THE DIRT ON INTERNATIONAL ENVIRONMENTAL LAW REGARDING SOILS: IS THE EXISTING REGIME ADEQUATE?

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How can I stand on the ground every day and not feel its power?
How can I live my life stepping on this stuff and not wonder at it?
- William Bryant Logan, Dirt: The Ecstatic Skin of the Earth[1]

I. INTRODUCTION

Soil, "the living skin of Earth"[2] and a foundation for all terrestrial life, does not tend to get the respect or attention it deserves. Rich soil is glorious stuff, packed with life and recycled lives past; it is the complex interface between rock and sky, the "critical zone"[3] of our planet where nature's dynamic systems are regulated and renewed. Yet the world's soil is being stripped, poisoned, suffocated, and abused more than ever before—even though humans need quality soil more than ever before, too. Population pressures, economic pressures, and global and local changes now drive massive soil transformation and degradation.[4] Soil can take centuries to re-form once lost or degraded,[5] meaning that

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1. WILLIAM BRYANT LOGAN, DIRT: THE ECSTATIC SKIN OF THE EARTH 2 (2007).

2. Dan H. Yaalon, *Human-Induced Ecosystem and Landscape Processes Always Involve Soil Change*, 57 BIOSCIENCE 918, 918 (2007); *see also* INT'L UNION OF SOIL SCIS., SOIL—THE LIVING SKIN OF PLANET EARTH (2008), *available at* http://www.iuss.org/Soil%20Flyer%20IYPE%202008/Soil%20Flyer%202008%20-%20English.pdf.

3. Yaalon, *supra* note 2, at 918 (citing COMM. ON BASIC RESEARCH OPPORTUNITIES IN THE EARTH SCIS., NAT'L RESEARCH COUNCIL, BASIC RESEARCH OPPORTUNITIES IN EARTH SCIENCE (2001), *available at* http://www.nap.edu/catalog.php?record_id=9981).

4. *See infra* part II.

5. *See* DAVID R. MONTGOMERY, DIRT: THE EROSION OF CIVILIZATIONS 10–11 (2007); ROBERT E. WHITE, PRINCIPLES AND PRACTICE OF SOIL SCIENCE: THE SOIL AS A NATURAL RESOURCE 98 (6th ed. 2006).

many soil changes today are largely irreversible on human time-scales. The impacts of soil problems are felt not only locally, but also globally: food and water insecurity, biodiversity loss, climate change, and the economic, political, and humanitarian consequences of all of these and more.[6]

Many international environmental law instruments, both global and regional, binding and non-binding, touch on the protection of soil and its functions to some degree.[7] These instruments have the potential to accomplish much, especially with fuller implementation than at present. However, soil would be better protected if it could be addressed more comprehensively, with its functions not only better singled out for recognition, but also more fully tied together, highlighting soil law and policy as a focal topic unto itself.

The broad topic of international soil law and policy has begun to receive significant attention, if only recently. In particular, the International Union of Soil Sciences (IUSS)[8] and the International Union for Conservation of Nature (IUCN), or World Conservation Union,[9] have taken the lead in proposing concrete international actions to protect and sustain soil resources for future generations. These proposals have been favored with discussion at international

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6. *See infra* part II.

7. *See infra* part III.

8. *See* WORKING GROUP ON INT'L ACTIONS FOR THE SUSTAINABLE USE OF SOILS (IASUS) OF THE INT'L UNION OF SOIL SCIENCES (IUSS), A WORLD SOILS AGENDA: DISCUSSING INTERNATIONAL ACTIONS FOR THE SUSTAINABLE USE OF SOILS (Hans Hurni & Konrad Meyer eds., 2002), *available at* http://www.north-south.unibe.ch/content.php/publication/id/1707 [hereinafter IASUS, WORLD SOILS AGENDA]; *see also* WORKING GROUP ON IASUS, SOILS ON THE GLOBAL AGENDA: DEVELOPING INTERNATIONAL MECHANISMS FOR SUSTAINABLE LAND MANAGEMENT (Hans Hurni et al. eds., 2006), *available at* http://www.north-south.unibe.ch/content.php/publication/id/1948 [hereinafter IASUS, SOILS ON THE GLOBAL AGENDA].

9. *See* IAN HANNAM & BEN BOER, INT'L UNION FOR CONSERVATION OF NATURE, LEGAL AND INSTITUTIONAL FRAMEWORKS FOR SUSTAINABLE SOILS: A PRELIMINARY REPORT (2002), *available at* http://data.iucn.org/dbtw-wpd/edocs/EPLP-045.pdf [hereinafter HANNAM & BOER, LEGAL FRAMEWORKS]; *see also* IAN HANNAM & BEN BOER, INT'L UNION FOR CONSERVATION OF NATURE, DRAFTING LEGISLATION FOR SUSTAINABLE SOILS: A GUIDE (2004), *available at* http://www.iucn.org/dbtw-wpd/edocs/EPLP-052.pdf [hereinafter HANNAM & BOER, DRAFTING LEGISLATION].

> IUCN is the world's oldest and largest global environmental network—a democratic membership union with more than 1,000 government and NGO member organizations, and almost 11,000 volunteer scientists in more than 160 countries. IUCN's work is supported by over 1,000 professional staff in 60 offices and hundreds of partners in public, NGO and private sectors around the world.

IUCN, About IUCN, http://cms.iucn.org/about/index.cfm (last visited Dec. 2, 2008).

soil science meetings and at United Nations bodies, but not as much within American legal publications.[10]

This note begins by providing some essential background on the nature of soil, followed by a description of the current state of the world's soil and its ability to fulfill its diverse, interwoven, and deeply vital functions. This foundation shows that soil protection is a matter of urgent global concern, worthy of international legal attention. A broad overview of various binding, non-binding, and regional international environmental law instruments regarding soil follows. This note then analyzes the gaps and deficiencies in this current mix of legal regimes, and how they lead to under-protection of global soil functions. These deficiencies have led entities like the IUSS, IUCN, and others to call for a more comprehensive approach. Finally, this note evaluates some of the factors promoting or hindering the prospects for meaningful changes in the legal position, and the practical circumstances, of global soil.

II. THE GLOBAL FUNCTIONS OF SOIL

A. What Is Soil?

Many people tend to see soil as mere dirt, a single category of stuff that is generally avoided and scraped off of shoes; in fact, this perception partly underlies the low profile of soil in current U.S. and international legal discussion.[11] Yet soil is truly an incredibly complex, diverse, living, changing, and most of all, valuable entity. Soil is somewhat difficult to define,[12] but one useful definition is:

> The natural dynamic system of unconsolidated mineral and organic material at the earth's surface . . . . Soil materials include organic matter, clay, silt, sand and gravel mixed in such a way as to provide the natural medium for the growth of land plants. Soil comprises organised profiles of layers more or less parallel to the earth's

10. The main exception as of the writing of this note comes from an IUCN-affiliated colloquium, and largely focuses on the IUCN proposal's template for analyzing national soil laws as it highlights enforcement failures in United States domestic soil programs. *See, e.g.*, J. William Futrell, *The IUCN Sustainable Soil Project and Enforcement Failures*, 24 PACE ENVTL. L. REV. 99 (2007) (from the Fourth IUCN Academy of Environmental Law Worldwide Colloquium, on Implementing Environmental Legislation).

11. *See, e.g.*, HANNAM & BOER, LEGAL FRAMEWORKS, *supra* note 9, at 9.

12. *See* WHITE, *supra* note 5, at 4 ("There is little merit in attempting to give a rigorous definition of soil because of the complexity of its make-up, and of the physical, chemical and biological forces that act on it.").

> surface and formed by the interaction of parent material, climate, organisms and topography over generally long periods of time.[13]

Any soil can be divided into its inorganic solid (e.g., rock), organic solid (e.g., decomposed material), liquid, gaseous, and living parts, or "phases."[14] It is also sorted into horizons, which at their most basic include the O (organic top layer), A (surface mineral-organic mix or topsoil), B (subsoil), and C (weathered rock) horizons, with the bedrock below.[15]

Formation of soil is slow and complex. An inch of soil can take centuries or even millennia to form, depending on the location and conditions.[16] Plants, animals, bacteria, and fungi accelerate the weathering of rock and add organic matter, such that over the history of the planet, "life and soils symbiotically grew and diversified."[17] These processes are ongoing but variable: soil is a dynamic, open system, being affected continually by energy and material inputs, transformations, and removals.[18] If soil is produced faster than it erodes or degrades, then soil builds up, though not indefinitely.[19] If, however, soil erodes faster than it can be made, then it effectively becomes a scarce and non-renewable resource.[20]

The diversity of soils is staggering, as is "[t]he possible number of pedogenic [soil-forming] events and combinations and interactions among them."[21] Modern U.S. soil taxonomists recognize twelve orders, sixty-four suborders, over three hundred "great groups," and

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13. HANNAM & BOER, LEGAL FRAMEWORKS, *supra* note 9, at 9–10 (quoting P.D. HOUGHTON & P.E.V. CHARMAN, SOIL CONSERVATION SERV. OF NEW S. WALES & STANDING COMM. ON SOIL CONSERVATION, GLOSSARY OF TERMS USED IN SOIL CONSERVATION 115 (1986)). In addition to the five traditional soil-formation factors of parent material, climate, organisms, topography, and time, some pedologists, or soil scientists, advocate for the addition of a sixth: humanity. *E.g.*, Daniel deB. Richter, Jr., *Humanity's Transformation of Earth's Soil: Pedology's New Frontier*, 172 SOIL SCI. 957, 961–62 (2007).

14. *See generally* SOILS: BASIC CONCEPTS AND FUTURE CHALLENGES 23–101 (Giacomo Certini & Riccardo Scalenghe eds., 2006) [hereinafter SOILS: BASIC CONCEPTS].

15. MONTGOMERY, *supra* note 5, at 21–22; *see also* Stanley W. Buol, *Pedogenic Processes and Pathways of Horizon Differentiation*, *in* SOILS: BASIC CONCEPTS, *supra* note 14, at 11–19; WHITE, *supra* note 5, at 176–79.

16. *See* MONTGOMERY, *supra* note 5; WHITE, *supra* note 5.

17. MONTGOMERY, *supra* note 5, at 16.

18. *See* Buol, *supra* note 15, at 11–12.

19. MONTGOMERY, *supra* note 5, at 13 (noting that "a thicker soil protects the underlying rocks[,]" thereby introducing a negative feedback mechanism in the rate of soil formation).

20. *See* Jessica Marshall, *Artificial Soil: Quick and Dirty*, NEW SCIENTIST, Aug. 11–Aug. 17, 2007, at 33, 33–35. Speeding up soil creation to make artificial soils is expensive and problematic, and not likely to solve our global-scale soil problems in the foreseeable future. *Id.*

21. Buol, *supra* note 15, at 11.

on through subgroups, families, and over nineteen thousand "soil series."[22] This mind-boggling dirt diversity, distinguishing the many kinds of minerals, components, structures, hydrology, and other properties, can be important in optimizing uses, to the extent that users are actually made aware of their soil types.[23] "Soil" is generally referred to as a singular, categorical entity, but it can be illuminating to recognize its heterogeneity through use of the plural "soils" as well; this note uses the words more or less interchangeably.

B. What Does Soil Do?

Soil's diverse and essential functions, and the current threats facing those functions, provide the framework in this note for analyzing the adequacy of the international legal regime regarding soils in several ways. First, the functions of soil *justify* performing the analysis at all. With the notable exceptions of transboundary air and water transport of soil, soil itself largely remains within a nation's boundaries as it is degraded.[24] Nevertheless, the spillover effects of soil degradation greatly and increasingly impact world politics, the world economy, and global issues of environmental sustainability.[25] Second, the functions of soil *define the scope* of the analysis; many international legal instruments not directly focused on soil nonetheless implicate soil functions within their mandates.[26] Third, the functions of soil *provide the means* for the analysis in parts IV and V: "It is essential that the principal functions of soil, which include its ecological functions, cultural functions, and its land use functions, must strongly influence the formulation and design of national and international legal frameworks for soil."[27] Toward this analytical end, soil's functions must be viewed not only in isolation, but also in terms of their interactions. Finally, far greater popular awareness of soil's important functions and its fragility is necessary to build momentum to improve the legal frameworks to protect the world's soil. Any improved international environmental law regarding soil could

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22. NATURAL RES. CONSERVATION SERV., SOIL TAXONOMY: A BASIC SYSTEM OF SOIL CLASSIFICATION FOR MAKING AND INTERPRETING SOIL SURVEYS 119–24 (2d ed. 1999).

23. *See generally id.*

24. *See* ELS WYNEN, A UN CONVENTION ON SOIL HEALTH OR WHAT ARE THE ALTERNATIVES? 27–29 (2002), *available at* http://www.okologiens-hus.dk/PDFs/Muldrap.doc; Richter, Jr., *supra* note 13, at 961.

25. *See infra* part III.B.

26. *See infra* part III.

27. HANNAM & BOER, LEGAL FRAMEWORKS, *supra* note 9, at 10 (emphasis omitted).

greatly increase this awareness, and improve the relationship between people and soil.

