

BIODIVERSITY AND BIOTECHNOLOGY: A MISUNDERSTOOD RELATION*

*Jim Chen***

2005 MICH. ST. L. REV. 51

TABLE OF CONTENTS

I.	A BIOLOGICALLY BIFURCATED BIOGRAPHY OF “BIOPIRACY”	53
II.	DARWIN’S DUAL DYNAMIC	68
	A. Phenotypes and Genotypes	69
	B. Genes and Memes	73
III.	“PHARMS” AND FARMERS	86
IV.	WHAT CROWS KNOW: A STORY OF DEVOTION TO INNOVATIVE FREEDOM	99

Biodiversity and biotechnology, according to received wisdom, can scarcely coexist. The global south is home to most of earth’s threatened and endangered species, while the global north holds the capital and technology needed to develop this natural wealth. The south argues that intellectual property laws enable pharmaceutical companies and seed breeders in the industrialized north to commit biopiracy. Advocates for less developed countries urge legal parity for each side’s source of value, either through a reduction in the protection accorded conventional forms of intellectual property or through formal recognition of traditional knowledge within the World Trade Organization’s (WTO) accord on Trade-Related Aspects of Intellectual Property Rights (TRIPS).¹ By contrast, the United States has

* Cf. RICHARD A. POSNER, *LAW AND LITERATURE: A MISUNDERSTOOD RELATION* (1988).

** Associate Dean for Faculty and James L. Krusemark Professor of Law, University of Minnesota Law School <chenx064@maroon.tc.umn.edu>. This paper profited from presentations at the University of Florida and the University of Illinois, in addition to Michigan State University’s symposium, *Intellectual Property, Sustainable Development, and Endangered Species: Understanding the Dynamics of the Information Ecosystem*. Keith Aoki, Dan L. Burk, Thomas F. Cotter, Gil Grantmore, Gregory Graff, Mark Janis, Dennis S. Karjala, Jay P. Kesan, Christine A. Klein, Ruth Gana Okediji, Srividhya Ragavan Tirunelveli, and Peter K. Yu provided helpful comments. Firooz Basri, Elizabeth Maxeiner, and Alison Stover supplied very capable research assistance. Special thanks to Kathleen Chen.

1. Agreement on Trade-Related Aspects of Intellectual Property Rights, Apr. 15, 1994, Annex 1C, 33 I.L.M. 1197 (1994), *reprinted in* WORLD TRADE ORGANIZATION, *THE RESULTS OF THE URUGUAY ROUND OF MULTILATERAL TRADE NEGOTIATIONS* 365 (1994) [hereinafter TRIPS].

characterized the United Nations Convention on Biological Diversity² as a threat to the global life sciences industry in general and to American seed breeders and pharmaceutical companies in particular. Both sides magnify the significance of the dispute, having reached an apparent consensus that commercial exploitation of genetic resources holds the key to biodiversity conservation.

I contest these conventional views of the relationship between biodiversity and biotechnology. Both sides of the debate have overstated the significance of bioprospecting. Commercial development aids biodiversity primarily by overcoming perverse economic incentives to consume scarce natural resources that may turn out to have greater value from a global, long-term perspective. It is simply erroneous to frame the issue as whether intellectual property in the abstract can coexist with the international legal framework for preserving biodiversity. I intend to expose this fallacy through the application of three conceptual filters: genotypes versus phenotypes, genes versus memes, and pharmaceutical versus agricultural applications of biotechnology.

To be sure, the notion of intellectual property is elastic enough to embrace all of the intangible assets at stake, including raw genetic resources, advanced agricultural and pharmaceutical research, and the ethnobiological knowledge that often transforms a locally useful organism into a globally valued application of biotechnology. It will not do, however, merely to acknowledge that intellectual property *can* be reshaped to embrace ethnobiological know-how and other forms of traditional knowledge. Whether traditional knowledge *should* be treated as an independent and universally accepted form of intellectual property presents an altogether distinct question. I conclude that ethnobiological knowledge should not be given proprietary status. As a general rule, intellectual property should be recognized only when it would spur innovation. With respect to biological knowledge already diffused within a traditional community, intellectual property confers no additional incentive to invent or discover. These ideas therefore belong in the global public domain.

2. United Nations Conference on Environment and Development: Convention on Biological Diversity, June 5, 1992, 31 I.L.M. 818 [hereinafter CBD].

