FOREST DECLINE AND REPRODUCTION: REGIONAL AND GLOBAL CONSEQUENCES 3 (1987). *See generally* J. BRUNNEE, ACID RAIN AND OZONE LAYER DEPLETION: INTERNATIONAL LAW AND REGULATION (1988).

2. Ecosystems are complex and evolved interdependent communities of plant, animal and microorganism species interacting with their environment. *See generally* THE TEMPERATE FOREST ECOSYSTEM (Y. Hanxi, W. Zahn, J. Jeffers & P. Ward eds. 1986). Forest systems recycle nutrients, recharge water and constitute habitat for a rich diversity of flora and fauna. Forests remove carbon dioxide from the atmosphere, thereby mitigating global warming. Forests also provide people with values and uses, including watersheds for fisheries and water supplies, trees for timber and wood pulp, and environments for recreation, tourism, and spiritual and aesthetic experiences. Forests are homelands for indigenous peoples. Thus, damage to forests threatens both global ecological processes and human values that depend on sustainable forests. *See* UNIFICATION OF EUROPEAN FOREST PATTERN RESEARCH (P. Schmidt, R. Oldeman & A. Teller eds. 1989); WORLD DEFORESTATION IN THE TWENTIETH CENTURY (J. Richards & R. Tucker eds. 1988).

3. *See* Kariukstis, *supra* note 1, at 3. Although not discussed here, air pollution severely threatens temperate forests. *See generally* J. BRUNNEE, *supra* note 1; INVENTORYING AND MONITORING ENDANGERED FORESTS (P. Schmid-Haas ed. 1985).

4. *See generally* Jeffers, *The Importance of Research in Temperate Forests,* in THE TEMPERATE FOREST ECOSYSTEM 9 (1986).

5. *See infra* notes 62–65 and accompanying text.

hasten rather than slow deforestation. Thus, forest protection requires regulatory policies and alternative methods of assessing forest values.

International economic pressures, uneven development of environmental law, and the global impact of the forest crisis require international regulation of forests. Because of interconnections among tropical and temperate forest nations, a global agreement should protect the forests in both regions. International legal principles and prior international agreements comprise the bases for international environmental law applicable to forest regulation. International legal principles address and define international environmental problems and solutions. In contrast, international agreements legally bind parties, creating both rights and obligations concerning the regulated global resources.[6] These existing principles and agreements, however, are inadequate models on which to base an international forest agreement. Therefore, this Comment suggests some of the general contours and components of an effective international forest agreement.

I. FOREST CRISIS AND THE NEED FOR INTERNATIONAL LAW

A. Deforestation and the Need for Regulation

Despite the importance of forests as ecosystems and human environments, temperate nations continue to deplete their forests. The accelerated conversion of forests into timber occurs because the market neither includes environmental costs in the price of timber production nor recognizes the magnitude of non-market forest values. Valuation methods exist, however, that would enable decisionmakers to measure non-market forest values and more accurately weigh them in forest policy decisions.

1. Transformation of Natural Forests into Timber Resources

Modern timber policies in temperate forest countries lead to the conversion of vast areas of natural forest ecosystems into single-species stands of trees.[7] Timber companies clear-cut and deforest old growth areas and then replant, grow and harvest valuable timber species of

6. *Cf.* M. JANIS, AN INTRODUCTION TO INTERNATIONAL LAW 9 (1988) (treaties create legal rights and duties). As used here, the term "global resources" refers to natural resources that confer on the world substantial benefits, including environmental services, genetic diversity or symbolic value.

7. Old-growth temperate forests in western Washington and Oregon, which once covered 6 million hectares, number only 2 million hectares, of which 400,000 hectares are reserved. Franklin, *Current Ecosystem Research Topics in the United States*, in THE TEMPERATE FOREST ECOSYSTEM 55 (1986).

trees.[8] Although trees return to the area, the forest ecosystem vanishes.[9]

The destruction of forest ecosystems eliminates other species of flora and fauna and causes the loss of entire environmental systems.[10] Deforestation undermines watersheds, causing flooding, erosion, and soil loss.[11] Conversion to secondary forests releases substantial amounts of carbon dioxide into the atmosphere.[12] Moreover, deforestation interferes with recreation, aesthetic enjoyment and religion.[13]

Ironically, this destruction of forest ecosystems occurs during a period when the total area of temperate forest lands has actually increased.[14] This increase, however, disguises the serious threat that deforestation poses to northern forest ecosystems. Although increased agricultural productivity enables reforestation of farmlands, such processes do not replace the loss of native habitat and species due to the clearing of original forests.[15] Moreover, reforestation in one area of a country or region merely offsets deforestation in another area.[16]

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8. Any given area of secondary or plantation forest is more industrially productive than an equal area of natural forest. *See* L. CALDWELL, INTERNATIONAL ENVIRONMENTAL POLICY 195–96 (1984); *see also* Szujecki, *Pattern Analysis for Silviculture,* in UNIFICATION OF EUROPEAN FOREST PATTERN RESEARCH 62 (1989) (rational management limited to trees and not applied to other components of the ecosystem).

9. Deforestation in the Pacific Northwest has been severe enough to stimulate federal protection for the habitat of the endangered Northern Spotted Owl. *See* Hays, *The New Environmental Forest,* 59 U. COLO. L. REV. 517, 532 (1988) (the government protects the owl both for its value as a species and as an indicator of forest health).

10. *Id.* at 533 (conversion of forests to monocultures of trees threatens diversity).

11. *Id.* at 526.

12. National Audubon Society, Draft for Discussion: Elements of a Global Forest Protocol Within a Climate Treaty 2 n.1 (Jan. 1991).

13. *See* Lyng v. Northwest Indian Cemetery Protective Ass'n, 485 U.S. 439, 461–63 (1988) (Brennan, J., dissenting) (timber harvests and road construction would devastate the site-specific religion of Native Americans in northwest California).

14. Since 1975, total forest cover in Europe and Canada increased by 1.3% and 5.9% respectively. WORLD RESOURCES INST., WORLD RESOURCES 268–69 (1990). Soviet Union forests, comprising 25% of the world's timber and over half the world's conifers, increased in area between 1961 and 1978, yet the increase may be attributable to different inventory methods. *Id.* at 126. Forest area in the United States, however, decreased 8.8% between 1975 and 1987. *Id.* at 268. Generally, temperate forest area has decreased by one-third since pre-agricultural times. *Id.* at 107.

15. *See* Jeffers, *supra* note 4.

16. In contrast to the eastern United States, forest inventories in the western United States have declined because harvests of mature stands have exceeded growth on National Forest and forest industry land on the Pacific Coast. E. RICHARDS, FORESTRY AND THE FOREST INDUSTRIES: PAST AND FUTURE 408 (1987).