1. Agriculture and Food Security

The interaction between soil and agriculture operates in both directions—any efforts to enhance or expand agricultural production that degrade the soil, and any efforts to protect soil that unduly reduce agricultural production, are self-defeating. Humans need plants to eat, whether directly or to feed our livestock higher on the food chain,[28] and plants need soil. Soil provides plants with water, air, anchorage for roots, a buffer against temperature, and a plethora of nutrients that are recycled and processed though a range of complex living and inorganic means.[29] The quality of soils dictates the degree to which they can provide these crop services. However, human impact, often through farming, has harmed these soil features around the world, impoverishing rich soils and trashing poorer varieties.

Sometimes, the soil is lost partially or entirely through accelerated soil erosion by wind and water. Erosion affects about 11% of Earth's land area, "and is by far the most widespread form of soil degradation."[30] Human activities accelerate soil erosion mainly through leaving fields uncovered by sufficient protective vegetation, due to overgrazing, deforestation, or the absence of crops outside the growing season.[31] The loss of soil nutrients by erosion costs hundreds of billions of dollars annually.[32] Even if the soil remains in place, human activity can exhaust, contaminate, and otherwise degrade soil. The degradation can be broadly categorized as chemical or physical.[33] Physically, "compaction, sealing and crusting of the soil surface, waterlogging and subsidence of organic soils [can] reduce the capacity of soil to support biomass production."[34] Chemically, the most common form of degradation is nutrient depletion. Soil's nutrients

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28. *See* Robert Goodland, *Environmental Sustainablility: Eat Better and Kill Less*, *in* THE BUSINESS OF CONSUMPTION: ENVIRONMENTAL ETHICS AND THE GLOBAL ECONOMY 203, 203–10 (Laura Westra & Patricia Hogue eds., 1998). Fish and other aquatic protein, which depend on quality soil only very indirectly, "provide less than 1 percent of the world's food . . . and less than 5 percent of the world's protein. While this makes a big difference to many of the world's poor, it is much less significant for global food supplies." *Id.* at 207.

29. ALAN WILD, SOILS, LAND AND FOOD: MANAGING THE LAND DURING THE TWENTY-FIRST CENTURY 21 (2003).

30. *Id.* at 74.

31. *Id.* at 74, 80–81; WHITE, *supra* note 5, at 245.

32. WILD, *supra* note 29, at 75.

33. *Id.* at 70. Chemical and physical degradation often occur together, however. *Id.*

34. *Id.*; *see also id.* at 88–90; WHITE, *supra* note 5, at 245–46.

are taken up by plants that are cropped or eaten by animals, and also removed by drainage water and evaporation. Nutrient depletion, or "nutrient mining," occurs when these processes remove nutrients faster than they are replaced through biological nitrogen fixation, mineral weathering, and deposition.[35] People can limit nutrient depletion by replacing nutrients via animal dung, rotation of nitrogen-fixing crops like legumes, and chemical fertilizers.[36] However, fertilizers raise their own serious environmental problems, in addition to their expense.[37] Another chemical harm is soil salinization from irrigation.[38] "[S]alinization provides a large part of the explanation for why applying the term 'Fertile Crescent' today to Iraq and Syria, formerly the leading center of world agriculture, would be a cruel joke."[39]

Not all of the threats to soil arise directly from agriculture,[40] and on the flip side, not all of the threats to agriculture and food security (such as poor distribution) arise directly from soil constraints.[41] Nevertheless, soil, as a limiting input into agricultural production, plays a dominant role in present and future food insecurity. All in all,

> [n]early 2 billion hectares of land, an area about the combined size of Canada and the United States, is affected by human-induced

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35. WILD, *supra* note 29, at 81.

36. *See* JULIO HENAO & CARLOS BAANANTE, INT'L CTR. FOR SOIL FERTILITY & AGRIC. DEV., AGRICULTURAL PRODUCTION AND SOIL NUTRIENT MINING IN AFRICA: IMPLICATIONS FOR RESOURCE CONSERVATION AND POLICY DEVELOPMENT 1–2 (2006), *available at* http://allafrica.com/sustainable/resources/view/00010778.pdf (noting also that where nutrient replacements are unavailable, farmers must put new, but more marginal lands, into agricultural production as older fields wear out).

37. *See, e.g.*, U.N. ENV'T PROGRAMME, UNEP'S STRATEGY ON LAND USE MANAGEMENT AND SOIL CONSERVATION 11–13 (2004), *available at* http://www.unep.org/pdf/UNEP-strategy-land-soil-03-2004.pdf [hereinafter UNEP'S STRATEGY] ("Unregulated fertiliser input, often subsidised, causes water pollution, biodiversity shifts and health threats.").

38. WILD, *supra* note 29, at 84–85.

39. JARED DIAMOND, COLLAPSE: HOW SOCIETIES CHOOSE TO FAIL OR SUCCEED 48 (2005).

40. Global climate change, for example, is driven more by fossil fuel use than by land use, but nonetheless affects soil functions. *See infra* note 143 and accompanying text. Urbanization and other non-agricultural uses also impact soil, reducing its future agricultural potential. UNEP'S STRATEGY, *supra* note 37, at 11, 32.

41. Distribution problems, rather than an absolute global-level food scarcity, explain much of the current level of undernourishment. UNEP'S STRATEGY, *supra* note 37, at 11. Many of these distribution problems are rooted in developed countries' agricultural subsidies. *See, e.g.*, Carol J. Williams, *Tracing Roots of Food Crisis in Haiti*, L.A. TIMES, May 13, 2008, at A4, *available at* http://www.latimes.com/news/nationworld/world/la-fg-rice13-2008may13,0,3507989.story (describing how U.S.-subsidized rice has "flooded" the Haitian market for decades, decimating Haiti's domestic production).

> degradation of soils, putting the livelihoods of nearly one billion people at risk . . . . Each year an additional 20 million hectares of agricultural land either becomes too degraded for crop production, or becomes lost to urban sprawl.[42]

In total, some 40% of the world's croplands now may have "some degree of soil erosion, reduced fertility, or overgrazing."[43]

Food insecurity is one of the most serious and frightening consequences of soil degradation, and a very global concern. At least 850 million people are hungry.[44] In sub-Saharan Africa, about a third of people are undernourished.[45] Recent and ongoing food crises may make problems even more severe in the near term; the tightness between world food supply and demand is being reflected in price spikes and food riots.[46] The practical and political impacts of food insecurity mandate *global* efforts to solve the problem in a sustainable and therefore soil-conscious way. Hunger stemming from land degradation creates massive international refugee flows and exacerbates many internationally significant political crises.[47] Even more directly, because commodity markets are so integrated in the "global farm,"[48] soil degradation can raise world commodity prices as well.[49] The Earth's rapidly growing human population, of course, dramatically compounds these various problems. The world's population is expected to reach nine, or possibly even twelve, billion people by 2050, amounting to at least a 50% increase over the global

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42. UNEP'S STRATEGY, *supra* note 37, at 9–11 (quoting KOFI A. ANNAN, WE, THE PEOPLES: THE ROLE OF THE UNITED NATIONS IN THE TWENTY-FIRST CENTURY 61 (2000)).

43. WORLD BANK, MANAGING LAND AND LANDSCAPES: A SOURCEBOOK 13 (2008), *available at* http://siteresources.worldbank.org/INTARD/927371-1205790395237/21689740/SourcebookMarch08.pdf. "The loss of native habitats [to land degradation] also affects agricultural production by degrading the services of pollinators, especially bees." *Id.*

44. FOOD & AGRIC. ORG., UNITED NATIONS, THE STATE OF FOOD INSECURITY IN THE WORLD 2006: ERADICATING WORLD HUNGER—TAKING STOCK TEN YEARS AFTER THE WORLD FOOD SUMMIT at 8 (2006), *available at* ftp://ftp.fao.org/docrep/fao/009/a0750e/a0750e00.pdf.

45. *See id.* at 5.

46. *See* Paul Krugman, Op-Ed., *Grains Gone Wild*, N.Y. TIMES, Apr. 7, 2008, at A21; Paul R. Ehrlich & Anne H. Ehrlich, Letter to the Editor, *The Food to Feed a Growing World*, N.Y. TIMES, Apr. 11, 2008, at A22; *see also* MONTGOMERY, *supra* note 5, at 170.

47. DAVID HUNTER, JAMES SALZMAN & DURWOOD ZAELKE, INTERNATIONAL ENVIRONMENTAL LAW & POLICY 26–27 (3d ed. 2007) (citing HAL KANE, WORLDWATCH INST., THE HOUR OF DEPARTURE: FORCES THAT CREATE REFUGEES AND MIGRANTS 10–14 (1995)); *id.* at 1215–16.

48. HANNAM & BOER, LEGAL FRAMEWORKS, *supra* note 9, at 30.

49. MONTGOMERY, *supra* note 5, at 170.

population in 2000.[50] Thus, even if distribution problems predominate now, absolute global food scarcities will be increasingly likely.[51]

To support the growing population, especially with its generally increasing consumption levels,[52] and to reduce hunger, food production will need to roughly double by mid-century.[53] This will require farming more soil area or farming soil more intensively, despite the risk of soil damage.[54] According to the UN Food and Agriculture Organization (FAO),

> [a]bout 80 percent of the increase in land-based agricultural production is expected to derive from increased input use and improved technology on existing agricultural land, while area expansion . . . is expected to account for the remaining 20 percent. Both sources of increased production can exacerbate damage to land-based ecosystems.[55]

In some regions, the area under agricultural production is actually decreasing.[56] Where it is increasing, the newly agricultural soil is mainly marginal and unsuitable.[57] Where soil is being used more intensively, the increased rate of production due to the past few decades' "Green Revolution" cannot continue indefinitely, and has essentially reached a plateau on many lands.[58]

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50. U.N. Dep't of Econ. and Soc. Affairs, Population Div., *World Population Prospects: The 2006 Revision*, 8, U.N. Doc ST/ESA/SER.A/261/ES (2007), *available at* http://www.un.org/esa/population/publications/wpp2006/English.pdf.

51. Daniel DeB. Richter, Jr. et al., *Long-Term Soil Experiments: Keys to Managing Earth's Rapidly Changing Ecosystems*, 71 SOIL SCI. SOC. AM. J. 266, 269–71 (2007).

52. David Streitfield, *A Global Need for Grain That Farms Can't Fill*, N.Y. TIMES, Mar. 9, 2008, at A1 (quoting an agriculture consultant's statement that "[e]veryone wants to eat like an American on this globe . . . [b]ut if they do, we're going to need another two or three globes to grow it all").

53. *See* Richter, Jr. et al., *supra* note 51, at 271; *cf.* WILD, *supra* note 29, at 207 (noting that food production will need to double in the developing world to meet its anticipated population growth).

54. WILD, *supra* note 29, at 3.

55. FOOD & AGRIC. ORG., UNITED NATIONS, THE STATE OF FOOD AND AGRICULTURE 2007: PAYING FARMERS FOR ENVIRONMENTAL SERVICES at 3 (2007), *available at* ftp://ftp.fao.org/docrep/fao/010/a1200e/a1200e00.pdf.

56. MONTGOMERY, *supra* note 5, at 170; Food & Agric. Org., United Nations, Soil Biodiversity Portal: Conservation and Management of Soil Biodiversity and its Role in Sustainable Agriculture, Biodiversity and Agriculture, http://www.fao.org/ag/AGL/agll/soilbiod/introtxt.stm (last visited Dec. 2, 2008) ("Vast amounts of land in Oceania, Asia, Africa, Europe and America are being taken out of production due to salinization, desertification and other human-induced phenomena, and are in danger of permanent degradation.").

57. *See* MONTGOMERY, *supra* note 5, at 171; WILD, *supra* note 29, at 163.

58. MONTGOMERY, *supra* note 5, at 238–40; Richter, Jr. et al., *supra* note 51, at 269–71. Furthermore, "the production of one kilogram of nitrogen fertiliser requires the energy equivalent of about one-and-a-half litres of oil," such that input-driven intensification is likely to

2. Biodiversity

Beneath our feet and invisible to us, soil is teeming with an unimaginable diversity of organisms living in the soil matrix and on the vast surface area of soil particles. According to the FAO, "Soil is one of the most diverse habitats on earth and contains one of the most diverse assemblages of living organisms. Nowhere [else] in nature are species so densely packed . . . . [A] single gram of soil may contain millions of individuals and several thousand species of bacteria," as well as fungi and larger organisms.[59] Even so, scientists do not know the full measure of biodiversity in the world's soil communities, which "are still extremely poorly understood and in dire need of further assessment."[60] Soil is diverse *among,* as well as *within,* communities.[61] However, conservation scientists note that we are in the sixth great wave of species extinction,[62] and soil is no exception to the general trend of declining biodiversity. Soil biodiversity responds to human-induced degradation, and tends to be reduced in tandem with aboveground biodiversity.[63]

Soil's biodiversity values help make its protection a global issue. Conservation of biodiversity in general has been declared a "common concern of humankind" because of the many global benefits such diversity provides.[64] Biodiversity "confer[s] stability and resilience to perturbations in some ecosystems," and the degree to which any given species is either essential or redundant for such ecosystem benefits is very rarely known in advance.[65] Soil biodiversity in

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depend on energy prices as well. HELENA NORBERG-HODGE ET AL., FROM THE GROUND UP: RETHINKING INDUSTRIAL AGRICULTURE 10 (2d ed. 2001).