I. A BIOLOGICALLY BIFURCATED BIOGRAPHY OF “BIOPIRACY”

The putative conflict between biodiversity and biotechnology arises from a fundamental difference in factor endowments.³ The global north is rich in financial capital and industrial technology but poor in genetic resources. The global south is the precise opposite: biologically rich but economically poor. This split fuels the south’s traditional attack on northern conceptions of intellectual property.⁴ The United Nations Environment Programme has succinctly summarized the south’s complaint: “[Intellectual property rights] systems [either] encourage the appropriation of [traditional] knowledge for commercial use without the fair sharing of benefits, or . . . violate indigenous cultural precepts by encouraging the commodification of such knowledge.”⁵

Read carefully, the southern complaint embodies two distinct objections. First, northern notions of intellectual property have allegedly deprived the south of its fair share of developmental benefits. Second, the northern understanding of intellectual property purportedly cannot coexist with the communal systems of knowledge at the heart of many southern cultures. Whether couched as biopiracy or as an affront to the autonomy of developing nations, the failure to reconcile southern claims to sovereignty over biological

3. See, e.g., ROBERT S. PINDYCK & DANIEL L. RUBINFELD, MICROECONOMICS 597-99 (2d ed. 1992) (defining comparative advantage in terms of superior transportation, natural resources, and labor); Robert E. Hudec, *Differences in National Environmental Standards: The Level-Playing-Field Dimension*, 5 MINN. J. GLOBAL TRADE 1, 21-22 (1996) (defining “factor endowments” as “[n]atural advantages such as the fertility of soil, climate, rainfall, available raw materials, and transportation facilities such as deep harbors and navigable rivers”); cf. STRATEGIC TRADE POLICY AND THE NEW INTERNATIONAL ECONOMICS 7-8 (Paul R. Krugman ed., 1986) (distinguishing between natural “factor endowments” and “human capital”). See generally ROBERT J. CARBAUGH, INTERNATIONAL ECONOMICS 17-50 (5th ed. 1995); Christopher R. Drahozal, *On Tariffs v. Subsidies in Interstate Trade: A Legal and Economic Analysis*, 74 WASH. U. L.Q. 1127, 1142-50 (1996).

4. See generally Ruth Gana Okediji, *Copyright and Public Welfare in Global Perspective*, 7 IND. J. GLOBAL LEGAL STUD. 117 (1999); J.H. Reichman, *Intellectual Property in International Trade: Opportunities and Risks of a GATT Connection*, 22 VAND. J. TRANSNAT’L L. 747 (1989), reprinted in INTERNATIONAL INTELLECTUAL PROPERTY LAW 272 (Anthony D’Amato & Doris Estelle Long eds., 1997).

5. United Nations Environment Programme, *The Impact of Intellectual Property Rights Systems on the Conservation and Sustainable Use of Biological Diversity and on the Equitable Sharing of Benefits from Its Use* 32, U.N. Doc. No. UNEP/CBD/COP/3/22 (1996); accord, e.g., JOSEPHINE AXT ET AL., BIOTECHNOLOGY, INDIGENOUS PEOPLES, AND INTELLECTUAL PROPERTY RIGHTS 58 (1993).

resources with northern intellectual property interests may, at the very least, disappoint aspirations expressed in the international law of human rights.⁶

Insofar as the southern complaint alleges a failure to divide benefits more equitably, the real objection does not lie with the recognition of intellectual property in developed nations, but rather with the richer countries' failure to share the spoils. Srividhya Ragavan Tirunelveli, for instance, criticizes the Biodiversity Convention's failure "to ensure compensation and rights over . . . indigenous material[s]" and the Convention's implicit assumption that "the most downtrodden societies of the world should provide" genetic material "for the benefit of 'mankind.'"⁷ The developing world, to put it bluntly, expects minimal gain from a strengthening of existing intellectual property laws.⁸

In a legal regime more sympathetic to its grievances, the south would demand fair compensation for its contributions to the developed world's life sciences industries. The north extracted much of the south's biological bounty when few barriers to exploitation existed. Having built an economic and political empire from those resources, the north then fashioned a regime of intellectual property rights that foreclosed the very sort of free exchange that facilitated its development.⁹ Worst of all, this bait-and-switch maneuver now enables the north to gouge the south on the sale of finished products derived from the south's biological resources.¹⁰ The United States and its fellow

6. See Rosemary J. Coombe, *Intellectual Property, Human Rights and Sovereignty: New Dilemmas in International Law Posed by the Recognition of Indigenous Knowledge and the Conservation of Biodiversity*, 6 IND. J. GLOBAL LEGAL STUD. 59 (1998); Kara H. Ching, *Indigenous Self-Determination in an Age of Genetic Patenting: Recognizing an Emerging Human Rights Norm*, 66 FORDHAM L. REV. 687 (1997); Laurence R. Helfer, *Adjudicating Copyright Claims Under the TRIPs Agreement: The Case for a European Human Rights Analogy*, 39 HARV. INT'L L.J. 357 (1998). See generally Ruth L. Gana, *The Myth of Development, the Progress of Rights: Human Rights to Intellectual Property and Development*, 18 LAW & POL'Y 315 (1996).