2. *The Market Underprices Timber as a Commodity*

Despite negative environmental impacts, deforestation continues at an accelerated rate because market forces and policy makers fail to include the effects of logging on forest ecosystems in the price of timber.[17] The marginal cost of production is lower than the marginal social and environmental costs of production.[18] As a result, consumers pay less for and consume more timber products than they would if the market price included externality costs.[19] Thus, underpriced timber increases consumption and accelerates deforestation.

3. *Market Forces and Decisionmakers Overvalue Timber in Relation to Non-market Forest Values*

Although both market and forest policy underprice timber as a commodity, they overvalue it as a forest use. Because most non-timber forest values are not priced in a market,[20] decisionmakers and market forces fail to recognize forest values other than timber. Contrary to national forest policies[21] and popular preferences,[22] this bias toward timber production tilts policy decisions against environmental services, wildlife habitat and other non-market forest values.[23]

4. *Economic Valuation of Non-market Natural Resources*

To overcome the bias against non-market values, valuation techniques enable policy-makers to estimate the economic value of non-market forest values and include them in the decisionmaking process.[24] Both resource economists and American law accept valuation

17. J. BRUNNEE, *supra* note 1, at 53 (deterioration of terrestrial environments and diminution of aesthetic values are production costs, but society, not the producer, generally bears them).

18. *Id.* Treating forests as free goods also underestimates the real costs of airborne pollution, and thus fails to provide incentives for pollution eradication. Brunnee discusses in depth the treatment of resources as free goods in the context of airborne pollution.

19. *See* Williams, *Benefit-Cost Analysis in Natural Resources Decision-making: An Economic and Legal Overview,* 11 NAT. RESOURCES LAW. 761, 769 (1978).

20. *See* Price, *Temperate Mountain Forests: Common-Pool Resources with Changing, Multiple Outputs for Changing Communities,* 30 NAT. RESOURCES J. 685, 688 (1990).

21. *See* Multiple-Use Sustained Yield Act of 1960 § 529, 16 U.S.C.A. § 528 (West 1990) ("In the administration of the national forests, due consideration shall be given to the relative values of the various resources.").

22. *See* Hays, *supra* note 9, at 544 (net present benefit of environmental uses, especially recreation, fishing, wildlife and wilderness exceeded that for commodity uses such as timber).

23. On the complexities of defining comparative forest values in policy decisions, see Price, *supra* note 20, at 690.

24. *See, e.g.,* Hays, *supra* note 9, at 544 (monetization of environmental values allows their advocacy in the same terms as commodity values during the planning process); *see also* Navrud & Solberg, *Possible Regional Economic Consequences of Forest Dieback—Norway as an Example,*

techniques to measure three aspects of natural resource value: use value, non-use value and replacement value.[25]

First, forest ecosystems comprise use values stemming from public recreational activities such as hiking, fishing, wildlife observation and tourism.[26] Second, forests provide non-use values that include existence value, option value and intergenerational value.[27] Existence value assesses the value that people place on preserving a forest in its current state, regardless of whether they physically use it.[28] Option value measures the economic value of retaining forests in their current condition for future use.[29] Non-use value also includes the value that forest preservation has for future generations.[30] Finally, replacement value measures the costs of restoring a forest ecosystem to its unharmed condition.[31] Replacement value emphasizes restoration of damaged resources rather than compensation to a party for the lost use of those resources.[32] Although no single valuation method, including the market, measures all the environmental and economic aspects of forests, valuation techniques enable decisionmakers to compare and weigh diverse forest values.[33]

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in FOREST DECLINE AND REPRODUCTION: REGIONAL AND GLOBAL CONSEQUENCES 594 (1987).

25. *See* Comprehensive Environmental Response, Compensation, and Liability Act § 9651(c)(2), 42 U.S.C.A. § 9601 (West 1990) (use value is a factor to be considered in resource valuation); *see also* Ohio v. United States Dep't of the Interior, 880 F.2d 432, 476 (D.C. Cir. 1989) (contingent valuation can assess use and existence values for natural resource damages). Contingent valuation measures the willingness to pay for a non-market value, based on surveys that gauge economic preferences and impute market values to them. *Id.*

26. *See* Navrud & Solberg, *supra* note 24.

27. *Id.*; *cf.* Hays, *supra* note 9, at 527 (forest wilderness lands provide existence values).

28. *See* Navrud & Solberg, *supra* note 24, at 594. Existence values include aesthetic values such as landscapes, symbolic value, biodiversity and biological value as part of the biosphere. *Id.* Non-use values include the value that people from other regions or nations place on a particular forest ecosystem. *See, e.g.*, d'Arge & Kneese, *State Liability for International Environmental Degradation: An Economic Perspective,* 20 NAT. RESOURCES J. 427, 442 (1980).

29. Option value includes the option for recreational activities in the future as well as the value of preserving forests for future benefits presently unknown. *Cf.* Cross, *Natural Resource Damage Valuation,* 42 VAND. L. REV. 269, 286 (1989).

30. The United States Congress recognized such intergenerational obligations in the National Environmental Policy Act of 1969, 42 U.S.C.A. § 4331(b) (West 1990) (Congress shall fulfill the responsibilities of each generation as trustee of the environment for succeeding generations).

31. *See* Ohio v. United States Dep't of the Interior, 880 F.2d 432, 444 (D.C. Cir. 1989) (noting a congressional preference for replacement value over diminution of use value because replacement value is more conducive to conservation policy). Replacement costs may be extensive. *See id.* at 454 (replacement damages include costs of restoration and the value of all lost uses of the damaged resources).

32. *Id.* at 444.

33. The value of a forest ecosystem or any of its components may be the total of its market, use and non-use values. *See* Cross, *supra* note 29, at 314.

B. The Need for International Regulation of Forests

Although nations have developed legislative and economic tools to discourage deforestation,[34] participation in a global market undermines the effectiveness of national measures. First, even if all nations wish to adopt a policy of including environmental costs in timber prices, each may hesitate to act unilaterally because of international economic pressures.[35] For example, concern about balance of payments and balance of trade deficits create incentives to accelerate harvests in order to derive hard currency from timber exports.[36]

Second, disparities among nations in environmental law and policy create disincentives to protect forests fully.[37] Nations can develop a competitive advantage in timber production by not using sustainable forest methods, thus underselling timber from other nations that include environmental costs in their price.[38] As a result, a nation can reap the benefits of other nations' environmental activities while taking limited action at home.[39] In effect, the failure to use sustainable forestry methods creates artificially low timber export prices, amounting to an unfair trade subsidy.[40]

Third, economic pressures and uneven environmental policies among world regions also affect timber trade patterns and deforestation. Because most tropical timber nations underprice their timber,[41] temperate forest nations substitute tropical timber imports for domestic production or temperate timber trade.[42] Thus, temperate forest

34. *See, e.g.*, National Forest Management Act of 1976, 16 U.S.C.A. §§ 1600–14 (West 1990).