59. Food & Agric. Org., United Nations, Soil Biodiversity Portal: Conservation and Management of Soil Biodiversity and its Role in Sustainable Agriculture, Soil Biodiversity and Agricultural Context, http://www.fao.org/ag/AGL/agll/soilbiod/fao.stm (last visited Dec. 2, 2008) (citations omitted).

60. Food & Agric. Org., United Nations, Soil Biodiversity Portal: Conservation and Management of Soil Biodiversity and its Role in Sustainable Agriculture, What is Soil Biodiversity and What are its Functions?, http://www.fao.org/ag/agl/agll/soilbiod/soilbtxt.stm, (last visited Dec. 2, 2008).

61. *Id.*

62. *E.g.*, HUNTER, SALZMAN & ZAELKE, *supra* note 47, at 1011.

63. MIKE SWIFT & DAVID BIGNELL, STANDARD METHODS FOR ASSESSMENT OF SOIL BIODIVERSITY AND LAND USE PRACTICE 4 (2001), *available at* http://www.fao.org/ag/AGL/agll/soilbiod/docs/manual-soil%20bioassessment.pdf; Food & Agric. Org., United Nations, *supra* note 60.

64. *See* HUNTER, SALZMAN & ZAELKE, *supra* note 47, at 1023.

65. *Id.* at 1018; *see also* Food & Agric. Org., United Nations, *supra* note 60 ("It is recognised that soil biodiversity can be used as an indicator of soil quality and stable ecosystems.").

particular contributes to agricultural and ecosystem productivity and to aboveground biodiversity.[66] Soil biodiversity also has instrumental value for pharmaceuticals; most of our antibiotics already come from soil microorganisms, and greater soil biodiversity may increase the potential for finding valuable new drugs.[67] Additionally, many people call for preservation of biodiversity on ethical grounds, based on the intrinsic value of species.[68] By focusing on the great variability of all life, "[t]he concept of biodiversity demands equal concern for both ant and anteater,"[69] and also soil organisms many times smaller than the ant—though these tiny life forms receive far less attention.

3. Water Quality

Soil and water are deeply intertwined. When soil contains too much or too little water, or when water contains too much soil sediment, humans and ecosystems that depend on them can feel the impact severely. Soil filters the water that it contains before that water reaches surface streams or reservoirs or groundwater, adsorbing and decomposing chemicals that would otherwise contaminate the water and pose hazards to human and ecosystem health.[70] When soil erodes, all of its water quality functions are lost, and water problems are compounded by the addition of the eroded soil and the various contaminants that may be attached to it.[71] Excessive surface water sedimentation from accelerated soil erosion is the largest water pollutant, by volume, in many parts of the world.

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66. Food & Agric. Org., United Nations, *In-depth Review of the Programme of Work on Agricultural Biodiversity: The International Organizations' Contribution to the Implementation of the Programme of Work on Agricultural Biodiversity: How Far Have We Come?*, 14–19, U.N. Doc. UNEP/CBD/SBSTTA/13/INF/2 (Nov. 2007), *available at* http://www.cbd.int/doc/meetings/sbstta/sbstta-13/information/sbstta-13-inf-02-en.pdf [hereinafter *How Far Have We Come?*]; Lijbert Brussaard, Peter C. de Ruiter & George G. Brown, *Soil Biodiversity for Agricultural Sustainability*, 121 AGRIC., ECOSYSTEMS & ENV'T 233, 242 (2006) (valuing these ecosystem services from soil biota at well over a trillion $USD annually).

67. Jo Handelsman, *How to Find New Antibiotics: Metagenomics Could Be the Way to Mine the Soil Beneath Our Feet*, THE SCIENTIST, Oct. 10, 2005, *available at* http://www.the-scientist.com/article/display/15764/ ("Most of the antibiotics used today . . . come from cultured soil bacteria . . . . Given the many antibiotics cultured soil bacteria have already provided us, the rest of the population is certainly worth exploring.").

68. *See, e.g.*, HUNTER, SALZMAN & ZAELKE, *supra* note 47, at 1009, 1015.

69. *Id.* at 1005.

70. WILD, *supra* note 29, at 86.

71. *Id.*

With over a billion people lacking access to safe water,[72] the contributions of soil to both water filtration and pollution must not be ignored.

Soil degradation's impacts can reach as far as the oceans. Over 80% of total marine pollution is land-based.[73] "Sedimentation caused by soil erosion, as well as [associated] agro-chemicals . . . threatens coastal and marine ecosystem function."[74] When soil erodes, some of the sediment load reaches the oceans, where "the water becomes cloudy, causing regional declines in coral reefs, and affecting coastal fisheries."[75] Soil degradation also underlies humans' massively increasing use of fertilizers to replace lost nutrients; excess fertilizer nutrients, applied or over-applied to the land surface, wash into the ocean, causing algal blooms and enormous dead zones.[76] While land-based marine pollution is clearly a global concern, little progress has been made toward meaningful international controls or standards.[77]

4. Climate Regulation and Atmospheric Impacts

The direct role of soil in regulating the global climate is substantial, and quite complex.[78] The most prominent role of soil in regulating the climate is as a part of the carbon cycle. Carbon in the atmosphere, as carbon dioxide (CO_2), is the main greenhouse gas causing anthropogenic climate change, or global warming.[79] Any atmospheric CO_2 that is sequestered, then, reduces the magnitude of

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72. NATURAL RES. DEF. COUNSEL, GLOBAL SAFE WATER: SOLVING THE WORLD'S MOST PRESSING ENVIRONMENTAL HEALTH PROBLEM 1 (2007), *available at* http://www.nrdc.org/international/water/safewater.pdf.

73. HUNTER, SALZMAN & ZAELKE, *supra* note 47, at 832.

74. U.S. AGENCY FOR INT'L DEV., USAID'S INVESTMENTS IN ADDRESSING LAND-BASED SOURCES OF MARINE POLLUTION 10 (2006), *available at* http://www.usaid.gov/our_work/environment/water/tech_pubs/marine_pollution_2006.pdf.

75. Rhett A. Butler, Impact of Deforestation: Erosion and Its Effects, http://rainforests.mongabay.com/0903.htm (last visited Dec. 2, 2008).

76. *150 'Dead Zones' Counted in Oceans: U.N. Report Warns of Nitrogen Runoff Killing Fisheries*, MSNBC.COM, Mar. 29, 2004, http://www.msnbc.msn.com/id/4624359/ (explaining that a "dead zone" occurs when excess nitrogen and other nutrients cause algal blooms whose decomposition consumes too much of the ocean's oxygen, thereby "suffocating" other sea life).

77. HUNTER, SALZMAN & ZAELKE, *supra* note 47, at 832–42.

78. *See* Richter, Jr. et al., *supra* note 51, at 271–74 (noting the need for long-term soil experiments to understand the carbon cycle).

79. Richard B. Alley et al., *Summary for Policymakers*, *in* CLIMATE CHANGE 2007: THE PHYSICAL SCIENCE BASIS. CONTRIBUTION OF WORKING GROUP I TO THE FOURTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE 2 (S. Solomon et al. eds., 2007), *available at* http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-spm.pdf.

global warming.[80] Soil stores carbon from plants, which take up CO_2 from the atmosphere through photosynthesis, then drop their leaf litter or die.[81] Microorganisms recycle much of this carbon into the atmosphere as they decompose organic material, but massive stocks of carbon remain in the soil.[82] "[S]oils constitute the largest surface [carbon] pool, approximately 1500 GtC [gigatons of carbon], which is almost three times the quantity stored in the terrestrial biomass, and twice that in the atmosphere."[83] Thus, any modification of land use can very substantially change the capacity of soil as a carbon sink.[84] Soil degradation also indirectly contributes to global warming by increasing the amounts of chemical fertilizers needed for agriculture, as fertilizer production consumes large amounts of fossil fuels.[85]

As discussed below, much of climate policymakers' focus on carbon sinks is fixed on plants, particularly forests, rather than on soils.[86] Yet while soil degradation does contribute CO_2 to the atmosphere, soil appears to have an even greater capacity as a potential carbon *sink* than its current contribution as a net *source*. In fact, a U.S. Department of Agriculture study predicted that "[w]ith improved management, [U.S.] farms and rangelands have the potential to store an additional 180 million metric tons [of carbon] annually, for a total of 200 million metric tons a year. This would be 12 to 14 percent of total U.S. emissions."[87] Even better, soil carbon

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80. Terry Barker et al., *Summary for Policymakers*, *in* CLIMATE CHANGE 2007: MITIGATION. CONTRIBUTION OF WORKING GROUP III TO THE FOURTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE 10, 14 (B. Metz et al. eds., 2007), *available at* http://www.ipcc.ch/pdf/assessment-report/ar4/wg3/ar4-wg3-spm.pdf.

81. FOOD & AGRIC. ORG., UNITED NATIONS, WORLD SOIL RES. REPORTS NO. 102, CARBON SEQUESTRATION IN DRYLAND SOILS at 2 (2004), *available at* ftp://ftp.fao.org/agl/agll/docs/wsrr102.pdf.

82. *Id.* at 1–4; *cf.* Richter, Jr. et al., *supra* note 51, at 274 (noting that temperature drives decomposition, likely introducing a positive feedback mechanism between temperature and release of soil carbon).

83. Martial Bernoux et al., *Chapter 2: Soil Carbon Sequestration*, *in* ADVANCES IN SOIL SCIENCE: SOIL EROSION AND CARBON DYNAMICS 13, 13 (Eric J. Roose et al. eds., 2006).

84. *Id.*; Ian Hannam, *International and National Aspects of a Legislative Framework to Manage Soil Carbon Sequestration*, 65 CLIMATE CHANGE 365, 368–69 (2004).

85. NORBERG-HODGE ET AL., *supra* note 58, at 10.

86. *See* HUNTER, SALZMAN & ZAELKE, *supra* note 47, at 694; *infra* notes 147–50 and accompanying text.

87. MONTGOMERY, *supra* note 5, at 212–13 (describing the potential of no-till agriculture to increase soil carbon); Don Comis et al., *Depositing Carbon in the Bank: The Soil Bank, That Is*, 49 AGRIC. RES. 4 (Feb. 2001), *available at* http://www.ars.usda.gov/is/AR/archive/feb01/bank0201.htm; *see also* Agric. Research Serv., U.S. Dep't of Agric., CQESTR, http://www.ars.usda.gov/Research/docs.htm?docid=13499 (last visited Dec. 2, 2008) (describing the CQESTR mathematical model for evaluating the effects of soil management on soil carbon

storage is a win-win proposition: "[A]ny action taken to sequester [carbon] in biomass and soils will generally increase the organic matter content of soils, which in turn . . . [causes] increases in soil fertility, land productivity for food production and security, and prevention of land degradation."[88]

An example of this carbon enriching has actually been practiced for thousands of years in the Amazon. While tropical soils tend to be especially thin and poor for agriculture because the nutrients are so quickly recycled into living biomass,[89] *terra preta do indio* (terra preta) soil is rich, dark, and fertile, with very high carbon content.[90] Amazonians developed terra preta through intensive composting and stirring charcoal and other material into the soil.[91] Terra preta and similarly created modern soils, called biochar, lock up carbon in a much more durable form, essentially as fine-grained charcoal, which can remain in soils—rather than in the usual cycle of photosynthesis and decomposition—for centuries to millennia.[92] Biochar can store more than twice as much carbon as more typical soils, and also holds nutrients well, thereby protecting water quality, enhancing yields, and reducing the need for fertilizers.[93]

Soil impacts our atmosphere on smaller geographical scales and shorter time scales as well. On a day-to-day basis, soil moderates weather.[94] Soil also directly affects short-term air quality, both locally and globally. In one striking example from 1998, a giant yellow dust cloud originating from the Gobi Desert in China made its way across the Pacific Ocean over the course of five days and reduced solar radiation by up to forty percent in California, with the Gobi dust continuing to be detected as far east as Minnesota.[95] Dust eroded

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content, captured as organic matter, and model results showing that "[t]illage practices that increase contributions to biomass, limit inversion tillage and provide annual root and shoot biomass return to the soil promote [carbon] storage").

88. FOOD & AGRIC. ORG., UNITED NATIONS, *supra* note 44, at 2.

89. *See* MONTGOMERY, *supra* note 5, at 75–76.

90. *Id.* at 142–44.

91. *Id.* at 143. The Amazonians, researchers believe, also "add[ed] soil rich in microorganisms to initiate the composting process, as a baker adds yeast to make bread." *Id.*

92. Johannes Lehmann, *Commentary: A Handful of Carbon*, 447 NATURE 143, 143 (May 2007).

93. *Id.*

94. It is important to keep in mind that weather is distinct from climate. *See* Nat'l Ctr. for Atmospheric Research, Weather and Climate Basics, http://eo.ucar.edu/basics/ (last visited Dec. 2, 2008).

95. R.B. Husar et al., *Asian Dust Events of April 1998*, 106 J. GEOPHYS. RES. 18,317, 18,317–30 (2001).

from Africa and transported across the Atlantic Ocean also contributes considerably to violations of U.S. federal air quality regulations in Florida.[96]

5. Cultural Services

As a stage for human history, soil is more than a passive platform. "Soils are a . . . cultural heritage, forming an essential part of the landscape in which humans live, and concealing paleontological and archaeological information of high value for the understanding of the history of earth and humankind."[97] The cultural significance of geographically-specific soils is nicely illustrated by the descriptions of soil used to enhance wine aficionados' enjoyment of regional wines.[98] Soil is also used as a source of primary substances, such as gravel and clay, that are used in a variety of applications, including construction.[99] Quality soil can be invaluable in waste management,[100] structural support,[101] and other socially essential roles. However, soil's usefulness for these roles is finite, and use of soil for certain functions precludes its use for others.