7. Srividhya Ragavan, *The Global South as the Key to Biodiversity and Biotechnology* A Reply to Professor Chen, 32 ENVTL. L. REP. 10,358, 10,359 (2002).

8. See EDITH T. PENROSE, *THE ECONOMICS OF THE INTERNATIONAL PATENT SYSTEM* 116-17 (1951); Dru Brenner-Beck, *Do as I Say, Not as I Did*, 11 UCLA PAC. BASIN L.J. 84, 84 (1992) (arguing that benefits from an intellectual property regime accrue only after a nation has attained a threshold of development); Kevin W. McCabe, *The January 1999 Review of Article 27 of the TRIPs Agreement: Diverging Views of Developed and Developing Countries Toward the Patentability of Biotechnology*, 6 J. INTELL. PROP. L. 41, 56-57 (1998); Arvind Subramanian, *The International Economics of Intellectual Property Right Protection: A Welfare-Theoretic Trade Policy Analysis*, 19 WORLD DEV. 945, 947-52 (1991).

9. See Nadia Natasha Seeratan, Comment, *The Negative Impact of Intellectual Property Patent Rights on Developing Countries: An Examination of the Indian Pharmaceutical Industry*, 3 SCHOLAR 339, 383 (2001).

10. See David S. Tilford, *Saving the Blueprints: The International Legal Regime for*

northern countries have purportedly “engaged in unfair [trade] practices” by “freely tak[ing] the biological diversity of the Third World to spin millions of dollars of profits, none of which [has] been shared with Third World countries, the original owners of the germ plasm.”¹¹ The story is the traditional agrarian complaint of buying at retail and selling at wholesale played out on a global stage.¹²

The south’s supporters have derided the north’s practices as “biopiracy,” an insidious channel for further economic exploitation, or even the *de facto* reimposition of colonial dominion.¹³ Such harsh rhetoric echoes the passions of the larger war against globalization, particularly the debate over potential conflicts between liberalized trade and environmental protection.¹⁴ The “seemingly narrow and unusual” question of how, if at all, to accommodate traditional knowledge within conventional systems of intellectual property has become emblematic of larger and more contentious “question[s] of economic relations between developing and developed countries” and “between the control and structure of global and regional marketplaces.”¹⁵ For example, “the indigenous peoples of Asia” allegedly regard “the intellectual property rights system . . . not only [as] a very new concept but . . . also [as] very western.”¹⁶

Plant Resources, 30 CASE W. RES. J. INT’L L. 373, 377 (1998) (arguing that the citizens of less developed countries often must purchase goods that wealthier countries developed through plant genetic resources provided without charge by developing countries).

11. VANDANA SHIVA, *MONOCULTURES OF THE MIND: PERSPECTIVES ON BIODIVERSITY AND BIOTECHNOLOGY* 80 (1993).

12. See GILBERT C. FITE, *AMERICAN FARMERS: THE NEW MINORITY* 32 (1981) (“[F]armers bought at retail and sold at wholesale.”).

13. See, e.g., VANDANA SHIVA, *BIOPIRACY: THE PLUNDER OF NATURE AND KNOWLEDGE* (1997); Keith Aoki, *Neocolonialism, Anticommons Property, and Biopiracy in the (Not-So-Brave) New World Order of International Intellectual Property Protection*, 6 IND. J. GLOBAL LEGAL STUD. 11 (1998); Craig D. Jacoby & Charles Weiss, *Recognizing Property Rights in Traditional Biocultural Contribution*, 16 STAN. ENVTL. L.J. 74, 89-91 (1997); Lakshmi Sarma, Note, *Biopiracy: Twentieth Century Imperialism in the Form of International Agreements*, 13 TEMP. INT’L & COMP. L.J. 107 (1999); Laurie Anne Whitt, *Indigenous Peoples, Intellectual Property and the New Imperial Science*, 23 OKLA. CITY U. L. REV. 211 (1998).

14. See Jim Chen, *Globalization and Its Losers*, 9 MINN. J. GLOBAL TRADE 157, 183-93 (2000); Jim Chen, *Epiphytic Economics and the Politics of Place*, 10 MINN. J. GLOBAL TRADE 1 (2001); Jim Chen, *Pax Mercatoria: Globalization as a Second Chance at “Peace for Our Time,”* 24 FORDHAM INT’L L.J. 217 (2000).

15. Shubha Ghosh, *Traditional Knowledge, Patents, and the New Mercantilism (Part I)*, 85 J. PAT. & TRADEMARK OFF. SOC’Y 828, 832 (2003).

16. United Nations Development Programme Consultation on the Protection and Conservation of Indigenous Knowledge (Feb. 24-27, 1995), at <http://users.ox.ac.uk/~wgrtr/sabah.htm>.