35. *See* d'Arge & Kneese, *supra* note 28, at 434.

36. *Id.* at 445. The Soviet Union has begun to open the vast northern Siberian forest to economic exploitation by the United States, Japan and others. Scientists believe the negative effects on forests could dwarf what has happened in the tropics, endangering the cultures of indigenous peoples and threatening the Siberian tiger with extinction. Seattle Times, Feb. 14, 1991, at A10, col. 1.

37. For similar reasons, the United States supported the Stockholm Declaration, *infra* note 51, to protect American economic interests placed at a potential disadvantage in international markets due to domestic pollution control legislation. Springer, *United States Environmental Policy and International Law: Stockholm Principle 21 Revisited,* in INTERNATIONAL ENVIRONMENTAL DIPLOMACY 49 (J. Carroll ed. 1988).

38. Non-sustainable forestry methods are underpriced because they fail to include environmental externalities in the costs of production. *Cf. supra* note 18 and accompanying text.

39. Hahn & Richards, *The Internationalization of Environmental Regulation,* 30 HARV. INT'L L.J. 421, 429 (1989). The advantages of waiting for others to act is known as the free rider effect. *See* J. BRUNNEE, *supra* note 1, at 54.

40. *See, e.g.*, M. JANIS, *supra* note 6, at 210 (subsidies include any form of import or price support that operates directly or indirectly to increase exports).

41. Laarman, *Export of Tropical Hardwoods,* in WORLD DEFORESTATION IN THE TWENTIETH CENTURY 163 (1988).

42. *See* T. HPAY, THE INTERNATIONAL TROPICAL TIMBER AGREEMENT: ITS PROSPECTS FOR TROPICAL TIMBER TRADE, DEVELOPMENT AND FOREST MANAGEMENT 5 (1985)

nations shift the environmental consequences of timber production to tropical forests.[43] This uneven development of conservation policies between the tropical and temperate forest regions causes an increase in imports of undervalued timber from relatively unprotected, and thereby undervalued, forest areas.[44] Because of the international nature of the problem, forest protection must occur on a global, rather than a national, scale.

II. INTERNATIONAL ENVIRONMENTAL LAW

Because of both the global ramifications of deforestation and the inadequacy of national regulation, states need to use international environmental law to protect forest ecosystems.[45] States generally look to international law for common rules, reciprocal constraints on harmful behavior, or guidelines for achieving international goals.[46] To accomplish these objectives, states develop international legal principles and binding international agreements.[47]

A. International Environmental Legal Principles

International environmental legal principles contained in declarations, charters and resolutions address and define common problems and goals.[48] These principles create standards that guide national law and provide conceptual frameworks for international agreements.[49] International environmental legal principles, comprising a liability model and a sustainable ecosystems model, form the basis for a prospective international forest agreement.

(increasing substitution of tropical timber for end-uses which previously depended almost entirely on temperate timber).

43. Laarman, *supra* note 41, at 160. The availability of imports makes the choice between economic and non-economic forest uses less difficult. Cox, *The North American-Japanese Timber Trade: A Survey of its Social, Economic, and Environmental Impact,* in WORLD DEFORESTATION IN THE TWENTIETH CENTURY 175 (1988). Japan is second only to Finland in its percentage of forested land. *Id.* at 164. Japan, however, imports roughly half of the world's trade volume in tropical hardwoods. Laarman, *supra* note 41, at 160.

44. T. Hpay, *supra* note 42, at 5.

45. International environmental law applies to ecological crises, including those arising beyond the jurisdiction of one state, or those that, although localized, may be common to many states and thus amenable to international cooperation. *See* L. CALDWELL, *supra* note 8, at 12.

46. M. JANIS, *supra* note 6, at 7.

47. *Id.* at 36. When widespread state practices and policies conform to such principles, they become binding as international customary law. *See id.* at 44.

48. Birnie, *The Role of International Law in Solving Certain Environmental Conflicts,* in INTERNATIONAL ENVIRONMENTAL DIPLOMACY 99 (J. Carroll ed. 1988).

49. *Id.* (such instruments have important normative effects); *see also* Hahn & Richards, *supra* note 39, at 437.

1. *The Model of International Environmental Liability: The Stockholm Declaration*

The liability model for international environmental harm represents a significant step in global environmental policy.[50] As expressed in the Stockholm Declaration of the 1972 United Nations Conference on the Human Environment,[51] the liability model recognizes a state's sovereign right to exploit its resources.[52] The model, however, defines a state's duty to prevent activities within its jurisdiction that cause environmental harm beyond its borders.[53] Breach of this duty entitles other states to receive damages for the resulting harm.[54] Although the liability model defines international environmental duties, states maintain the option to perform those duties or pay damages.[55]

2. *The Sustainable Ecosystems Model: The World Conservation Strategy*

The sustainable ecosystems model complements and surpasses the liability model. As expressed in the World Conservation Strategy,[56] the sustainable ecosystems model encourages states to maintain essential ecological processes and life support systems, preserve genetic diversity, and ensure the sustainable utilization of species and ecosystems. In contrast to the liability model, the sustainable ecosystems model articulates affirmative duties of protection, thereby emphasizing environmental conservation over injury compensation.[57]

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50. *See* Gray, *The United Nations Environment Programme: An Assessment*, 20 ENVTL. L. 291, 293 (1990).

51. U.N. Doc. A/CONF. 48/14 (1972) [hereinafter Stockholm Declaration].

52. States have the "sovereign right to exploit their own resources pursuant to their own environmental policies and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other states or of areas beyond the limits of national jurisdiction." Stockholm Declaration, *supra* note 51, Principle 21.

53. *Id.* (Principle 22 mandates that states shall cooperate to further international law regarding liability and compensation for environmental damage).

54. *See* d'Arge & Kneese, *supra* note 28, at 430.

55. G. BINDER, TREATY CONFLICT AND POLITICAL CONTRADICTION: THE DIALECTIC OF DUPLICITY 67 (1988).

56. In 1980, the International Union for the Conservation of Nature and Natural Resources (IUCN), in cooperation with the United Nations Environment Programme, World Wildlife Fund, and United Nations Education, Scientific, and Cultural Organization released the World Conservation Strategy. *See* L. CALDWELL, *supra* note 8, at 271–72, 345 n.13 (quoting IUCN, UNITED NATIONS ENVIRONMENTAL PROGRAM, AND THE WORLD WILDLIFE FEDERATION, WORLD CONSERVATION STRATEGY: LIVING RESOURCE CONSERVATION FOR SUSTAINABLE DEVELOPMENT (1980)).