Of course, soil's underlying roles in maintaining food supply, biodiversity, clean water, and stable climate, as already described, are fundamental—without these functions societies simply cannot endure. As Jared Diamond details in his book, *Collapse*, the Norse Greenland colony's dramatic collapse in the 1400s after only about four centuries was partly predicated on their abuse of the large island's fragile soils.[102] In fact, "soil problems contributed to the collapses of all past societies described in th[e] book."[103] David R. Montgomery also vividly describes how human-caused soil erosion, contamination, and exhaustion devastated the society of ancient

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96. Am. Geophysical Union, *African Dust Called a Major Factor Affecting Southeast U.S. Air Quality*, SCIENCEDAILY, July 14, 1999, http://www.sciencedaily.com-/releases/1999/07/990714073433.htm.

97. HANNAM & BOER, LEGAL FRAMEWORKS, *supra* note 9, at 11.

98. *See, e.g.*, E.S. Brown, *The World's Top 10 Wine Soils*, WINEGEEKS, July 5, 2007, http://winegeeks.com/articles/139 ("It's no secret that those in the know in the wine biz get all giddy when talking about soil. Wine lovers and makers alike droll on and on about how one vineyard has subterraneous tufa while another vineyard boasts a blend of calcareous marl and limestone clay."); *see generally* ROBERT E. WHITE, SOILS FOR FINE WINES (2003).

99. *See* HANNAM & BOER, LEGAL FRAMEWORKS, *supra* note 9, at 11.

100. WHITE, *supra* note 5, at 334.

101. HANNAM & BOER, LEGAL FRAMEWORKS, *supra* note 9, at 11.

102. DIAMOND, *supra* note 39, at 248–55.

103. *Id.* at 490. Some of the other societies discussed by Diamond include Easter Island, the Anasazi of what is now the Southwestern United States, and the Maya. *See generally id.*

Sumer,[104] contributed to the geographical expansion and then the decline of the Roman empire,[105] helped cause the collapse of the Mayan,[106] and probably the Pueblo, civilizations,[107] fueled Western European warfare and colonization,[108] and helped drive and shape American expansion westward.[109] While these great social changes were characterized by expansion to new lands, our globally integrated modern society for the most part simply has nowhere else to go. Understanding and addressing the world's soil and its functions and threats has therefore never been more urgent.

III. CURRENT INTERNATIONAL ENVIRONMENTAL LAW RELATING TO SOILS

According to the United Nations Environment Program (UNEP), taking a broad view, "The *majority* of multilateral environmental agreements (MEAs) relate either directly or indirectly to land and soil issues."[110] This note does not canvass the lot,[111] but rather highlights those that are most important to soil and its functions, and shows how soil protection fits into the mandates of those instruments. However, even focusing on these most relevant instruments, "[w]hile a number of [MEAs] contain elements that can assist in achieving sustainable use of soil, it is contended that none are sufficient in their own right to meet the requirements of international environmental law in relation to soil."[112]

A. The Rio Conventions

The 1992 United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro, Brazil, known to many as "Rio," was a watershed moment in international environmental law.

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104. MONTGOMERY, *supra* note 5, at 36–40.

105. *Id.* at 49–73.

106. *Id.* at 73–77.

107. *Id.* at 79–81.

108. *Id.* at 91–93, 99–104, 110.

109. *Id.* at 117–41.

110. UNEP'S STRATEGY, *supra* note 37, at 21 (emphasis added).

111. *See* HANNAM & BOER, DRAFTING LEGISLATION, *supra* note 9, at 95–100 (giving a more extensive list of international instruments, declarations, strategies, and regional instruments and agreements; even this lengthy list does not take into account lower-level or interim UN or treaty Conference of the Parties decisions or other smaller facets of international legal and institutional action).

112. *Id.* at 59.

It gave rise to the Rio Declaration[113] and Agenda 21,[114] as well as to a number of binding treaties, including agreements regarding biodiversity and climate change which were adopted at the Conference, and a commitment to a treaty on desertification which was adopted by the General Assembly two years later.[115] It is important to note that these conventions are evolving, sometimes in fairly rapid bursts,[116] and their treatment of soil issues in particular may—and should—change in the future.

1. UN Convention to Combat Desertification (UNCCD)

Of all of the treaties to arise from Rio, the Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa, known as the UNCCD, most directly addresses soil conservation and management—but only with respect to a subset of the world's soils, soil functions, and soil threats.[117] The UNCCD was adopted in 1994 and became effective in late 1996.[118] It is mainly a capacity-building, rather than a regulatory, treaty and focuses on process and a bottom-up approach.[119] Desertification is defined as "land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities."[120] Parties to the UNCCD that are affected by desertification thus defined are required to develop National Action Programs (NAPs) to combat

113. United Nations Conference on Environment and Development, Rio de Janeiro, Braz., June 3–14, 1992, *Rio Declaration on Environment and Development*, U.N. Doc. A/CONF.151/26 (Aug. 12, 1992), *available at* http://www.un.org/documents/ga/conf151/aconf15126-1annex1.htm [hereinafter *Rio Declaration on Environment and Development*].

114. UNITED NATIONS CONFERENCE ON ENVIRONMENT AND DEVELOPMENT, AGENDA 21, U.N. Doc. A/CONF.151/4 (1992), *available at* http://www.un.org/esa/sustdev/documents/agenda21/english/Agenda21.pdf. [hereinafter AGENDA 21].

115. *See* HUNTER, SALZMAN & ZAELKE, *supra* note 47, at 187, 197, 1221.

116. *See, e.g.*, *infra* notes 141, 151–53, 164 and accompanying text (discussing various changes made via conferences and other means).

117. United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa, June 17, 1994, 33 I.L.M. 1328, *available at* http://www.unccd.int/convention/text/pdf/conv-eng.pdf [hereinafter UNCCD].

118. HUNTER, SALZMAN & ZAELKE, *supra* note 47, at 1221; *see also* United Nations Convention to Combat Desertification, Country Information Database: United States (2008), http://www.unccd.int/php/countryinfo.php?country=USA (last visited Dec. 2, 2008) (showing that the United States is a party to this treaty).

119. HUNTER, SALZMAN & ZAELKE, *supra* note 47, at 1221.

120. UNCCD, *supra* note 117, art. 1, para. (a).

desertification and mitigate its effects.[121] Parties are also instructed to focus on underlying causes, especially socioeconomic factors.[122] "Non-affected" developed country parties, for their part, are required to "actively support" and "provide substantial financial resources and other forms of support to" affected developing country parties.[123] Resources, such as grants and loans, to cover the "incremental costs" of programs to combat desertification are largely mobilized through the Global Environment Facility (GEF).[124]

The UNCCD, by its nature, does not contain legal elements to address soil problems or interactions among soil functions comprehensively, and in its geographical focus on drylands, it ignores the similarly severe soil problems that occur in different parts of the world.[125] However, "the [UN]CCD could possibly be amended so as to add some additional and special ecological rules for the sustainable use of soil, or . . . a Protocol could be drafted to directly address these matters."[126] Additionally, the UNCCD has evolved somewhat in the past decade, and the most recent strategic plan for 2008–2018 does include objectives "to improve the conditions of affected ecosystems" and to more broadly "generate global benefits" including through "[i]ncrease in carbon stocks (soil and plant biomass) in affected areas."[127]

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121. HUNTER, SALZMAN & ZAELKE, *supra* note 47, at 1222; UNCCD, *supra* note 117, arts. 9–10, 19.

122. UNCCD, *supra* note 117, art. 5, para. (c); *see also* United Nations Convention to Combat Desertification, National, Regional and Sub-Regional Programs, http://www.unccd.int/actionprogrammes/menu.php (last visited Dec. 2, 2008) (providing all NAPs received from parties).

123. UNCCD, *supra* note 117, art. 6.

124. *Id.* art. 20; HUNTER, SALZMAN & ZAELKE, *supra* note 47, at 1583 ("[The GEF] is the primary mechanism for providing financial assistance to developing countries to address specific global environmental priorities[, and is] the largest source of grant funds available for environmental protection."); Julian Dumanski, Soil Conservation and the International Environmental Conventions (2006) (unpublished paper presented at the 14th International Soil Conservation Organization Conference in Marrakech, Morocco) (on file with author) (explaining that under the new Operational Program 15 on land degradation, adopted in 2002 to better implement the UNCCD, the GEF is funding dozens of projects involving hundreds of millions of U.S. dollars).

125. HANNAM & BOER, LEGAL FRAMEWORKS, *supra* note 9, at 63 (noting inter alia that the UNCCD does not "adequately recognize soil as an individual ecological element").

126. *Id.*

127. United Nations Convention to Combat Desertification, Madrid, Spain, Sept. 3–14, 2007, *Report of the Conference of the Parties on its Eighth Session*, 16–17, U.N. Doc. ICCD/COP(8)/16/Add.1 (Oct. 23, 2007), *available at* http://www.unccd.int/cop/officialdocs/cop8/pdf/16add1eng.pdf.

2. UN Convention on Biological Diversity (CBD)

"[M]ost of the land's biodiversity lives in the soil, not above ground,"[128] but in the UN Convention on Biological Diversity (CBD), in force since 1993,[129] soil biodiversity is nearly invisible.[130] The near-total absence of soil as a CBD issue is rather striking, given the structural setup of the treaty. In recognizing the concept of biodiversity as a "common concern of humankind," the CBD provides important theoretical justification for *global* responsibility for soil protection, justifying international action regarding resources generally occurring within national boundaries while still acknowledging state sovereignty.[131] "Biological diversity" and the scope of the treaty are further defined as "[t]he variability among living organisms from *all* sources . . . and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems."[132] Soil is implicit in this definition. The stated objectives of the CBD can also encompass soil protection, as they include "the conservation of biological diversity [and] the sustainable use of its components."[133] To meet these objectives, the CBD requires international cooperation and information exchange; national strategies or plans, which shall include identification and monitoring, protected areas, incentive measures, and other prescribed measures; and integration of biodiversity protection into other policies and decisionmaking processes, including by impact assessments.[134] These actions would also seem able to accommodate soil biodiversity as well as the larger, (mostly) aboveground life forms that are its current focus. Finally, at the 2003 Conference of the Parties (COP), the CBD also adopted and began implementing an "ecosystem approach," which is described as a "strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way" and that applies scientific methodologies, adaptive management, and

128. DAVID DENT ET AL., EARTH SCIS. FOR SOC'Y FOUND., SOIL—EARTH'S LIVING SKIN 2 (Ted Nield ed., 2005), *available at* http://www.yearofplanetearth.org/content/downloads/Soil.pdf.

129. United Nations Convention on Biological Diversity, art. 2, June 5, 1992, 1760 U.N.T.S. 79, *available at* http://www.cbd.int/doc/legal/cbd-un-en.pdf [hereinafter CBD]; Convention on Biological Diversity, Welcome to the CBD Secretariat, http://www.cbd.int/secretariat/ (last visited Dec. 2, 2008).

130. *See* HANNAM & BOER, LEGAL FRAMEWORKS, *supra* note 9, at 64.

131. HUNTER, SALZMAN & ZAELKE, *supra* note 47, at 1022–23.

132. CBD, *supra* note 129, art. 2 (emphasis added).

133. *Id.* art. 1.

134. *See generally id.*

precautionary principles.[135] The focus on ecosystems, and the express mention of land, would seem to incorporate greater concern for soil protection as well.

Despite the implied inclusion of soil in the theoretical basis, definitional scope, overall objectives, implementing action requirements, and recent ecosystem approach of the CBD, observers generally agree that actual on-the-ground implementation of the CBD has not significantly addressed soil issues.[136] But this may be slowly changing. Since 2002, the CBD and its COP have added greater emphasis on agricultural biodiversity, including some level of recognition of soil biodiversity.[137] FAO, as a non-party participant in the CBD, has been particularly prominent in pushing for greater recognition of the importance of soil biodiversity to the support of other biodiversity and of humans.[138] FAO and the CBD COP have begun coordinating a Soil Biodiversity Initiative, with goals of raising awareness, increasing understanding, strengthening collaboration, and "mainstreaming" soil protection into land management decisions, but progress has been fairly limited.[139] The integration of soil biodiversity protection into the CBD is largely in initial, awareness-raising stages, but structurally, soil issues could be much better included.

3. UN Framework Convention on Climate Change (UNFCCC)

The UN Framework Convention on Climate Change (UNFCCC),[140] and the subsequent Kyoto Protocol[141] added to it, address sources, reservoirs, and sinks of greenhouse gases. Soil and land-use changes fall into all three targeted categories, and are able to

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135. Convention on Biological Diversity, Nairobi, Kenya, May 15–26, 2000, *COP 5 Decision V/6*, *available at* http://www.cbd.int/decisions/?m=COP-05&id=7148&lg=0; HUNTER, SALZMAN & ZAELKE, *supra* note 47, at 1025.

136. *See How Far Have We Come?*, *supra* note 66, at 44; HANNAM & BOER, LEGAL FRAMEWORKS, *supra* note 9, at 64; WYNEN, *supra* note 24, at 19 ("Biodiversity below ground level, in soils, has hardly been discussed, but this may be where the aims of a soil convention could be subsumed into an existing agreement.").