The south's second and more broadly gauged attack takes aim at the very notion of intellectual property. The northern conception of intellectual property, so the argument goes, does not suit the communally acquired and shared nature of ethnobiological knowledge.¹⁷ The developing countries of the global south purportedly exalt gift-giving and other communitarian norms over the market-based ethos of the capitalistic north.¹⁸ Such communal norms are presumably strongest among people "who are regarded as indigenous on account of their descent from the populations which inhabited [their] country . . . at the time of conquest or colonisation . . . and who . . . retain some or all of their own social, economic, cultural and political institutions."¹⁹ By contrast, "[d]eveloped countries" allegedly "have a eurocentric, individualistic understanding of property that 'ignores the collective labor of generations.'"²⁰ Privileging northern views of intellectual property allegedly impairs the "vital role" of "[i]ndigenous people and their communities," derived from "their knowledge and traditional practices," "in environmental management and development."²¹ The divine status of the natural world in some indigenous cultures²² stands in stark contrast with what is at best the

17. See, e.g., JAMES BOYLE, SHAMANS, SOFTWARE, AND SPLEENS: LAW AND THE CONSTRUCTION OF THE INFORMATION SOCIETY 141 (1996); Aoki, *supra* note 13, at 46; Coombe, *supra* note 6, at 87; Alan S. Gutterman, *The North-South Debate Regarding the Protection of Intellectual Property Rights*, 28 WAKE FOREST L. REV. 89, 122 (1993); Lara E. Ewens, Note, *Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds*, 23 B.C. INT'L & COMP. L. REV. 285, 304-05 (2000); Melissa L. Sturges, Note, *Who Should Hold Property Rights to the Human Genome? An Application of the Common Heritage of Humankind*, 13 AM. U. INT'L L. REV. 219 (1997).

18. See generally, e.g., MARCEL MAUSS & MARY DOUGLAS, *THE GIFT: THE FORM AND REASON FOR EXCHANGE IN ARCHAIC SOCIETIES* (W.D. Halls trans., 1950); Timothy L. Fort & James J. Noone, *Gifts, Bribes, and Exchange: Relationships in Non-Market Economies and Lessons for Pax E-Commercia*, 33 CORNELL INT'L L.J. 515 (2000).

19. International Labour Organization: Convention Concerning Indigenous and Tribal Peoples in Independent Countries, June 27, 1989, art. 1(b), 28 I.L.M. 1382, 1385 (defining "indigenous peoples").

20. Sarma, *supra* note 13, at 117 (quoting James O. Odek, *Bio-Piracy: Creating Proprietary Rights in Plant Genetic Resources*, 2 J. INTELL. PROP. L. 141, 154 (1994)).

21. United Nations Conference on Environment and Development: Rio Declaration on Environment and Development, June 14, 1992, princ. 22, 31 I.L.M. 874, 880 [hereinafter Rio Declaration].

22. Cf., e.g., JAMES S. OLSON & RAYMOND WILSON, *NATIVE AMERICANS IN THE TWENTIETH CENTURY* 16 (1984) (describing some Native Americans' use of soft moccasins as motivated by a desire to avoid harming the earth-mother).

ambiguous place of environmental advocacy within the Christian tradition.²³ In this sense indigenous cultures are “environmentally friendly”) “not just green,” but “dark green” in that they require their members “to live entire lives which accord as much respect to natural things as to” humans.²⁴ At least one critic argues that indigenous cultures provide the “inspiration” for “an ecological world-view” by showing that “the overriding goal of the behaviour pattern of an ecological society must be to preserve the critical order of the natural world.”²⁵

Nor is southern hostility to intellectual property limited to indigenous populations. Elements of mainstream society have also taken up the cause. For instance, the Catholic Church in Brazil has condemned a new law allowing patents on genetically modified organisms, while intellectual property holders in Peru must pay enforcement and prosecution costs.²⁶ Among developing nations, perhaps India has taken the most aggressive stance against what it considers the postcolonialist commodification of its natural heritage.²⁷ The conflict pits north versus south directly, obscuring potentially deeper social divisions within less developed countries.