57. According to the Strategy, inadequate legislation and lack of awareness of the benefits of conservation comprise some of the obstacles to achieving sustainable ecosystems. *See* L. CALDWELL, *supra* note 8, at 272. In 1982, the United Nations General Assembly adopted the World Charter for Nature, affirming the need for sustainable ecosystems. The Charter warned

B. International Environmental Agreements

Unlike international declarations, international agreements create rights and obligations legally binding on states.[58] Based on the mutual assent of the parties,[59] international agreements help create uniform expectations through international rules and harmonize the national laws of different nations.[60]

1. International Agreements Concerning Global Resources Located Within National Borders

Existing international environmental agreements provide an important basis for international forest protection. They protect globally significant natural resources located within national boundaries such as wetlands habitat,[61] sites of world heritage,[62] endangered flora and fauna,[63] and tropical forests.[64] These agreements rely on two distinct policies to protect natural resources: land preservation[65] and trade regulation.[66]

The preservation approach seeks to protect internationally significant resources from encroachment by setting aside natural reserves.[67]

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against international security threats caused by scarce resources and urged that the law of each state incorporate international environmental law. The World Charter for Nature, G.A.Res. 7, 36 U.N. GAOR Supp. (No. 51) at 17, U.N. Doc. A/51 (1982), *cited in* Wood, *The United Nations World Charter for Nature: The Developing Nations' Initiative to Establish Protections for the Environment,* 12 ECOLOGY L.Q. 977, 992 (1985).

58. International agreements include treaties, conventions, protocols and accords. *See* M. JANIS, *supra* note 6, at 9.

59. National representatives, international officials and non-governmental organizations negotiate the contours of an international agreement. The latter include international networks of environmentalists, scientists, and trade groups that play a pivotal role in treaty initiation, compliance, public education and technical assistance. *See* S. FITZGERALD, INTERNATIONAL WILDLIFE TRADE: WHOSE BUSINESS IS IT? 331 (1989). *See generally* L. CALDWELL, *supra* note 8, at 96–100;

60. M. ARSANJANI, INTERNATIONAL REGULATION OF INTERNAL RESOURCES 187 (1981).

61. Convention on Wetlands of International Importance Especially as Waterfowl Habitat, Feb. 2, 1971, —U.S.T.—, T.I.A.S. No. 11084, 996 U.N.T.S. 245 [hereinafter Ramsar]; *see* Comment, *An Analysis of Municipal Wetlands Laws and Their Relationship to the Convention on Wetlands of International Importance Especially as Waterfowl Habitat (Ramsar),* 4 PACE ENVTL. L. REV. 177, 179 (1986).

62. Convention For the Protection of the World Cultural and Natural Heritage, Nov. 16, 1972, 27 U.S.T. 37, T.I.A.S. No. 8226, 1037 U.N.T.S. 151 [hereinafter World Heritage].

63. Convention on the International Trade in Endangered Species of Wild Fauna and Flora, Mar. 3, 1973, 27 U.S.T. 1087, T.I.A.S. No. 8249, 993 U.N.T.S. 243 [hereinafter CITES].

64. *See, e.g.,* T. HPAY, *supra* note 42.

65. Ramsar, *supra* note 61; World Heritage, *supra* note 62.

66. CITES, *supra* note 63; International Tropical Timber Agreement (ITTA), *cited in* T. HPAY, *supra* note 42, at 1–2.

67. Ramsar seeks to protect wetlands, particularly those of international significance as migratory fowl habitat. *See* Comment, *supra* note 61, at 206. World Heritage protects sites of

States designate areas within their territory for inclusion in an international list of protected sites.[68] The agreements then legally obligate each state to protect the listed sites within its territory.[69] To further promote cooperation, the agreements perform consultative or coordinative functions.[70] Thus, the preservation approach relies on state action, augmented by limited international cooperation, to protect particular examples of globally significant resources.

Other international agreements seek to protect global resources through trade regulation.[71] International trade is a substantial factor in the loss of species and ecosystems.[72] To combat this loss, interna-

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outstanding value that comprise part of humanity's common heritage. World Heritage, *supra* note 62, at 153. Of the 47 World Heritage sites, those in the United States include Mammoth Cave, Olympic, Grand Canyon, Redwood, Everglades and Yellowstone National Parks. Edmonds, *The Queensland Rainforest and Wetlands Conflict: Australia's External Affairs Power—Domestic Control and International Conservation,* 20 ENVTL. L. 387, 404 (1990).

68. In Ramsar, states designate wetlands of significance, located within their borders, to the list of special protection. *See* Ramsar, *supra* note 61 (article 2). In World Heritage, states delineate areas within their territory for listing as protected Heritage sites. From these, the World Heritage Committee selects and adds to the World Heritage List. *See* World Heritage, *supra* note 62 (articles 11–13). Heritage criteria include outstanding examples of evolution, superlative natural formations and significant natural habitat for flora and fauna. *See* Edmonds, *supra* note 67, at 404.

69. *See* Comment, *supra* note 61, at 206; *see also* Edmonds, *supra* note 67, at 401–02. Other binding legal duties include gathering and exchanging scientific research. *See* Comment, *supra* note 61, at 206; *see also* Edmonds, *supra* note 67, at 401–02. World Heritage further defines duties to save heritage for future generations and undertake active measures such as comprehensive planning and public services to protect heritage sites. *Id.*

70. In Ramsar, states must consult other states when their activity affects wetlands common to more than one state. *See* Ramsar, *supra* note 61 (article 5). The World Heritage Convention maintains a coordinative body which provides administrative assistance to states. *See* Edmonds, *supra* note 67, at 401.

71. CITES seeks to protect endangered species which are a source of aesthetic benefits, medical products and environmental services to the world. *See generally* Heppes & McFadden, *The Convention on International Trade in Endangered Species of Wild Fauna and Flora: Improving the Prospects for Preserving Our Biological Heritage,* 5 B.U. INT'L L.J. 229 (1987). The International Tropical Timber Agreement (ITTA) seeks to protect the future of the tropical timber trade and, increasingly, conserve forest ecosystems. *See generally* THE FUTURE OF THE TROPICAL RAIN FOREST (M. McDermott ed. 1988). Tropical forests absorb carbon dioxide, stabilize global climate, and contain 80% of the world's species, providing both genetic diversity and products used world-wide in agriculture, medicine and industry. *See, e.g.,* Belson, *Tropical Deforestation and the Response of the United States Congress,* 2 GEO. INT'L ENVTL. L. REV. 111 (1989). Furthermore, tropical forests are home for indigenous peoples whose existence depends on forest preservation. Ling, *The Tropical Forestry Action Plan: People or Profits? A Response from a Non-Governmental Perspective,* in THE FUTURE OF THE TROPICAL RAIN FOREST 33 (M. McDermott ed. 1988). Over half of the world's tropical forests have been destroyed in the last four decades. Belson, *supra,* at 111.