137. *See How Far Have We Come?*, *supra* note 66, at 1, 14–19, 43–44.

138. *See generally id.*

139. *Id.* at 43–44; *see also* IASUS, SOILS ON THE GLOBAL AGENDA, *supra* note 8, at 41–47.

140. United Nations Framework Convention on Climate Change, May 9, 1992, 1771 U.N.T.S. 107, *available at* http://unfccc.int/resource/docs/convkp/conveng.pdf [hereinafter UNFCCC].

141. Agreement for the Kyoto Protocol to the United Nations Framework Convention on Climate Change, Dec. 11, 1997, 37 I.L.M. 22, *available at* http://unfccc.int/resource/docs/convkp/kpeng.pdf [hereinafter Kyoto Protocol].

alternatively contribute to, or alleviate, climate change.[142] Since soil and its functions are also affected *by* climate change,[143] soil is implicit in the overall objectives of the UNFCCC: "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system . . . within a time frame sufficient to allow ecosystems to adapt naturally . . . , to ensure that food production is not threatened and to enable [sustainable] economic development."[144]

Under the Kyoto Protocol regime, "Annex I" parties, comprising industrialized nations (not including the non-party United States), collectively committed to net emissions reductions 5% below the 1990 baseline by 2008–2012, with a "cap-and-trade" approach adding flexibility in the manner of reaching that goal.[145] The "Clean Development Mechanism" (CDM) adds further flexibility: through CDM, Annex I countries can fund (through governmental or private actors) projects and activities in non-Annex I countries that result in measurable emissions reductions, and then can use those reductions, once certified, toward their compliance. All parties also committed to create and implement national programs for climate change mitigation and adaptation.[146] It would seem that the UNFCCC climate regime is comprehensive and flexible enough to allow a fair amount of soil protection to be accomplished through it.

Of course, the devil is in the details. For the Kyoto climate regime to work, emissions reductions and greenhouse gas sinks must be measurable by agreed-upon standards, and these have proven controversial.[147] Because of their greater measurability and scale, emissions from the industrial sector, rather than non-industrial and

142. *See supra* notes 78–96 and accompanying text.

143. Climate change is predicted to increase the area of soils subject to salinization and alkalinization (extreme chemical pH) due to direct effects on water balance and indirect effects on land use patterns, such as increased irrigation. I. Szabolcs, *Impact of Climatic Change on Soil Attributes: Influence on Salinization and Alkalinization*, *in* SOILS ON A WARMER EARTH: EFFECTS OF EXPECTED CLIMATE CHANGE ON SOIL PROCESSES, WITH EMPHASIS ON THE TROPICS AND SUB-TROPICS 61, 61–63 (Scharpenseel et al. eds., 1990). Other effects of global warming on the morphology, biology, chemical properties, and fertility of soils are far less predictable. *Id.* at 61.

144. UNFCCC, *supra* note 140, art. 2.

145. Kyoto Protocol, *supra* note 141, art. 3, ¶ 1, art. 4, art. 17; HUNTER, SALZMAN & ZAELKE, *supra* note 47, at 691.

146. Kyoto Protocol, *supra* note 141, art. 10.

147. *See* HUNTER, SALZMAN & ZAELKE, *supra* note 47, at 694–98.

agricultural land use sectors, have been the primary focus.[148] Even within the parts of the Kyoto system that address land use and land use change, soil has not been a priority. Article 3.4 of the Kyoto Protocol does specifically direct the parties to decide whether and how "changes in greenhouse gas emissions by sources and removals by sinks in the agricultural soil and land use change and forestry categories, shall be added to, or subtracted from, the assigned amounts" for Annex I net emissions targets.[149] But when the decisions on land use rules were made in 2001, farming-based soil carbon sequestration was specifically excluded from CDM, at least through 2012.[150]

Yet greater potential exists for soil protection through the UNFCCC regime. The prime example is biochar. Each CDM project methodology must be specifically approved by the CDM Board, and due to the 2001 COP decisions, biochar is not an approved methodology.[151] However, at the December 2007 UNFCCC 13th COP in Bali, Indonesia, at a UNCCD-sponsored presentation regarding "sustainable land management for adaptation to climate change," a representative from the UNCCD Secretariat strongly promoted modifying CDM's rules to at least "ensure [biochar's] inclusion in a post-2012 climate regime."[152] Though research on biochar is still in its infancy, biochar very likely has distinct advantages in terms of measurability and durability of sequestered emissions, with little continuing monitoring necessary and diverse

148. *See* HANNAM & BOER, LEGAL FRAMEWORKS, *supra* note 9, at 65; *see also* FOOD & AGRIC. ORG., UNITED NATIONS, *supra* note 81, at 5 ("The lack of sound scientific evidence and the difficulty of carbon accounting have probably prevented the explicit inclusion of soils in the [Kyoto Protocol]."). Two main sources of uncertainty persist: the carbon sequestration potential derived from various land use and management changes, and the land area that can feasibly be converted to those management forms. Michel Robert, *Global Change and Carbon Cycle: The Position of Soils and Agriculture*, *in* ADVANCES IN SOIL SCIENCE: SOIL EROSION AND CARBON DYNAMICS 3, 9 (Eric J. Roose et al. eds., 2006).

149. Kyoto Protocol, *supra* note 141, art. 3, ¶ 4.

150. FOOD & AGRIC. ORG., UNITED NATIONS, THE STATE OF FOOD AND AGRICULTURE 2002: AGRICULTURE AND GLOBAL PUBLIC GOODS TEN YEARS AFTER THE EARTH SUMMIT at 194 (2002), *available at* http://www.fao.org/DOCREP/004/y6000e/y6000e00.htm; HUNTER, SALZMAN & ZAELKE, *supra* note 47, at 695–96.

151. *See* Lehmann, *supra* note 92, at 144; CDM, Methodologies for CDM Project Activities, http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html (last visited Dec. 2, 2008).

152. Int'l Inst. for Sustainable Dev., *UNCCD: Sustainable Land Management for Adaptation to Climate Change*, EARTH NEGOTIATIONS BULLETIN ON THE SIDE, Dec. 14, 2007, at 1, *available at* http://www.iisd.ca/climate/cop13/enbots/pdf/enbots1239e.pdf (summarizing the comments of Goodspeed Kopolo).

positive impacts on environmental and social goods besides climate.[153] FAO has also discussed the possibilities for CDM to allow poor land-users to be carbon credit providers. While noting the many hurdles, such as high transaction costs and risk of reversal, FAO concluded that with concerted efforts, such payments could finance development efforts and encourage sustainable agricultural practices.[154]

B. Non-Binding Instruments

There have been a number of declarations of principles, action plans, and practical guidelines and codes of practice relating to soil, laying a groundwork for evaluation of more concrete measures. These non-binding or "soft law" instruments "embrac[e] a broader range of actors (including scientific organizations, academic specialists, NGOs, and industry)" and often act as an essential step in consensus-building for later treaties.[155] While not legally binding on adopting countries or entities, these instruments are nonetheless usually carefully negotiated and drafted, and characterized by some level of good faith commitment.[156] However, their non-binding nature tends to severely limit their on-the-ground impact.

Agenda 21,[157] adopted in 1992 at Rio, is among the most significant and ambitious non-binding action plans in international environmental law.[158] Agenda 21 was intended as a detailed practical blueprint for global cooperation in future implementation of sustainable development.[159] It comprises forty substantial chapters and hundreds of pages; those on the atmosphere, land resources, deforestation, desertification, mountain development, sustainable agriculture, biodiversity, freshwater, and other topics discuss

153. Lehmann, *supra* note 92, at 143–44.

154. FOOD & AGRIC. ORG., UNITED NATIONS, *supra* note 150, at 189–212.

155. HUNTER, SALZMAN & ZAELKE, *supra* note 47, at 353.

156. PATRICIA BIRNIE & ALAN BOYLE, INTERNATIONAL LAW AND THE ENVIRONMENT 24–25 (2d ed. 2001).

157. AGENDA 21, *supra* note 114.

158. *See, e.g.*, Donald A. Brown & John Lemons, *Introduction*, *in* SUSTAINABLE DEVELOPMENT: SCIENCE, ETHICS, AND PUBLIC POLICY 1, 3, 5 (John Lemons & Donald A. Brown eds., 1995) (noting that "[a]lthough it did not receive as much publicity . . . as the treaties on climate change and biodiversity, Agenda 21 may prove to be the most significant of all the Earth Summit agreements[,]" and that while Agenda 21 is non-binding "most analysts view it as an ambitious and significant attempt to develop principles to guide future action").

159. HUNTER, SALZMAN & ZAELKE, *supra* note 47, at 195.

substantive issues directly affecting soil and its functions.[160] Though Agenda 21 does provide a useful and agreed-upon framework, and has led to, among other things, some increased monitoring and reporting of environmental measures,[161] "[t]he tangible developments which flow directly from the text are limited."[162]

The World Soils Charter[163] and World Soils Policy[164] are obviously much more targeted instruments than Agenda 21. The FAO and UNEP prepared them in collaboration in the early 1980s. Since then, "they have been influential in raising the profile of soil conservation as an international environmental management issue, as well as providing some relatively straightforward guideline material for States to adopt in the preparation of domestic laws and policies."[165] The instruments recognize that soil is a fragile, finite, and non-renewable resource, essential for ecological balance and basic human needs.[166] These and other principles from the instruments have been influential in shaping FAO and UNEP projects, as well as the national soil policies of several countries worldwide.[167] Nonetheless, according to IUCN analysts, the World Soils Charter and World Soils Policy, like Agenda 21, "fall well short of the basic necessities of a modern day suitable non-binding 'soft law' instrument" for soil protection.[168]

The Non-Legally Binding Authoritative Statement of Principles for a Global Consensus on the Management, Conservation and Sustainable Development of All Types of Forests (Forest Principles) is another non-binding international environmental law instrument

160. AGENDA 21, *supra* note 114; *see also* FOOD & AGRIC. ORG., UNITED NATIONS, *supra* note 150, at 177 (illustrating some soil-related public goods associated with chapters 10–15 of Agenda 21 and the geographical range of spillover impacts of those goods).

161. *See, e.g.*, UNEP'S STRATEGY, *supra* note 37, at 8–9 (discussing the *Global Environmental Outlook* report as it relates to soil, and describing the report as "a response to the Agenda 21 request for comprehensive environmental reporting").

162. PHILIPPE SANDS, PRINCIPLES OF INTERNATIONAL ENVIRONMENTAL LAW 57 (2d ed. 2003); *see also* HUNTER, SALZMAN & ZAELKE, *supra* note 47, at 196 ("*Agenda 21* has been disappointing.").

163. Food & Agric. Org., United Nations, World Soil Charter, Nov. 25, 1981, 21 FAO Conf. Res. 8/81, *available at* http://www.fao.org/docrep/T0389E/T0389E0b.htm.

164. SANDS, *supra* note 162, at 555 (citing U.N. ENV'T PROGRAMME, WORLD SOILS POLICY (1982)).

165. HANNAM & BOER, LEGAL FRAMEWORKS, *supra* note 9, at 61.

166. *See id.*; *see also* UNEP'S STRATEGY, *supra* note 37, at 6–7.

167. HANNAM & BOER, LEGAL FRAMEWORKS, *supra* note 9, at 61.

168. *Id.*

with ramifications for soil protection.[169] The Forest Principles arose after intense, divisive negotiation prior to, and at, the Rio Conference.[170] The Forest Principles, in recognizing nations' sovereign rights to utilize their forests,[171] "reject[] any significant international interest in the protection of forests."[172]

C. Regional Instruments

Regional agreements may have the advantages of being able to tackle discrete, unique problems, and may even be easier to negotiate as the states that are parties have a somewhat lower level of heterogeneity. Some analysts propose that, for structural reasons supported by game-theoretic models, "regional cooperation might be a good alternative to global [MEAs] for environmental problems like climate change" or soil protection, because less depth of agreement has to be sacrificed in order to broaden the appeal to more countries and get them on board.[173] On the other hand, regional agreements are, by definition, less geographically comprehensive.

Europe has been a leader in regional environmental law instruments specifically targeting soil. In 1972, the Council of Europe adopted a European Soil Charter, the only regional non-binding instrument of its type for soil.[174] The EU's European Charter for the Protection and Sustainable Management of Soil was revised in 2003, and provides a substantial overview of terms, principles, and recommendations.[175] The European Commission of the European Union also adopted the Thematic Strategy for Soil Protection in

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169. United Nations Conference on Environment and Development, Rio de Janeiro, Braz., June 3–14, 1992, *Statement of Principles for a Global Consensus on the Management, Conservation and Sustainable Development of All Types of Forests*, U.N. Doc. A/Conf.151/6/Rev.1, 31 I.L.M. 881 (1992) [hereinafter Forest Principles].

170. HUNTER, SALZMAN & ZAELKE, *supra* note 47, at 1185–87.

171. Forest Principles, *supra* note 169, ¶¶ 1–2.

172. HUNTER, SALZMAN & ZAELKE, *supra* note 47, at 1188; *cf.* Matthew B. Royer, *Halting Neotropical Deforestation: Do the Forest Principles Have What It Takes?*, 6 DUKE ENVTL. L. & POL'Y F. 105, 149 (1996) (offering a more generous early assessment).