Neither prong of the southern assault on intellectual property withstands careful scrutiny. There is no way to determine *a priori* whether any particular distribution of benefits from the commercial development of biological resources is “just.” From an evolutionary and ecological perspective, many contemporary inequalities stem from differences in initial natural

23. Compare Lynn White, Jr., *The Historical Roots of Our Ecologic Crisis*, 155 SCIENCE 1203 (1967) (describing the Book of Genesis as the origin of the Judeo-Christian tradition’s strictly instrumental attitude toward nature) with John Copeland Nagle, *Playing Noah*, 82 MINN. L. REV. 1171 (1997) (describing the story of Noah as the Judeo-Christian basis for advocating biodiversity conservation). See generally DAVID KINSLEY, *ECOLOGY AND RELIGION* (1995); J. BAIRD CALLICOTT, *EARTH’S INSIGHTS: A SURVEY OF ECOLOGICAL ETHICS FROM THE MEDITERRANEAN BASIN TO THE AUSTRALIAN OUTBACK* 14 (1994) (identifying the “historical roots of European attitudes and values” on the environment); JOHN PASSMORE, *MAN’S RESPONSIBILITY FOR NATURE* (1974); Jim Chen, *Of Agriculture’s First Disobedience and Its Fruit*, 48 VAND. L. REV. 1261 (1995); Jim Chen, *Webs of Life: Biodiversity Conservation as a Species of Information Policy*, 89 IOWA L. REV. 495, 591-602 (2004); Judith M. Green, *Retrieving the Human Place in Nature*, 17 ENVTL. ETHICS 381, 389-93 (1995).

24. H. PATRICK GLENN, *LEGAL TRADITIONS OF THE WORLD: SUSTAINABLE DIVERSITY IN LAW* 68-69 (2000).

25. EDWARD GOLDSMITH, *THE WAY: AN ECOLOGICAL WORLD-VIEW*, at xvii-xviii (1992).

26. Jeb Blount, *Hands of Steel*, 24 LATIN TRADE 50, 54, 58 (1996).

27. See generally Meetal Jain, *Global Trade and the New Millennium: Defining the Scope of Intellectual Property Protection of Plant Genetic Resources and Traditional Knowledge in India*, 22 HASTINGS INT’L & COMP. L. REV. 777 (1999).

endowments.²⁸ There is a perverse relationship between absolute levels of biological diversity and contemporary socioeconomic welfare. At a critical phase in human development, certain temperate, relatively nondiverse portions of the northern hemisphere had precisely the combination of plant and animal candidates for domestication that vaulted Eurasia to global domination.²⁹ Meanwhile, the tropical islands that shelter much of the world's biodiversity pose formidable physical barriers to human habitation and development.³⁰ It is not biological diversity per se but rather the right combination of factor endowments that dictates the wealth and poverty of nations.³¹

The natural history of Hawaii illustrates the tenuous connection between human development and absolute levels of biological diversity. Throughout Polynesia, each island's fortunes turned not on its native biological diversity, but rather on whether its first human settlers succeeded in transplanting as many as three species of domesticated animals of Eurasian provenance: pigs, dogs, and chickens.³² The prominence of words for these three animals in the Hawaiian language (*pua'a*, *ilio*, *moa*) illustrates the centrality of animal husbandry in Polynesian culture before European contact.³³ Notwithstanding the infamous Supreme Court case which invalidated Hawaii's discriminatory tax scheme favoring *okolehao* (a brandy distilled from the native *ti* plant),³⁴ agriculture in contemporary Hawaii relies principally on exotic crops. Pineapples, unprocessed sugar cane, macadamia nuts, and coffee rank among Hawaii's top six agricultural commodities by value of production.³⁵ Let us set aside milk and seed crops, which rank fourth and fifth, as staples of any American state's agricultural economy.³⁶ Cattle and cereal grains, in any event, hail from the Eurasian cradle of dominant world culture. Pineapple, sugar cane, macadamia nuts, and coffee are the true freaks of nature. Hawaii's stereotypically "tropical" crops all trace their origins to other parts of the

28. See JARED DIAMOND, GUNS, GERMS, AND STEEL: THE FATES OF HUMAN SOCIETIES 405-25 (1997); W. GORDON EAST, THE GEOGRAPHY BEHIND HISTORY (1965); HUGO HASSINGER, GEOGRAPHISCHE GRUNDLAGEN DER GESCHICHTE 9 (2d ed. 1953).

29. See DIAMOND, *supra* note 28, at 93-103.

30. See Barbara Crossette, *Small Islands, Big Trouble: Looking for Paradise? Keep Looking*, N.Y. TIMES, June 11, 2000, § 4, at 1.

31. See Chen, *Epiphytic Economics*, *supra* note 14, at 17.

32. See DIAMOND, *supra* note 28, at 60.

33. See SALLY ENGLE MERRY, COLONIZING HAWAII: THE CULTURAL POWER OF LAW 221-42 (Sherry B. Ortner et al. eds., 2000); PATRICK VINTON KIRCH, ON THE ROAD OF THE WINDS: AN ARCHAEOLOGICAL HISTORY OF THE PACIFIC ISLANDS BEFORE EUROPEAN CONQUEST (2000).

34. See *Bacchus Imports, Ltd. v. Dias*, 468 U.S. 263 (1984).

35. See HAWAII AGRICULTURAL STATISTICS SERVICE, STATISTICS OF HAWAII AGRICULTURE, available at <http://www.nass.usda.gov/hi/stats/stat-13.htm>.