72. *See* Heppes & McFadden, *supra* note 71, at 229; *see also* Glennon, *Has International Law Failed the Elephant?,* 84 AM. J. INT'L L. 1, 3 (1990) (illegal killing of elephants for their ivory reduced the African elephant population from 1.5 million to fewer than one-half million in the last decade).

tional agreements restrict trade in endangered species and their products.[73] For example, the International Tropical Timber Agreement, through consultation and cooperation between importers and exporters, seeks to improve market information and thus discourage overharvesting and deforestation.[74]

Participation in trade regulation agreements is substantial.[75] Furthermore, the agreements recognize ongoing interests of both importer and exporter states in decisions affecting international resources.[76] Unlike the preservation approach, however, the trade regulation approach seeks to protect global resources by regulating the trade products of endangered species and habitat, and not the species and habitat directly.[77]

III. ANALYSIS OF EXISTING INTERNATIONAL ENVIRONMENTAL LAW

Existing international environmental law provides a necessary but insufficient foundation for international forest regulation.[78] The liability and sustainable ecosystem models are inadequate legal principles for international forest protection because they fail to combine preservation duties with support duties. Likewise, existing conventions provide some of the legal bases for a forest agreement but lack the necessary scope, legal obligations and valuation methods necessary for

73. *See, e.g.*, Kosloff & Trexler, *The Convention on International Trade in Endangered Species: Enforcement Theory and Practice in the United States*, 5 B.U. INT'L L.J. 328 (1987) (CITES "sets as its goal the prevention of the endangerment or extinction of species that could result from international trade in those species and their products").

74. *See* T. HPAY, *supra* note 42, at 5 (market intelligence could rationalize both the tropical timber market and relations between the world's temperate and tropical timber markets).

75. CITES represents 103 states. Burns, *CITES and the Regulation of International Trade in Endangered Species of Flora: A Critical Appraisal*, 8 DICK. J. INT'L L. 203, 204 (1990). The ITTA represents states that comprise 70.6% of global population, 82.7% of the world gross domestic product of tropical timber, and over 95% of tropical timber imports. *See* T. HPAY, *supra* note 42, at 1. Major importers include temperate timber producers such as Germany, Finland, Norway, Sweden, the Soviet Union, Canada and the United States. *Id.* at 18.

76. *See* Bilder, *International Law and Natural Resources Policies*, 20 NAT. RESOURCES J. 451, 471 (1980).

77. *See* Heppes & McFadden, *supra* note 71, at 230 (the gravest danger to wildlife species is loss of habitat). The ITTA, on the other hand, increasingly emphasizes conservation and sustainable timber. The Tropical Forest Action Plan seeks to integrate forestry with other land uses, develop forest-based local economies, and conserve tropical forest ecosystems. Ljungman, *The Tropical Forestry Action Plan*, in THE FUTURE OF THE TROPICAL RAIN FOREST 20–21 (M. McDermott ed. 1988).

78. *See* L. CALDWELL, *supra* note 8, at 280 (the Stockholm Declaration, World Conservation Strategy and World Charter comprise "an international constitution for the world environment"). Furthermore, to the extent such instruments guide national conduct, they become binding as international customary law. *Id.*

effective international forest regulation. Nonetheless, these principles and agreements provide points of departure for new international instruments that would effectively protect the world's forests.

A. Analysis of International Environmental Legal Principles

1. The Liability and Compensation Model of International Environmental Harm: The Stockholm Declaration

Although the liability model, as expressed in the Stockholm Declaration, defines state duties to prevent environmental harm, it ultimately fails to resolve international environmental crises such as deforestation. The liability model constitutes an important first step in international environmental law. The model provides constraints on the sovereign right to use natural resources destructively,[79] and provides a mechanism to compensate for the harmful effects of breached environmental duties.[80] Nonetheless, the liability model fails to protect forests because of ill-defined responsibilities, the inadequacy of damages, problems with apportionment, and narrowness of scope.

First, the liability model fails to provide clear guidelines for state responsibility.[81] Without a consensus about the nature of preventive duties, emphasis focuses on after-the-fact damages.[82] Second, damages fail to adequately compensate environmental harm that is unique, lasting or non-restorable.[83] Even when damages could make an environmental injury whole, replacement costs may be so large that they discourage compensation.[84] Third, the liability model faces difficulties apportioning liability and damages for many environmental crises.[85] Disincentives for compensation and uncertainties about apportionment increasingly create conflicts and undermine international order.[86] Fourth, the protection of forests and other global resources involve issues other than harm and liability, such as the positive bene-

79. *See* M. ARSANJANI, *supra* note 60, at 70 (increasing demands made upon limited resources have begun to restrict the sovereignty of states with regard to resources located within their territorial boundaries).

80. *See* d'Arge & Kneese, *supra* note 28, at 429.

81. *Id.* at 430–31.

82. Brunnee, for example, distinguishes between longer-term, preventive policies and reactive, curative measures. J. BRUNNEE, *supra* note 1, at 165.

83. *See* M. ARSANJANI, *supra* note 60, at 411.

84. *See supra* notes 31–32 and accompanying text.

85. For example, deforestation contributes to global warming and environmental harm but the liability model fails to provide a mechanism to allocate relative shares of either liability or damages. *See, e.g.,* d'Arge & Kneese, *supra* note 28, at 431.

86. *See, e.g.,* Fairclough, *Global Environmental and Natural Resource Problems—Their Economic, Political, and Security Implications,* 14 WASH. Q. 81, 86 (1991) (global environmental crises have increasingly strategic implications on a par with military and political crises).

fits of environmental services, genetic diversity and common heritage.[87] Accordingly, the liability model, by itself, is inadequate to internationally regulate forests and other global resources.

2. *Sustainable Ecosystems Model*

Unlike the liability model, the sustainable ecosystems model articulates guidelines for preventing environmental harm.[88] By focusing on the international cooperation necessary to maintain essential ecological processes, this model emphasizes the benefits of conservation rather than injury compensation.[89] Thus, the model suggests common ground on which states could affirmatively cooperate to develop sustainable ecosystems.

The sustainable ecosystem model, however, fails to articulate the rights and duties of states concerning globally important ecosystems located within national borders. The model provides that states should preserve ecosystems, but it fails to address the support obligations of other states.[90] Thus, the model is inadequate because it fails to define the affirmative duties of all states with interests in forest regulation.