173. Geir B. Asheim et al., *Regional versus global cooperation for climate control*, 51 J. OF ENVTL. ECON. & MGMT. 93, 94–95 (2006).

174. Comm. of Ministers, Council of Eur., *European Soil Charter*, Resolution (72) 19 (May 30, 1972), *available at* https://wcd.coe.int/com.instranet.InstraServlet?command=com.instranet.CmdBlobGet&InstranetImage=588295&SecMode=1&DocId=644074&Usage=2; HANNAM & BOER, LEGAL FRAMEWORKS, *supra* note 9, at 60.

175. Comm. of Ministers, Council of Eur., *Revised European Charter for the Protection and Sustainable Management of Soil*, Appendix 28 (May 28, 2003), *available at* https://wcd.coe.int/ViewDoc.jsp?id=37477&Site=CM&BackColorInternet=9999CC&BackColorIntranet=FFBB55&BackColorLogged=FFAC75.

2006.[176] The Thematic Strategy establishes a decade-long work program and also proposes a framework Directive.[177] The framework Directive would be a binding, non-regulatory law requiring a variety of specific capacity-enhancing measures and broader protective strategies among EU member states.[178] As of the time of writing this note, the Directive has been endorsed with some amendments by the European Parliament.[179] Europe also has "the only specific binding instrument for soil in the world,"[180] the Alpine Convention Soil Conservation Protocol.[181] The Protocol was adopted in 1998 and entered into force in 2006.[182] Parties to the convention must meet obligations regarding precautionary legal measures, integration of the objectives of the Protocol into related policies, information availability, and other specific goals. The IUCN analysis declares that the Protocol "contains many of the ecological concepts and principles advocated by [its] report as being 'essential,'" particularly in that it is "based on an ecosystem perspective" and "sets out the functions of soil . . . emphasising that they be safeguarded and preserved to maintain an ecological balance in the region, and soil diversity, for future generations."[183]

Africa, with roughly seventy percent of its land either desert or drylands,[184] has understandably been a leader in regional environmental law relating to its fragile soils as well. The original

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176. European Commission, The Soil Thematic Strategy, http://ec.europa.eu/environment/soil/three_en.htm (last visited Dec. 2, 2008).

177. *Id.*

178. *Commission Proposal for a Directive of the European Parliament and of the Council Establishing a Framework for the Protection of Soil and Amending Directive 2004/35/EC*, COM (2006) 232 final (Sept. 22, 2006), *available at* http://ec.europa.eu/environment/soil/pdf/com_2006_0232_en.pdf.

179. Bulletin of the European Union, Environment, Nov. 14, 2007, http://europa.eu/bulletin/en/200711/p122001.htm.

180. HANNAM & BOER, LEGAL FRAMEWORKS, *supra* note 9, at 68.

181. Protocol on the Implementation of the Alpine Convention of 1991 in the Field of Soil Conservation, 2005 O.J. (L 337) 29, *available at* http://www.alpenkonvention.org/NR/rdonlyres/3E7071BB-29A9-4082-91B9-5D8471FB2BA1/0/ SoilProtocolEN.pdf [hereinafter Alpine Convention Soil Conservation Protocol]. The full Alpine Convention text is available at http://www.convenzionedellealpi.org/theconvention/index_en (last visited Dec. 2, 2008).

182. European Commission, Treaties Office, Protocol on the Implementation of the Alpine Convention of 1991 in the Field of Soil Conservation, Summary of Treaty, http://ec.europa.eu/world/agreements/prepareCreateTreatiesWorkspace/treatiesGeneralData.do?step=0&redirect=true&treatyId=2701 (last visited Dec. 2, 2008).

183. HANNAM & BOER, LEGAL FRAMEWORKS, *supra* note 9, at 68–69 (citing Alpine Convention Soil Conservation Protocol, *supra* note 181, art. 1).

184. HUNTER, SALZMAN & ZAELKE, *supra* note 47, at 1215.

1968 version of the African Convention on the Conservation of Nature and Natural Resources[185] was significantly revised, with the cooperation of UNEP and IUCN, in 2003.[186] The article on Land and Soil is still the first of the topical articles, and now provides more expansively that States "shall take effective measures to prevent land degradation, and to that effect shall develop long-term integrated strategies for the conservation and sustainable management of land resources, including soil, vegetation and related hydrological processes."[187] The measures required to accomplish this have been expanded as well, and better reflect the UNCCD.[188] Among the changes, land use plans must be based on "local knowledge and experience" as well as on science; substantive improvements when implementing agricultural practices must additionally address forestry and various forms of pollution; States must take action to address non-agricultural land uses, such as mining; States must implement land rehabilitation in affected areas; and "land tenure policies . . . taking into account the rights of local communities" are required to facilitate all of the other necessary measures.[189]

Other regional agreements impact soil sustainability as well. The ASEAN (Association of Southeast Asian Nations) Agreement on the Conservation of Nature and Natural Resources[190] was adopted in 1985 but has not entered into force.[191] Its Article on Soil would obligate States to undertake conservation and rehabilitation measures, objectives that are additionally supported by other Articles on ecosystem functioning, environmental planning, research, and cooperation.[192] Other regional conventions that are in force, like the Protocol Concerning Specially Protected Areas and Biological Diversity in the Mediterranean, the Convention for the Protection of the Mediterranean Sea Against Pollution, and the Convention for the

185. African Convention on the Conservation of Nature and Natural Resources, Sept. 15, 1968, 1001 U.N.T.S. 3.

186. African Convention on the Conservation of Nature and Natural Resources, July 11, 2003, *available at* http://faolex.fao.org/docs/pdf/mul45449.pdf [hereinafter African Convention]; INT'L UNION FOR CONSERVATION OF NATURE & NATURAL RES., AN INTRODUCTION TO THE AFRICAN CONVENTION ON THE CONSERVATION OF NATURE AND NATURAL RESOURCES vii, 2 (2004), *available at* http://www.sprep.org/legal/documents/IUCNApia.pdf.

187. African Convention, *supra* note 186, art. VI(1).

188. INT'L UNION FOR CONSERVATION OF NATURE & NATURAL RES., *supra* note 186, at 8.

189. African Convention, *supra* note 186, art. VI.

190. Ass'n of Southeast Asian Nations, Agreement on the Conservation of Nature and Natural Resources, July 9, 1985, 15 E.P.L. 64, *available at* http://www.aseansec.org/1490.htm.

191. HANNAM & BOER, LEGAL FRAMEWORKS, *supra* note 9, at 69.

192. *Id.*

Protection of the Natural Resources and Environment of the South Pacific Region, impact soil degradation to the extent that it leads to marine pollution or coastal impacts.[193]

IV. INADEQUACY OF EXISTING INTERNATIONAL LEGAL REGIMES FOR THE LONG-TERM PROTECTION OF THE WORLD'S SOILS

Given all of the MEAs just described—and still others not mentioned—that touch on many of the agricultural, hydrological, biodiversity, climate, and other functions of soil, an observer might initially conclude that international environmental law protects soil and its functions fairly comprehensively. Despite its overlap with many soil functions, however, the hodgepodge of legal instruments actually ignores many important technical, social, and economic aspects of soil protection. Furthermore, given the lack of an integrated focus on soil protection needs, the current regime would continue to miss many of these facets, even if the existing MEAs' specific targets, like biodiversity and climate, evolved to better recognize the roles of soil in those functions. This section provides a deeper analysis of what an international environmental law regime for soils should and could aim to address in order to provide adequate protection of the global functions of soil for present and future generations.

A key idea in assessing international environmental law is that while on-the-ground actions are the ultimate targets, nations are the primary players on the international stage and international law rarely acts directly on individuals. While nations clearly can and should develop soil protecting laws and policies, even absent the spur of international action telling them to do so, an adequate international legal regime is important to bring about national and sub-national actions in several ways. First, without prominent international environmental action specifically and comprehensively focused on soil and its interrelated functions, the visibility of the issue is much lower and countries have less incentive to act. Visibility of soil issues in the current, disparate regime is unquestionably low.[194] Second, even if soil issues were to significantly rise in visibility, such as through the efforts of the IUCN, UN bodies, and soil science institutions, countries would still refrain from making some substantial efforts because of collective action problems. For

193. *Id.* at 66–68 (citing above-mentioned Protocols).

194. IASUS, WORLD SOILS AGENDA, *supra* note 8, at 3.

example, because changing agricultural practices often has immediate costs, "the 'race-to-the-bottom' may disadvantage a country that takes national action in soil management."[195] Third, international environmental law can be essential for financing soil protection efforts. Developing countries may be reluctant to undertake soil protection efforts having initial costs without pledges of funding from wealthier nations; and those wealthier nations, which would tend to benefit from spillover effects of soil protection, need to be influenced to dedicate that funding.[196] Fourth, comprehensive international environmental law regimes seem to create international pressure for participation and genuine action in a way that, say, non-governmental organizations' (NGOs') promotion of an issue cannot.[197]

As important as the initiation of national actions to protect soil is, so too is the shape those actions ultimately take. Issue visibility, coordinated action, availability of funding, and political pressure can all generically increase the stringency of national soil protections. An international environmental law regime should also, more specifically, aim to provide for the creation of worldwide baseline information and trend monitoring about the status of soil, and for globally agreed-upon measurement indicators, all of which are utterly lacking under the status quo.[198] An effective regime for soils should also effectively facilitate the international transfer of evolving technical and legal information about best practices. Countries and researchers should have focused fora and mechanisms to easily share their knowledge concerning economic and legal incentives, regulations of industrial or private practices, governmental decisionmaking and planning procedures, public works, property rights and land tenure regimes, and other legal and practical elements important for the protection of soils and their functions. Most concretely, an adequate international soil protection regime should set forth specific principles and practices to which participating countries must adhere. Given the diversity of soils and soil problems,

195. WYNEN, *supra* note 24, at 28–29.

196. HUNTER, SALZMAN, & ZAELKE, *supra* note 47, at 128–37 (discussing the "tragedy of the commons," "free riders," and ways to internalize environmental costs in international law).

197. *E.g.*, IASUS, WORLD SOILS AGENDA, *supra* note 8, at 46–47.

198. The first two of the nine elements in the IUSS World Soils Agenda are creating a detailed assessment of the status and trends of soil degradation at a global scale, and defining assessment indicators and implementing a long-term monitoring system. *Id.* at 6.

as well as the obvious legal and social diversity among countries' situations, the principles must allow sufficient flexibility for success.[199]

While international environmental law regimes operate primarily on nations, UN bodies and convention secretariats and other international institutions also manage large amounts of money and important projects, and their decisionmaking impacting soils must also be optimized through an adequate regime. Perhaps the most urgent issue with respect to these entities is integration. Nowhere, it seems, is decisionmaking for these entities structured and centralized so that individual decisions are encouraged to fully account for all externalities and downstream impacts on soil. Though protecting soil usually adds value in the areas of climate, biodiversity, long-term food and water security, and more,[200] the instruments and institutions set up to deal with each of these problems prioritize only the soils and soil functions most directly relevant to their target issues,[201] and therefore under-value soil in the grand scheme. For example, a single acre of soil in Country X may provide some economic value in carbon sequestration, some mainly non-overlapping economic value in the pharmaceutical potentials from rich biodiversity, some more economic value in long-term food security and sustainable agriculture, and yet more economic value in terms of water filtration,[202] but the individual instruments in the current regime do not tend to add these values all together when deciding where to direct funds and institutional attention[203]—even though all of these values are real and substantial, and have at least some global component. The synergies among soil's roles in the targeted ecological and social values of the conventions and other instruments are thus not captured under the current regime.

The shortcomings of the regime are so severe that they fall short of other internationally agreed-upon standards. The disparate form of the current medley of soil-relevant instruments is targeted for improvement by UNEP's Program for the Development and Periodic Review of Environmental Law for the First Decade of the Twenty-

199. *See generally* HANNAM & BOER, DRAFTING LEGISLATION, *supra* note 9.
200. *See supra* part II.
201. *See supra* part III; HANNAM & BOER, LEGAL FRAMEWORKS, *supra* note 9, at 81.
202. *See supra* part II.
203. *See supra* part III; HANNAM & BOER, LEGAL FRAMEWORKS, *supra* note 9, at 81.

First Century (Montevideo Program III), adopted in 2001.[204] The Montevideo Program III specifically calls for "harmonized approaches," "coordination of relevant institutions," and "international action to address gaps and weaknesses" in environmental law generally.[205] It also includes specific provisions addressing the need for improved soil regimes: UNEP is to "promote the development and implementation of laws and policies for enhancing the conservation, sustainable use and, where appropriate, rehabilitation of soils."[206] The substantive results of the current regime also contradict the Rio Declaration on Environment and Development.[207] The regime even fails what are arguably recognized general principles of international environmental law: it does not address the core role of soil in sustainable development, does not apply the precautionary principle, and allows states' soil policies to cause the kinds of serious international environmental harms discussed in part II of this note.[208] Of course, the increasingly dire real-world status of soil is the clearest indicator of inadequacy. Soil is simply being eroded and degraded faster than it can form, and people are already feeling the consequences.[209] And without sustainable soils, all of the other hard-earned progress people have made toward

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204. U.N. Env't Programme, *The Programme for the Development and Periodic Review of Environmental Law for the First Decade of the Twenty-First Century* 2 (Feb. 9, 2001), *available at* http://www.unep.org/law/PDF/GC22_2_3_add2_Montevideo%20III.pdf.