36. See *id.*

world. Coffee comes from Anatolia, sugar cane comes from southeastern Asia, and pineapple comes from Brazil. Even the macadamia nut hails from Australia.³⁷ None of these crops is any more Hawaiian than reindeer are Alaskan.³⁸ Not surprisingly, an agricultural economy so dependent on exotic crops has come to be dominated by large, feudalistic landowners.³⁹

As lucrative as Hawaiian agriculture and tourism have become, we can only guess how much richer Hawaii would be today had neither Polynesians nor Europeans destroyed so much habitat, introduced so many exotics, or exterminated so many native species.⁴⁰ Just as the thoughtful observer “can’t help but wonder what it was like to live in the [American] South before” the region was “seduced by the economics of cotton and slavery, or, as Faulkner would have put it in stronger language, [it] . . . committ[ed] what amounted to its own Original Sin and suffer[ed] the commensurate curse,”⁴¹ the thoughtful visitor to Hawaii surely wonders how paradise must have looked before it got paved and embalmed in plastic.⁴² Hawaii, far from being the

37. On the origins of macadamia nuts, coffee, pineapple, and sugar cane (respectively), see JONATHAN D. SAUER, *HISTORICAL GEOGRAPHY OF CROP PLANTS: A SELECT ROSTER* 108-09, 130-38, 196-98, 236-50 (1993). For more information on the macadamia nut, see generally SANDRA WAGNER-WRIGHT, *HISTORY OF THE MACADAMIA NUT INDUSTRY IN HAWAII, 1881-1981: FROM BUSH NUT TO GOURMET’S DELIGHT* (1995).

38. See *Williams v. Babbitt*, 115 F.3d 657, 659 (9th Cir. 1997) (“Contrary to popular belief, reindeer are neither native to Alaska nor part of the Alaskan native way of life. [After] white settlers had just about exhausted the natural food supply of Alaskan natives, who traditionally relied on fishing and hunting[,] Dr. Sheldon Jackson . . . arranged for the importation of reindeer from Russia.”); *Alaska Legislation: Hearing on Bills Relating to the Territory of Alaska Before the House Comm. on the Territories*, 75th Cong., 1st Sess. 4-5 (1937) (statement of Rep. Dimond).

39. See *Haw. Hous. Auth. v. Midkiff*, 467 U.S. 229, 232 (1984); see also Eric Steven O’Malley, Note, *Irreconcilable Rights and the Question of Hawaiian Statehood*, 89 GEO. L.J. 501, 506-07 (2001) (noting that the predominant form of land tenure in Hawaii remains the long-term leasehold rather than the fee simple); cf. *Rice v. Cayetano*, 528 U.S. 495 (2000) (striking down an election limited to persons of native Hawaiian descent); Stuart Minor Benjamin, *Equal Protection and the Special Relationship: The Case of Native Hawaiians*, 106 YALE L.J. 537 (1996) (arguing that legal classifications involving Hawaiian natives should be treated as racial classifications rather than accommodations of native sovereignty).

40. Cf. Shayana Kadidal, Note, *Plants, Poverty and Pharmaceutical Patents*, 103 YALE L.J. 223, 228-30 (1993) (describing the conflict in many developing countries between biodiversity conservation and extractive industries such as agriculture).

41. WALKER PERCY, *Going Back to Georgia*, in *SIGNPOSTS IN A STRANGE LAND* 26, 33 (Patrick Samway ed. 1991).

42. Which thereby answers that provocative question posed at the dawn of modern environmentalism, “What’s wrong with plastic trees?” Martin H. Krieger, *What’s Wrong with Plastic Trees?*, 179 SCIENCE 446 (1973); hear also RADIOHEAD, *Fake Plastic Trees*, on *THE BENDS* (Capitol Records 1995) (“She looks like the real thing / She tastes like the real thing / My Fake Plastic Love”).

“unspoiled island paradise” of vacation brochures and movie posters, “[i]n actuality . . . is a killing field of biological diversity.”⁴³ The youngest of America’s fifty states thus answers, at long last, that bitter question of the biodiversity debate, “How then did a continent of berries become a global agricultural power?”⁴⁴

What has happened in Hawaii has happened in many other places, ranging from Mauritius to Madagascar to the entire continent of Australia. We have transformed biologically diverse jewels with unique, endemic species into resorts containing the same plants, the same animals, and the same tourist traps found on every warm-water beach in the world. What Holy Roman Emperor Charles V is reputed to have said after his architects erected a pedestrian baroque cathedral within the magnificent Mezquita de Córdoba aptly describes the disfiguring transformation of the world’s biodiversity troves into tropical resort destinations: “By building here what could have been built as well anywhere else, you have destroyed something that was unique in the world.”⁴⁵ Or in terms more familiar to fans of American pop music:

They paved paradise
And put up a parking lot
With a pink hotel, a boutique
and a swinging hot spot
Don’t it always seem to go
That you don’t know what you’ve got
Till it’s gone.⁴⁶

Geographic and historical literacy undermines the southern attack on the very idea of intellectual property. Private ownership of intellectual property, or at least private desire to own and exploit profitable ideas, flourishes in many poorer societies. The Honeybee Network, an Indian group advocating “grass roots innovation” in traditional communities, attributes many of the inventions it has documented to private individuals, who are not only pleased to claim credit but also hope to profit from the commodification and commercialization of their innovations.⁴⁷ The special legal status of dietary

43. EDWARD O. WILSON, *THE FUTURE OF LIFE* 43 (2002).

44. CALESTOUS JUMA, *THE GENE HUNTERS: BIOTECHNOLOGY AND THE SCRAMBLE FOR SEEDS* 51-52 (1989) (attributing the United States’ success to “plant introduction, technical change and institutional reform”); accord Neil D. Hamilton, *Who Owns Dinner: Evolving Legal Mechanisms for Ownership of Plant Genetic Resources*, 28 *TULSA L.J.* 587, 607-08 (1993).

45. Jerrilynn D. Dodds, *The Great Mosque of Cordoba*, in *AL-ANDALUS: THE ART OF ISLAMIC SPAIN* 11, 25 (Jerrilynn D. Dodds ed., 1992).

46. JONI MITCHELL, *Big Yellow Taxi*, on *LADIES OF THE CANYON* (WEA 1970).

47. See Anil K. Gupta, *Making Indian Agriculture More Knowledge Intensive and Competitive: The Case of Intellectual Property Rights*, 54 *INDIAN J. AGRIC. ECON.* 342, 346-52

supplements in the United States) dietary supplements are not regulated either as food additives or as drugs under the Food, Drug, and Cosmetic Act⁴⁸) has sparked a flurry of patent applications seeking to commodify and commercialize new applications and techniques based on traditional Chinese medicine.⁴⁹

Moreover, what we now call the developing world enjoys no monopoly on communal notions of ownership. In imperial China, for instance, “true scholars [apparently] wrote for edification and moral renewal rather than profit.”⁵⁰ As a result, “[v]irtually all known examples of efforts by the state to provide protection for what we now term intellectual property in China prior to the twentieth century seem to have been directed overwhelmingly toward sustaining imperial power.”⁵¹ If anything, Chinese cultural conventions, which reflect a preference for tradition and adherence to family over innovation and originality, represent the antithesis of the liberal Western polity enshrined in TRIPS.⁵² Unlike the West, China has neither valued physical authenticity nor reviled copying as forgery.⁵³ Whereas the West, scarred by cataclysmic episodes in its past, has tended to treat physical traces of its history as a crucial cultural resource, China has regarded itself a continuous civilization in which accurate copying, far from constituting forgery, represents a sign of respect by the present for the past.⁵⁴ What other cultures regard as a “national virtue,” the United States treats as a crime.⁵⁵

Whatever their merits in other contexts, allegations of fundamental boundaries between “civilizations”⁵⁶ and culture-based explanations of developmental differences⁵⁷ do not accurately describe the divide between

(1999).

48. See 21 U.S.C. § 321 (2000).

49. See Yinliang Liu, *IPR Protection for New Traditional Knowledge: With a Case Study of Traditional Chinese Medicine*, 25 EUR. INTELL. PROP. REV. 194, 198-99 (2003).

50. William P. Alford, *Tasseled Loafers for Barefoot Lawyers: Transformation and Tension in the World of Chinese Legal Workers*, in CHINA'S LEGAL REFORMS: STUDIES ON CONTEMPORARY CHINA 22, 29 (Stanley Lubman ed., 1996).

51. *Id.*

52. See HOWARD GARDNER, ART EDUCATION AND HUMAN DEVELOPMENT 51 (1950); Marci A. Hamilton, *Art Speech*, 49 VAND. L. REV. 73, 98-99 & n.106 (1996).

53. See ALEXANDER STILLE, THE FUTURE OF THE PAST 41-45 (2002).

54. See *id.* at 40-42; A. Dan Tarlock, *Slouching Toward Eden: The Eco-Pragmatic Challenges of Ecosystem Revival*, 87 MINN. L. REV. 1173, 1188 (2003), reprinted in THE JURISDYNAMICS OF ENVIRONMENTAL PROTECTION: CHANGE AND THE PRAGMATIC VOICE IN ENVIRONMENTAL LAW 145, 151-52 (Jim Chen ed., 2003) [hereinafter JURISDYNAMICS].