3. *Alternative Model—Duties of States to Protect Global Resources*

Modifying and combining aspects of the liability and sustainable ecosystem models would enhance the effectiveness of international environmental regulation. This alternative model would define the legal duty of states to protect global resources, such as forest ecosystems, that are located within their borders. This model would also recognize the correlative right of other states to the preservation of global resources.[91]

The duty to protect global resources creates mutual restrictions on national sovereignty analogous to international servitudes.[92] Because

87. *See, e.g.*, Glennon, *supra* note 72, at 29 (quoting Caron, *The Law of the Environment: A Symbolic Step of Modest Value*, 14 YALE J. INT'L L. 528, 529 (1989)) ("[T]he notion of legitimate interest seems to extend far beyond traditional notions of harm [to one of] preventing the loss of species, the destruction of cultural heritage, and the waste of natural resources.").

88. *See supra* notes 56–57 and accompanying text.

89. *Id.*

90. *See* Glennon, *supra* note 72, at 35 (support obligations refer to the duties of other states to contribute).

91. Because global warming affects everyone, all nations have an interest in preserving forests in order to mitigate the green-house effect. *See, e.g.*, Glennon, *supra* note 72, at 34–35 (nations have an environmental right to expect that a global resource within another nation's borders will be protected).

92. M. ARSANJANI, *supra* note 60, at 122 (a negative servitude exists where a nation limits its rights to use resources located within its territory for the benefit of other nations).

these servitudes confer substantial value on states that benefit from the protection of global resources, those states should share in the conservation costs.[93] Consequently, state obligations to protect global resources within national borders should extend to outsider states as well.[94] Thus, the actual distribution of benefits from global resources such as forests would determine the equitable allocation of preservation costs.[95]

In practice, this alternative legal model would combine the duty of states to conserve global resources within their borders with the mutual responsibility of other states to share the preservation costs of global resources. By using equitable considerations of costs and benefits to allocate legal rights and obligations, this principle would create economic incentives for states with interests in forests to restrict their sovereignty, share conservation costs, and effectively protect forest ecosystems.[96]

B. Analysis of International Agreements

The effectiveness of an international environmental agreement improves substantially with the existence of previous related conventions.[97] Nonetheless, previous agreements provide, at best, limited protection for international resources. Basic legal problems that affect these instruments will likely confront an international forest agreement. They include regulation of global resources located within national borders, state responsibility for global resources, methods of valuation and standards of fairness.

1. International Regulation of Global Resources Within National Boundaries

Although existing agreements create affirmative legal duties to conserve globally significant resources,[98] inadequacies concerning the

93. *See* Glennon, *supra* note 72, at 34–35 (all nations have a duty to share in preserving global environmental resources: nations with the resource have a "custodial obligation" and others have "support obligations").

94. *Id.* at 34.

95. For example, the United States owes a duty to Japan to preserve American forests because they are global resources that provide environmental services, biodiversity, and other values. Japan, because it benefits from American forest values, owes a duty to reimburse the United States for some of the costs of forest preservation. Likewise, the United States owes support to Brazil and other tropical forest nations whose forests confer substantial benefits on the United States.

96. Valuation techniques should assess the scope and magnitude of both the benefits and the costs of ecosystem preservation. *Cf. supra* notes 24–33 and accompanying text.

97. *See* Hahn & Richards, *supra* note 39, at 433–34.

98. *See supra* note 68.

scope of participation and the nature of the protected resource limit the effectiveness of these legal instruments. First, the degree of international participation must be adequate to accomplish the goals of the agreement. When the subject matter of a convention involves globally significant resources, participation must be generally inclusive.[99] For example, representing all the major tropical timber importers and exporters, the International Tropical Timber Agreement recognizes that interests in tropical forests extend beyond tropical states.[100] Conversely, the absence of major powers from a global resources agreement undermines its effectiveness.[101] Because some states benefit from the protection of global resources and others might gain a competitive advantage from failing to conserve, widespread participation is necessary to prevent the free rider effect.[102]

Second, the limited regulatory scope of current agreements undermines their effectiveness. Although habitat loss presents the gravest danger to flora and fauna,[103] the trade regulation approach regulates trade products, not the underlying flora and fauna.[104] States generally favor trade regulation because it puts fewer constraints on their sovereign control over national resources.[105] Restricting protection of global resources to regulation of their trade products, however, proves ineffective because it fails to articulate affirmative state duties for protecting ecosystems.[106]

99. *Cf.* M. ARSANJANI, *supra* note 60, at 39 ("The overriding policy is to permit and encourage participation by all who can affect or be affected by the making of such decisions.").

100. *See* T. HPAY, *supra* note 42, at 2 (tropical timber requires a global resource management perspective); *see also* Bilder, *supra* note 76, at 471 ("[I]nternational commodity organizations expressly recognize that both consumers and producers have interests in particular resources and should share certain kinds of decisions.").

101. The absence of the Soviet Union and Japan from membership in the World Heritage Convention, for example, narrows the scope and concept of world heritage protection. *But see* Edmonds, *supra* note 67, at 402–03 n.77 (that only the Soviet Union, Belgium, Holland, and Japan remain nonmembers indicates the Convention's breadth).

102. Hahn & Richards, *supra* note 39, at 429 (one nation benefiting from environmental protection while refusing to take such action on its own).

103. *See* Heppes & McFadden, *supra* note 71, at 230.

104. *See supra* note 77 and accompanying text.

105. Kosloff & Trexler, *supra* note 73, at 337.

106. The ineffectiveness of ITTA has forced it to modify the trade regulation approach and take measures to sustain tropical forest ecosystems. *See* Ljungman, *supra* note 77, at 20–21 (the Tropical Forest Action Plan includes conservation of forest ecosystems). On the other hand, trade regulation can provide effective protection to species when illegal trafficking, not habitat loss, endangers the species. *See generally* Glennon, *supra* note 72.

2. *The Scope of State Duties to Protect Global Resources Within National Borders*

Even when international agreements specify affirmative state duties to protect species and habitat,[107] they define the scope of those duties too narrowly to be effective. Because current agreements protect particular sites rather than classes of habitat or ecosystems, conservation is limited.[108] Substantial conservation of habitat requires setting aside national territory in ways that infringe on powerful economic or political interests.[109] When states underestimate environmental threats from the loss of natural resources and economic benefits from preservation, they lack countervailing incentives to preserve wider areas of habitat.

The lack of a duty to implement national legislation also reflects the narrow scope of state obligations under previous agreements.[110] Failure to prescribe legislative requirements limits the availability of effective state regulatory mechanisms for the protection of global resources.[111] Absent international coordination, states are less likely to commit themselves to a comprehensive conservation policy.[112]

3. *Standards of Fairness*

Inadequate or biased standards for apportioning rights and duties[113] produce ineffective global agreements.[114] In order to induce widespread participation, a global resources agreement must designate

107. *See supra* notes 67–70 and accompanying text (discussion of the land preservation approach).

108. *See* Comment, *supra* note 61, at 217 (not all wetlands can be saved by the protected areas approach). This approach can be effective where the site itself, such as the Grand Canyon, comprises the global resource. *See* World Heritage, *supra* note 62.