205. *Id.* at 6–7.

206. *Id.* at 11; *see also* HANNAM & BOER, LEGAL FRAMEWORKS, *supra* note 9, at 5–6 (noting that the objectives of the Montevideo Program guided UNEP's analysis of existing and prospective legal regimes for soil).

207. *See Rio Declaration on Environment and Development*, *supra* note 113. For example, failure to protect soil directly frustrates the Principle 3 definition of sustainable development, which states that "[t]he right to development must be fulfilled so as to equitably meet developmental and environmental needs of present and future generations." *Id.* Degradation of soil through agriculture and other human activities is certainly an "unsustainable pattern[] of production" that "States should reduce and eliminate" according to Principle 8. *Id.* The current regime also fails to prioritize the internalization of environmental costs, promoted by Principle 16. *Id.*

208. HUNTER, SALZMAN & ZAELKE, *supra* note 47, at 340–50 (quoting and discussing the International Court of Justice opinions in Gabcíkovo-Nagymaros Project (Hung. v. Slovk.), 1997 I.C.J. 1992 (Sept. 25), concerning sustainable development), 502–06 (discussing the obligation not to cause environmental harm, "generally considered a part of customary international law"), 513 (explaining the current debate about the legal status of the precautionary principle); *see also* SANDS, *supra* note 162, at 241 (explaining the responsibility not to cause environmental damage), 246–48 (explaining the status of the "principle of preventative action").

209. *See supra* part II.

countless other goals such as species protection and economic development will be undone in the long term.[210]

V. DIRT PATH FORWARD? PROSPECTS FOR MEANINGFUL CHANGE

A. Background: Calls for Change

The many serious inadequacies in the current international environmental regime regarding soils have seized the attention of both the soil science and international environmental law communities. These broad groups will both be essential for increasing the odds of meaningful improvements to the status quo as they continue to work together to press their cases to international decisionmakers and (to a somewhat lesser extent) to the public. They will also be invaluable in shaping and supporting resulting actions, though the groups' priorities and ambitions are not completely identical and must be balanced.

Soil scientists' interest in an international environmental law instrument to protect soil grew dramatically after the Rio Conference in 1992.[211] In 1998, the IUSS formed a working group to investigate the possibilities for such an instrument.[212] This working group, International Actions for the Sustainable Use of Soils (IASUS), proposed a nine-point "World Soils Agenda,"[213] which was unanimously endorsed and adopted by the General Assembly of the IUSS at their 2002 World Conference in Bangkok.[214] The agenda tasks include, inter alia, baseline assessment and monitoring, research and discussion, guidance for national governments, and inclusion of soil issues in development programs. The IUSS sees itself as potentially instrumental in most of these tasks.[215]

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210. *See id.*

211. IAN D. HANNAM, *Progress Towards an Improved International and National Legal Strategy for Sustainable Use of Soil: Partnership Between the Soil Science Community and the World Conservation Union*, *in* CONSERVING SOIL AND WATER FOR SOCIETY: SHARING SOLUTIONS 1, 1 (13th Int'l Soil Conservation Org. Conference, 2004).

212. *Id.*; *see also* IASUS, WORLD SOILS AGENDA, *supra* note 8, at 3 (noting that between 1998 and 2000, the focus of the working group expanded from a narrow emphasis on a UN convention to a broader examination of other potential global-level actions).

213. *See* IASUS, WORLD SOILS AGENDA, *supra* note 8, at 6–10.

214. *Id.* at 3.

215. *Id.* at 6–10. The tasks are incorporated with modification into IUCN's recommendations for national soil legislation. HANNAM & BOER, DRAFTING LEGISLATION, *supra* note 9, at 48.

On the international law side, also beginning in 1998, a European conference formulated and began circulating a concrete, comprehensive proposal (known as the "Tutzing Proposal") for a Soil Convention.[216] The introductory material to the draft Convention asserted that "there is an urgent need for internationally binding rules on the sustainable use of soils" and that "[t]he most appropriate instrument for this purpose is an international convention," like the UNFCCC or CBD, on which the draft was modeled.[217] In 1999, the International Conference on Land Degradation (ICLD) in Thailand also passed a resolution "seeking the introduction of an international soil conservation instrument."[218]

The Tutzing Proposal and the ICLD resolution spurred the IUCN's own resolution at its conference in Amman, Jordan in 2000, calling on its subsidiary Environmental Law Program (ELP) to "investigate the need for and feasibility of . . . an international instrument for the sustainable use of soils."[219] The ELP specialist group, allied with soil scientists, published two substantial documents. The first, published in 2002, broadly analyzed both national and international legal and institutional frameworks, finding (as one author summarized at a subsequent soil conference) that "[t]he existing [international law] instruments are insufficient as a framework for soil."[220] It recommended that higher levels of IUCN decisionmaking authority "select an appropriate option for an international instrument on the sustainable use of soils . . . and commence the development of a draft instrument."[221] The second document, published in 2004, provided concrete, targeted recommendations intended to be used by nations in drafting domestic soil legislation in the meantime.[222] The IUCN continues to investigate the optimal and most feasible legal solutions to worldwide soil

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216. HANNAM, *supra* note 211, at 1; *see also* MARTIN HELD ET AL., THE TUTZING PROJECT "TIME ECOLOGY," PRESERVING SOILS FOR LIFE: PROPOSAL FOR A "CONVENTION ON SUSTAINABLE USE OF SOILS" (1998).

217. HELD ET AL., *supra* note 216, at 3.

218. HANNAM, *supra* note 211, at 1; *see also* HANNAM & BOER, LEGAL FRAMEWORKS, *supra* note 9, at 6 (noting that the ICLD series arose from the Rio Conference in 1992 and comprises mainly soil scientists).

219. HANNAM & BOER, LEGAL FRAMEWORKS, *supra* note 9, at 4; *see also* HANNAM, *supra* note 211, at 1–2.

220. HANNAM, *supra* note 211, at 4.

221. HANNAM & BOER, LEGAL FRAMEWORKS, *supra* note 9, at xvi.

222. HANNAM & BOER, DRAFTING LEGISLATION, *supra* note 9.

problems.[223] Recent updates indicate that a Draft Protocol for the Conservation and Sustainable Use of Soils has been written and circulated among IUCN subgroups and at soil science meetings.[224]

The IUSS, Tutzing Conference, ICLD, and IUCN are far from the only focal points of discussion of international law regarding soils. Other soil conferences[225] and organizations[226] have investigated and promoted new international environmental law instruments regarding soil as well. While all agree with the IUCN that the status quo is inadequate, analysts disagree about what form any future international action should take.[227]

B. Considerations Shaping Future International Actions to Protect Soil

The declining status of Earth's soils and their functions imply that the need for *some* international action on soil is only growing, yet action can take many forms. Proponents of soil protection could consider a new binding soil convention, a new non-binding soil declaration or code of conduct, a soil-focused protocol to an existing treaty, an internationally-backed science and policy panel of experts, and myriad other potential improvements to the current international environmental law regime regarding soils. This note does not delve in detail into what such types of instruments or actions might look like or what particular legal, economic, or other elements they might or should include, because the range of possibilities is quite expansive.

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223. *See* HANNAM & BOER, LEGAL FRAMEWORKS, *supra* note 9, at 5; *see also* Int'l Union for Conservation of Nature, Soil, http://cms.iucn.org/about/work/programmes/environmental_law/elp_work/elp_work_issues/elp_work_soil/index.cfm (last visited Dec. 2, 2008).

224. INT'L UNION FOR CONSERVATION OF NATURE, CEL SPECIALIST GROUPS MEETING MINUTES, JUNE 1–2, 2006, 7–8, *available at* http://cmsdata.iucn.org/downloads/cel03a_sgmeetingfozjune06.pdf; *see also* Ingrid Barnsley & Julie Taylor, *International Forum on Soils, Society and Global Change Bulletin*, INT'L INST. FOR SUSTAINABLE DEV. REPORTING SERVS., Sept. 7, 2007, at 8–12, *available at* http://www.iisd.ca/download/pdf/sd/ymbvol144num1e.pdf.

225. For example, in 1999, the 10th International Soil Conservation Organization Conference recommended a global soil convention in order to best "mak[e] and put[] into practice a strong statement" for soil protection. ISCO, ACTION AGENDA: RECOMMENDATIONS FROM STRUCTURED DISCUSSIONS HELD AT ISCO 10, MAY 23–28, 1999, *available at* http://www.tucson.ars.ag.gov/isco/index_files/Page327.htm.

226. *E.g.*, the Danish Association for Organic Agriculture sponsored the study by Wynen, *supra* note 24, at 1.

227. *See, e.g.*, BERNARD VANHEUSEN & HRAFNHILDUR BRAGADÓTTIR, INT'L FORUM ON SOILS, SOC'Y AND GLOBAL CHANGE, REPORT OF WORKING GROUP 5 ON CAPACITY BUILDING APPROACHES IN LEGISLATIVE AND POLICY DEVELOPMENT TECHNIQUES 2 (2007), *available at* http://landbunadur.rala.is/landbunadur/wglgr.nsf/key2/results (noting discussion and disagreement within working group).

However, before examining the prospects for future international actions in light of these broad categories, it is useful to note a few of the many interrelated considerations bearing on all of them. These considerations include the relative costs of any given strategy, and the degree to which the strategy can overcome problems relating to soil's low visibility and high complexity.

New international law frameworks, in general, necessitate significant costs, in terms of money, time, attention, and even political capital, to draft and maintain.[228] Revisions to existing regimes, too, take a substantial amount of collective will to negotiate and adopt. However, costs differ depending on the degree of change, the locus of change (e.g., within or among institutions), the kinds of issues tackled, the number of stakeholders, the degree to which the interests of stakeholders conflict, the levels of binding obligations on countries, the degree of scientific uncertainty that must be overcome, and innumerable other factors.[229]

Another urgent consideration is the need for far greater visibility of the issue of global soil degradation, particularly among the public.

> There is an abundance of literature on problems with soil health written by scientists and lay people, but the public is generally not aware of the problems and the consequences. To date, soil problems haven't captured the imagination of the public as have other topics, such as climate change, ozone depletion or the extinction of whales or elephants. Although salinity and dust storms are visible enough, there is no perception of crisis amongst the public in most developed countries. Nor do events such as storms or floods occur frequently enough to be perceived as a permanent crisis.[230]

The masking of soil degradation effects by the substitution of extra capital or labor also decreases the effects' visibility.[231] What's more, with urbanization continuing to increase and over half of the world's population now living in urban areas,[232] fewer people work with the land and soil, compounding the lack of appreciation of soil's

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228. *See* WYNEN, *supra* note 24, at 11–14.

229. *See generally id.* (demonstrating extensive feasibility analyses of several different options).

230. *Id.* at 27.

231. *Id.*

232. Associated Press, *U.N.: World Population Increasingly Urban, Report Predicts Half The World's People Will Live In Cities By Year's End, 70 Percent By 2050*, CBSNEWS.com, Feb. 26, 2008, http://www.cbsnews.com/stories/2008/02/26/world/main3880698.shtml.

essential functions in people's daily lives.[233] The low issue salience among the public and decisionmakers cuts two ways. It makes any new efforts less likely, while on the other hand, it also highlights the need to discuss and promote the kinds of ambitious actions most likely to provide the greatest increase in soil's visibility as an issue of international environmental concern.

The extent to which any given strategy can effectively confront the diversity and complexity of soils and soil issues also bears on the strategy's initial feasibility and, if chosen, its design. Though this note has argued that a comprehensive approach is needed to account for all of the global impacts of soils and their functions, it is also the case that solutions would have to be tailored to local soils, local problems, and local conditions.[234] Complexity could be addressed in any given strategy (or via the choice among strategies) by either keeping commitments or goals more vague, or by multiplying and fine-tuning the legal or other elements of the instrument or approach. A related issue is uncertainty; while the general reality of extensive soil degradation is a matter of scientific consensus, there is less agreement about particular causes and solutions.[235]

C. Possible Actions: Pros and Cons

1. New Binding Soil Convention

According to IUCN analysts, an international soil regime should convey principles including "[a] right to an ecologically healthy soil environment" and "[a] right to expect the world community as a whole, and respective States, to protect and conserve soil for the benefit of present and future generations."[236] In their view, the principles should be fleshed out by specific legal elements to "create an obligation to conserve soil at the global level," including elements for global soil status monitoring and reporting using global indicators, for providing knowledge and implementation guidance for developing countries, for linkages to other relevant international environmental laws, and for "procedures for the global community to take action against States who use their soil in an ecologically

233. Interview with Daniel deB. Richter, Jr., Professor, Nicholas School of the Environment and Earth Sciences at Duke University, in Durham, NC (Apr. 8, 2008).

234. *E.g.*, WYNEN, *supra* note 24, at 13, 30.

235. *See id.* at 30–31.

236. HANNAM & BOER, LEGAL FRAMEWORKS, *supra* note 9, at 77.

unsustainable manner."[237] These principles and goals, particularly in their emphasis on global *obligations*, suggest that a new, binding soil convention would be the ideal solution for the problems facing soil, and that such an instrument should be striven for if at all feasible. However, since an entirely new soil convention would be the most dramatic change from the current regime, it faces the highest barriers to feasibility.