109. *See* Kosloff & Trexler, *supra* note 105, at 337.

110. Ramsar provides no guidelines for the implementation of national legislation for wetlands protection. *See* Comment, *supra* note 61, at 216. Although the World Heritage Convention requires states to adopt a general policy and to integrate protection of heritage into comprehensive planning programs, its terms are general and merely aspirational. *See supra* note 62.

111. *See* Comment, *supra* note 61, at 216 (Ramsar should complement the protected areas approach with consistent national land-use guidelines to promote the wise use of wetlands).

112. *See supra* notes 34–40 and accompanying text.

113. Standards of fairness refer to the principles by which an agreement apportions costs of regulation. *See* J. BRUNNEE, *supra* note 1, at 64. For a discussion of different standards, see Fairclough, *supra* note 86, at 92 (duties based on greatest wealth or responsibility for harm); *see also* Bilder, *supra* note 76, at 467 (duties based on equality or need); d'Arge & Kneese, *supra* note 28, at 428 (duties based on polluter pays or victim pays principles).

114. In one inspection of six Latin American ITTA members, five nations had no operational management policies for sustainable yield. McCarter, *Session Four Discussion,* in THE FUTURE OF THE TROPICAL RAIN FOREST 84 (1988) (remarks of Tim Synnot, Oxford Forest Inst.). ITTA's ineffectiveness is due, in part, to conflicts between tropical timber and industrialized

state duties according to standards of fairness.[115] Large regulatory costs make perceptions that the agreement is fair especially important.[116] The uneven distribution of environmental costs and benefits, however, undermines perceptions of fairness.[117] Moreover, each state or region tends to urge a standard of fairness consistent with its own interests.[118] Thus, effective international cooperation requires standards of fairness,[119] but conflicting interests undermine such standards.

4. Economic Valuation of Natural Resources

Existing international agreements undervalue natural resources, thereby limiting their effectiveness.[120] For example, one convention narrowly focuses on waterfowl and fails to recognize other environmental values, such as flood control and fisheries, which would induce broader wetland protection.[121] This inability to assess the full spectrum and magnitude of ecosystem values obscures the immediate economic benefits of resource protection. Proper valuation, however, would define the immediacy of a crisis, such as global deforestation, in economic, as well as ecological, terms. Instead of viewing the cost of environmental protection as economically prohibitive, valuation methods would reveal that failure to protect resources is economically disastrous.[122]

Because international environmental law is a relatively new and dynamic area, distinctions between successful or insufficient agreements are difficult to assess. On the one hand, many existing international environmental agreements contain weak enforcement

states about the allocation of the costs and benefits of forest conservation. *See* Belson, *supra* note 71, at 157–58.

115. *See* Hahn & Richards, *supra* note 39, at 435.

116. *Id.*

117. *Id.* Protection of resources not only confers global benefits unevenly but also may confer benefits on states other than those that bear the costs of conservation. For example, ITTA tropical timber states maintain that they bear the costs of conservation and restrictions on development while industrialized states enjoy the benefits of climate stabilization and other tropical forest amenities. *See also* Belson, *supra* note 71, at 157–58.

118. *See* Bilder, *supra* note 76, at 467.

119. *Supra* note 114 and accompanying text; *see also* Bilder, *supra* note 76, at 485 (agreements are effective only if the parties see them as fair).

120. *See* Comment, *supra* note 61, at 217 (narrow focus on waterfowl habitat excluding other wetland values).

121. *Id.* at 215.

122. Ramsar and CITES, like many international instruments, suffer from a lack of funding that limits their effectiveness. *See* Burns, *supra* note 75, at 219–20 (CITES' custom inspection system is plagued by personnel shortages and lack of training due to a meager budget); *see also* Comment, *supra* note 61, at 215–16 (lack of funding causes problems in monitoring wetlands).

mechanisms that threaten to make them mere tools of public rhetoric.[123] Even weak agreements, however, direct international attention to the issue, bring pressure for compliance, and lay the foudation for future agreements.[124]

IV. PROPOSALS FOR ELEMENTS OF AN INTERNATIONAL FOREST AGREEMENT

In order to overcome the ineffectiveness of prior agreements, an international forest agreement must create new legal approaches to international environmental problems. Although by no means comprehensive, the proposals below suggest constitutive elements of an international forest agreement that should facilitate its effectiveness.[125] These proposals leave to governments and international or non-governmental organizations[126] the task of defining the precise institutional form of an international forest agreement.[127] Regardless of the particular form, however, a forest agreement should comprise certain components necessary to promote the effective international protection of forests.

123. Hahn & Richards, *supra* note 39, at 437 (states may "reap the public image benefits of signature without bearing the cost of implementation").

124. *Id.* at 438.

125. For example, funding, though not discussed here, should be commensurate with the value of forest protection. Implementation costs for tropical forest preservation may be in the tens of billions. Fairclough, *supra* note 86, at 95. Ideas for revenue sources include a carbon tax proportional to carbon dioxide emissions and a trading system of pollution and conservation credits. *See* National Audubon Society, *supra* note 12; *see also* J. BRUNNEE, *supra* note 1, at 64. Likewise, monitoring of forests should assess threats to ecosystems and the efficacy of international regulation. Monitoring should include shared international databases and satellite mapping of the world's forests. *See, e.g.,* International Union for the Conservation of Nature (IUCN) Proposed Global Forest Protocol 4 (on file with the *Washington Law Review*); President Bush Proposal for Global Forestry Convention, 26 WEEKLY COMP. PRES. DOC. 1084 (July 16, 1990) [hereinafter Bush Proposal]. *See generally* INVENTORYING AND MONITORING ENDANGERED FORESTS (P. Schmid-Haas ed. 1985).

126. Bush Proposal, *supra* note 125, at 2 (a forest convention could address threats to the world's forests and could lead to positive action). The United Nations Food and Agriculture Organization supports negotiation of a forest convention by 1992. *See* Preparatory Committee Draft, United Nations Conference on Environment and Development 24 (Aug. 1990) (report of Elizabeth May, Canadian delegate). For proposals by the National Audubon Society and IUCN, see *supra* notes 12, 125.

127. The fundamental difference among other proposals is whether the forest agreement should be a protocol of a climate or biodiversity convention. *See, e.g.,* National Audubon Society, *supra* note 12. *But see* Bush Proposal, *supra* note 125 (indicating preference for separate convention).

A. *Global Significance of Forests*

By defining forests as global resources, an international agreement would correctly draw attention both to the global nature of the crisis and the necessary scope of the legal solution.[128] An international forest agreement should include all who benefit from forests.[129] Furthermore, a global agreement should act as a trustee for future generations' interests in contemporary forest preservation.[130]

The agreement should recognize that preservation of forest ecosystems is necessary for sustainable forests and the continuation of benefits from forest values and uses.[131] Accordingly, the forest agreement should set target dates for halting deforestation of natural tropical and temperate forests.[132] Furthermore, an agreement should increase global forest area through afforestation that complements, rather than converts, forest ecosystems.[133]

The agreement should establish an international administrative structure to implement the forest agreement.[134] Although some regulation will be global, the international forest agreement should also facilitate forest regulation at the regional, national and ecosystem levels.[135]

B. *State Responsibility for Forest Ecosystems*

An international forest agreement should obligate states to protect forests located within their borders and require other states that bene-

128. *See supra* notes 99–106 and accompanying text.

129. The agreement should include representation of indigenous groups in protection strategies. National Audubon Society, *supra* note 12. The agreement should also include island and coastal nations that face the threat of rising seas caused by global warming. *See, e.g.*, May, *supra* note 126, at 3 (global climate change threatens to increase sea level and destroy Pacific Island nations).

130. *See supra* note 30.

131. Benefits include the mitigation of global warming, protection of watersheds, supply of wood products, genetic diversity, indigenous homelands, recreation, scientific research, and common heritage. *See, e.g.*, National Audubon Society, *supra* note 12 (forests provide ecological and social benefits such as reduced soil erosion, protection of watersheds and coastal ecosystems, and sequestration of carbon dioxide).

132. *Id.* (advocating an end to deforestation of primary forests by 2010 with an interim target of 50% reduction by 2000, but sooner in nations with less than 15% of original natural forests).

133. *Id.*; *cf.* Bush Proposal, *supra* note 125 (committing to reforestation through planting one billion trees per year in the United States but failing to affirm the protection of forest ecosystems).

134. National Audubon Society, *supra* note 12 (create national planning process, establish funding mechanisms, create an independent source of scientific information, and plan for monitoring and enforcement).

135. *Cf.* M. ARSANJANI, *supra* note 60, at 426–27 (global approach may require bilateral and regional implementation).

fit from forest protection to share conservation costs equitably. In order to help enforce these binding legal duties and establish globally uniform forest policies, the agreement should require states to adopt national legislation consistent with the agreement. This will harmonize the different national forest policies, limit economic incentives that contribute to deforestation,[136] and provide a national dimension to enforcement.[137] Harmonized national laws should encourage globally consistent timber policies and mandate new forestry practices conducive to sustainable ecosystems. The forest agreement should promote uniform timber pricing policies that include externalities in the costs of production, and thereby prevent deforestation from becoming a short-term trade advantage.[138] Furthermore, legislation should carry out state obligations to support other states' forest conservation by mandating grants, technology and research transfers and other economic support.

C. *Standards of Fairness*

Standards of fairness should correspond to the twofold legal duty of forest protection: states must protect forests within their borders, and other states that benefit from forest preservation must share in the support costs.[139] By applying fairness to both costs and benefits, no state or region would bear an unfair burden: states would equitably share both preservation costs and the benefits of forest protection. The forest agreement should modify this basic twofold principle of cost-allocation with additional criteria, such as responsibility for airborne pollution, ability to pay,[140] and rates of deforestation.[141] States should explicitly negotiate and define such standards to avoid the ambiguities and uncertainties otherwise likely to occur in an agreement involving both diverse membership and large costs.[142]

D. *Valuation of Forest Ecosystems*

The forest convention should use valuation techniques to measure and compare all forest values and uses in order to include them in

136. *See* IUCN, *supra* note 125, at 4 (eliminate subsidies that contribute to deforestation).

137. *See* L. CALDWELL *supra* note 8, at 272 (according to the World Conservation Strategy, obstacles to conservation include inadequate legislation and enforcement).

138. *See supra* notes 37–38 and accompanying text.

139. *See supra* note 95 and accompanying text.

140. *See* Bilder, *supra* note 76, at 468 (rich nations should economically assist needy nations).

141. *See* Fairclough, *supra* note 86, at 92 (using an equitable basis of sharing costs that corresponds to responsibility for the problem).

142. *Id.* at 95 (implementation of the Tropical Forest Action Plan alone may cost tens of billions of dollars).

decision-making processes.[143] The convention should quantify forest values in order to assess the economic value of non-market forest qualities, and recognize the immediate economic benefits of forest protection on both the national and international levels.[144] Valuation will thus enable policy makers to weigh and prioritize forest values in accord with ecological needs and changing preferences. An international forest convention should use valuation methods to develop a global inventory of forest ecosystems in order to weigh priorities for preservation, biodiversity, indigenous homelands, environmental services, timber production, and other values. Accordingly, valuation of ecosystems should move beyond damage assessment and lay the basis for a global forest accounting system.[145]

V. CONCLUSION

The destruction of temperate and tropical forest ecosystems severely affects global environmental and economic processes. An international agreement is necessary to protect the world's forests. Previous agreements designed to protect global resources located within national borders have proven to be of limited effectiveness. States perceive conflicts between economic interests and conservation and fail to undertake measures that they believe are incompatible with national sovereignty. Thus, these agreements fail to provide adequate models on which to base an international forest agreement.

Because forests are global resources, an international forest agreement should represent and include the global community of states. A twofold principle should guide the agreement: first, states have a legal duty to protect forests located within their territory; and, second, states that benefit from forests have a legal duty to share in the costs of conservation. An international forest agreement should use valuation

143. Acceptance of valuation techniques should continue to increase following Ohio v. United States Dep't of the Interior, 880 F.2d 432 (D.C. Cir. 1989).

144. Benefits include biodiversity, ecosystem services, recreation, and existence or preservation values. *See supra* notes 18–26 and accompanying text. By assessing the economic value of ecosystem services and values, valuation would make the argument for forest preservation even more compelling. *See* National Audubon Society, *supra* note 12.

145. Based on compiled forest information and valuation techniques, the convention should develop an inventory of forests organized by ecosystem, endangered species, timber production, forest uses and other indicia. Global accounting of forests would enable the convention to evaluate the ecological and economic efficiency of international regulation as well as assess threats to forests. An inventory would help determine national and global requirements for carbon dioxide absorption, wood, wildlife habitat and other forest values. *See* IUCN, *supra* note 125, at 3 (an inventory could be a key element in negotiating obligations and targets); *cf.* Bush Proposal, *supra* note 125 (viewing an inventory as a tool for analyzing new forest products and uses).

techniques to assess the economic value of forest ecosystems. Valuation would thereby ensure that states recognize forest preservation as both ecologically essential and economically compelling. Moreover, valuation methods would enable states to calculate the costs and benefits of forest protection and apportion them equitably among states. Thus, although an international forest agreement will initially deter global deforestation, it will also constitute a starting point for joint international preservation and management of global forest ecosystems.

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