A soil convention could theoretically impose obligations at several levels. A regulatory and enforcement-oriented approach targeting outcomes, analogous to the Kyoto Protocol,[238] would be the least feasible. While binding requirements might best avoid collective action and race-to-the-bottom problems among States, they would simply be too burdensome. Soil degradation is difficult to monitor for that kind of enforcement, and does not yet have a coherent baseline against which progress can be measured. Soil degradation also involves too many dispersed actors with no major "upstream" sources of the problem, like electric utilities in the climate change context. The dispersed actors would be difficult to regulate, due not only to their numbers, but also to entrenched attitudes about local land use control.[239] However, a more capacity-building approach, analogous to the UNCCD and CBD, while still binding, could be at least plausible enough to merit discussion. Some soil science organizations have strongly urged a binding convention,[240] and a detailed draft soil convention, the Tutzing Proposal, has already been drafted and discussed.[241] If nothing else, discussing a soil convention may make measures seem more viable and urgent.[242]

Nevertheless, significant structural impediments to any new binding soil convention could mean that focusing on promoting this form of instrument would be futile, and could even prove to be a

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237. *Id.*

238. *See* Kyoto Protocol, *supra* note 141.

239. *See* WYNEN, *supra* note 24, at 28.

240. *See, e.g.*, Barnsley & Taylor, *supra* note 224, at 11 (noting a more recent soil science community recommendation for developing a binding instrument).

241. The Tutzing Proposal is no longer available in English online. It has perhaps been superseded in international discussions by the IUCN committee's draft Protocol. *See supra* note 224 and accompanying text.

242. *See, e.g.*, Nathan J. Russell, *An Introduction to the Overton Window of Political Possibilities*, MACKINAC CTR. FOR PUB. POLICY, Jan. 4, 2006, http://www.mackinac.org/article.aspx?ID=7504 (discussing the "Overton Window" concept in political theory).

distraction from more incremental progress.[243] Drafting an entirely new and binding soil convention would almost certainly impose the highest negotiating costs of any strategy. Soil's low issue visibility, too, hits hardest against a new soil convention, because while scientific consensus can drive the refininement of existing instruments and institutions, new conventions (partly due to their expense) are more often driven by public concern.[244] In investigating the viability of a UN soil convention in light of these barriers and others, Dr. Els Wynen, an Australian researcher and economist, conducted interviews in 2000–2001 with individuals (not in their official capacities) from a range of UN organizations, convention secretariats, and other international and national organizations, to gauge their attitudes regarding a new convention. She reported a distinct "lack of enthusiasm to institute another convention."[245] Most tellingly, representatives from the FAO and UNEP, the UN organizations that would be most instrumental in any soil convention, were "adamant that the idea of a soil convention per se should be put to rest."[246]

2. New Non-Binding Instrument

An instrument could be structured as a "Declaration" or "Charter," which could primarily serve the goal of awareness-raising and lead to some voluntary efforts by member countries to structure their national policies to comply with the instrument's principles. The IUCN's soil policy analysts appeared open to this idea, saying "there [was] a good range of opportunities within the scope of binding and non-binding environmental law frameworks."[247] Similarly, Dr. Wynen proposes that a Code of Conduct, as a joint effort between the FAO, UNEP, and other international agencies, would be the best option to protect the world's soil. According to Dr. Wynen, a Code of Conduct would have to be accepted by the relevant committees of the involved agencies, comprising representatives from a range of countries. In form, it could promote best practices, point out institutional gaps and problems, and build on Agenda 21.[248]

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243. *See* HUNTER, SALZMAN & ZAELKE, *supra* note 47, at 1193–94 (discussing some environmentalists' opposition to efforts for a binding forest protection convention after the 1992 Forest Principles because they feared it could entrench a "least common denominator" approach and lead to other threats to progress).

244. WYNEN, *supra* note 24, at 10–11.

245. *Id.* at 33–34.

246. *Id.*

247. HANNAM & BOER, LEGAL FRAMEWORKS, *supra* note 9, at 81.

248. WYNEN, *supra* note 24, at 38–41.

Non-binding instruments certainly have their advantages. Perhaps most importantly, it is easier for governments to agree on the terms of non-binding instruments.[249] Non-binding agreements can also embrace a broader range of actors besides nations.[250] A non-binding soil instrument could increase the visibility of soil issues, "serve[] the purpose of information-sharing and . . . coach[] governments to install and implement legislation which prevents the worst effects of soil degradation, if nothing else."[251] But while their greater ease is valuable, it obviously comes at the expense of the instruments' effectiveness. After all, "soft law measures concerning soils have been in place for a considerable period but have not led to sufficient protection of soils against erosion, compaction, sealing, contamination and other soil threats."[252] Then again, at least considering a prospective non-binding instrument rather than existing soft law on soil, the categories "binding" and "non-binding" in international law may not be so distinct. "Member States' delegations approach the negotiation of [soft law] provisions with extreme care, just as if they were negotiating treaty provisions. Such behavior suggests that States do not view such 'soft' recommendations as devoid of at least some political significance, if not, in the long term, any legal significance."[253] Thus, while pursuit of a non-binding instrument might disappoint soil science organizations,[254] it could significantly increase soil protection, in addition to potentially being an incremental step toward increasingly concrete measures in the future.

3. Protocol to an Existing Convention

Devising a soil protection protocol to an existing international environmental law instrument, such as the CBD or UNCCD, could potentially meet the IUCN authors' requirements for an adequate international soil regime[255] almost as well as a separate binding treaty. A protocol could take a variety of forms, but would depend upon the

249. *See* HUNTER, SALZMAN & ZAELKE, *supra* note 47, at 357 (citing Pierre-Marie Dupuy, *Soft Law and the International Law of the Environment*, 12 MICH. J. INT'L L. 420, 430 (1991)).

250. *Id.* at 353.

251. WYNEN, *supra* note 24, at 38.

252. VANHEUSEN & BRAGADÓTTIR, *supra* note 227, at 3.

253. HUNTER, SALZMAN & ZAELKE, *supra* note 47, at 356 (quoting Dupuy, *supra* note 249, at 429).

254. *E.g.*, VANHEUSEN & BRAGADÓTTIR, *supra* note 227; Barnsley & Taylor, *supra* note 224, at 11.

255. *See supra* notes 236–38 and accompanying text.

parties to the existing convention.[256] Because of this dependence, a main problem with using the protocol approach is that "generally, the text of an existing convention is rather clear as far as the mandate is concerned. Widening it is not easy, and would need very strong support if it were to be implemented."[257] And because none of the existing Rio Conventions addresses all of the major soil issues together, significant "widening" would be necessary to achieve the kind of comprehensiveness deemed necessary by the IUCN and others.[258] Conceivably, some degree of comprehensiveness could hinge on the CBD's ecosystem approach,[259] but this would still seem to deemphasize many urban and some agricultural soil problems, and also fail to fully account for soil's role in the global carbon cycle.[260]

Despite these difficulties, a soil protocol appears to be the most favored approach. Many of the international agency stakeholders interviewed by Dr. Wynen in 2001 expressed clear support for a protocol to the CBD or UNCCD, in particular emphasizing that "expansion of [these] conventions . . . should be done in an explicit way . . . and not implicitly as it is mainly done now."[261] A protocol to the CBD, in particular, is seen by some in the soil science community as a worthwhile focus of discussion.[262] Most concretely, as mentioned above, the IUCN is working on a draft protocol and has been seeking input from the soil science and policy communities.[263]

4. Intergovernmental Panel on Land and Soil, or Other International Task Force

An International or Intergovernmental Panel on Land and Soils (IPLS), analogous to the 2007 Nobel Prize-winning Intergovernmental Panel on Climate Change (IPCC)[264] that has been so forceful in the climate change debates, could be established to

256. HANNAM & BOER, LEGAL FRAMEWORKS, *supra* note 9, at 75.

257. WYNEN, *supra* note 24, at 38; *see also* Vanheusen & Bragadóttir, *supra* note 227, at 3 (noting the reluctance of CCD and CBD to significantly revise their texts).

258. WYNEN, *supra* note 24, at 38.

259. *See id.* at 19, 35; HANNAM & BOER, LEGAL FRAMEWORKS, *supra* note 9, at 63–64.

260. *See supra* part II.B.4.

261. WYNEN, *supra* note 24, at 35.

262. VANHEUSEN & BRAGADÓTTIR, *supra* note 227, at 2.

263. *See, e.g.*, Barnsley & Taylor, *supra* note 224, at 8–12; VANHEUSEN & BRAGADÓTTIR, *supra* note 227.

264. Press Release, Norwegian Nobel Comm., The Nobel Peace Price for 2007 (Oct. 12, 2007), http://nobelprize.org/nobel_prizes/peace/laureates/2007/press.html (last visited Dec. 2, 2008).

provide credible scientific and technical advice to international policymakers. An IPLS has already been proposed (though unsuccessfully) at a COP of the UNCCD.[265] Since the IPCC predated the UNFCCC by four years,[266] the Kyoto Protocol by nine years,[267] and arguably also predated wide public consciousness of the seriousness of global warming by some number of years as well, an IPLS could at least hypothetically lay the groundwork for increasing issue salience and for a future soil convention or protocol. An IPLS would also advance the goals of issue visibility, development of appropriate and agreed-on criteria and indicators, and centralized collection and distribution of baseline data and effective soil protection strategies. In a slight twist on this idea, the IASUS working group of the IUSS "aims to create an advisory body for governments and other stakeholders on soil and land issues. This body—to be named the 'World Soils Council'—would seek to serve as the major scientific and advisory voice . . . in international policy debates and processes."[268] The formation of the panel by the IUSS and affiliates would essentially be an end-run around having to initiate the kinds of international, UN-centered actions that created the IPCC, as the IASUS, for its part, concluded in 2006 that "political support for [an IPLS] seems to be minimal at this time."[269]

5. Improvements to Existing Instruments and Institutions

Implementation of all of the existing international environmental instruments should be strengthened and better funded, and soil protection should receive some of any increased attention and funding. There is enormous room for creativity in fully exploiting the potential of existing instruments to protect soils and their functions. For example, participants at the fall 2007 International Forum on Soils, Society and Global Change recommended "a soils 'synergies assessment report'" and "a voluntary certification scheme for project proposals that would indicate when a project jointly serves the aims

265. WYNEN, *supra* note 24, at 20; IASUS, SOILS ON THE GLOBAL AGENDA, *supra* note 8, at 56; *see also* HANNAM & BOER, LEGAL FRAMEWORKS, *supra* note 9, at 74 n.187 (opining that something like the IPLS "should be provided for in an international soil instrument"); HANNAM & BOER, DRAFTING LEGISLATION, *supra* note 9, at 32.

266. UNFCCC, *supra* note 140.

267. Kyoto Protocol, *supra* note 141.

268. IASUS, SOILS ON THE GLOBAL AGENDA, *supra* note 8, at 55.

269. *Id.* at 56. An IPLS had, however, been proposed as one of the nine elements of the World Soils Agenda. IASUS, WORLD SOILS AGENDA, *supra* note 8, at 8.

of all three [Rio] conventions."[270] Other international efforts have already begun, including FAO's efforts to add a soil focus to the CBD,[271] the UNCCD staff's efforts to add a soil focus to the UNFCCC,[272] and UNEP's inclusion of soil law reviews in its Montevideo Program III.[273] Furthermore, IUCN's and IUSS' efforts to reach out to countries' environmental ministries to help optimize their domestic soil protection programs are ongoing, and since so many national and sub-national laws are lacking in a comprehensive soil focus or up-to-date practices,[274] focusing on individual countries as well as on the international level could accomplish a great deal.

VI. CONCLUSION

Soil's lowly, dispersed status on the international legal scene is rooted in a widespread lack of appreciation—outside of the soil science community, at least—for soil's importance in sustaining globally essential ecological and social functions, and for the extent of the threats facing soil and its ability to fulfill these functions.[275] This note has attempted to justify and provide a baseline for greater discussion of soil issues in the legal community. It is clear that the current regime is inadequate to protect humanity's interests in soil,[276] but more voices are needed to come together and decide what the future will bring. For the good of present and future generations in light of present knowledge and uncertainties, discussion of soil protection strategies should keep options open while working steadily and immediately for incremental improvements in the environmental and legal status quo. It is also essential to maintain a focus on all of soil's functions together, and to look for ways to increase the harmony and comprehensiveness of the current legal regimes in any ways possible. The soil science and international law communities must learn to communicate much more freely and productively. But for this kind of discussion and effort to become more plausible, many more people will need to begin really taking the time to be grateful for all that soil does for us. Invigorating a sense of awe toward the diverse, balanced, cyclical, yet fragile, nature of the Earth's dirt is a

270. Barnsley & Taylor, *supra* note 224, at 9.
271. *See supra* notes 137–39 and accompanying text.
272. *See supra* note 152 and accompanying text.
273. *See supra* notes 204–06 and accompanying text.
274. *See* HANNAM & BOER, LEGAL FRAMEWORKS, *supra* note 9, at 35–42.
275. *See supra* notes 230–34 and accompanying text.
276. *See supra* part IV.

tall order, to be sure, especially in this modern and urbanizing world. Nonetheless, the growing human population of the future may well depend on this generation's ability to do so, and then to put that increased sense of awe and appreciation into concrete actions.