55. *Papachristou v. City of Jacksonville*, 405 U.S. 156, 163 (1972).

56. See SAMUEL P. HUNTINGTON, THE CLASH OF CIVILIZATIONS AND THE REMAKING OF WORLD ORDER (1996).

57. See, e.g., DAVID S. LANDES, THE WEALTH AND POVERTY OF NATIONS: WHY ARE

north and south on biodiversity and intellectual property. It is treacherous in any event to rely on essentialist distinctions between European and non-European societies. Distinctions of this sort have been used to excuse colonial domination of indigenous populations.⁵⁸ The United States, to name just one example, long ago decided to favor the colonial society of “agriculturalists, merchants and manufacturers” over the native American society of “fierce savages, whose occupation was war, and whose subsistence was drawn chiefly from the forest.”⁵⁹ In the specific context of international intellectual property law, developed nations have historically privileged written information over information transmitted orally within traditional communities. It is as though northern intellectual property law still endorses Edward Gibbons’s vicious dictum that “the use of letters is the principal circumstance that distinguishes a civilized people from a herd of savages incapable of knowledge or reflection.”⁶⁰ In light of these arguments’ checkered history, it is deeply ironic that advocates for the modern south would draw sharp cultural distinctions between the developed and developing worlds. If TRIPS does indeed “export[] and impose[] Protestant-based capitalism” on the world at large,⁶¹ it may be easier to defend TRIPS for its ability to project an “anti-authoritarian intellectual property ethos” onto the developing world.⁶² After all, no famine has ever occurred in a democratic country with a free press.⁶³

Finally, it is flatly wrong to describe the technological powerhouse of the global north as if it operated exclusively on the basis of a proprietary model. Indeed, in the developed world’s academic institutions, communal research is

SOME SO RICH AND SOME SO POOR? (1998).

58. See SHIVA, *supra* note 13, at 2-5.

59. *Johnson v. McIntosh*, 21 U.S. (8 Wheat.) 543, 590 (1823) (Marshall, C.J.). For a view of federal Indian law as an awkward transition from colonialism, see Philip P. Frickey, *Domesticating Federal Indian Law*, 81 MINN. L. REV. 31 (1996); Philip P. Frickey, *Marshalling Past and Present: Colonialism, Constitutionalism, and Interpretation in Federal Indian Law*, 107 HARV. L. REV. 381 (1993).

60. EDWARD GIBBONS, *THE HISTORY OF THE DECLINE AND FALL OF THE ROMAN EMPIRE* 235 (David Womersley ed., 1994), *quoted in* Margo A. Bagley, *Still Patently Unconstitutional: A Reply to Professor Nard*, 88 MINN. L. REV. 239, 243 n.23 (2003); Ruth L. Gana, *Has Creativity Died in the Third World? Some Implications of the Internationalization of Intellectual Property*, 24 DENV. J. INT’L L. & POL’Y 109, 112 (1995).

61. Marci A. Hamilton, *The TRIPs Agreement: Imperialistic, Outdated, and Overprotective*, 29 VAND. J. TRANSNAT’L L. 613, 617 (1996).

62. *Id.* at 619.

63. See JEAN DRÈZE & AMARTYA SEN, *INDIA: ECONOMIC DEVELOPMENT AND SOCIAL OPPORTUNITY* 76 (1995).

the norm rather than the exception.⁶⁴ Access to ethnobiological knowledge thus presents legal issues that are conceptually akin to those raised by researchers and scientists in disputes over academic freedom. American courts have asked seriously whether the widespread practice of copying from scientific journals could sustain a claim of fair use.⁶⁵ American scholars have long urged the recognition of an explicit First Amendment right to conduct scientific research,⁶⁶ which is no idle threat in a country that is “deeply committed to safeguarding academic freedom” as a “transcendent value.”⁶⁷ As “a special concern of the First Amendment,”⁶⁸ academic freedom most effectively fosters the “robust exchange of ideas”⁶⁹ when governments and universities respect the individual “right . . . to seek, teach, and write the truth.”⁷⁰ Empowering researchers, scientists, scholars, and teachers with the “freedom to reason and freedom for disputation on the basis of observation and experiment” provides “the necessary conditions for the advancement of

64. See Robert P. Merges, *Property Rights Theory and the Commons: The Case of Scientific Research*, 13 SOC. PHILOS. & POL’Y 145 (1996); Ejan MacKaay, *L’Édition Électronique par et pour la Communauté Scientifique*, 12 CAHIERS DE PROPRIÉTÉ INTELLECTUELLE 159 (1999).

65. See *Am. Geophysical Union v. Texaco Inc.*, 60 F.3d 913, 931 (2d Cir. 1994) (rejecting the claim), *cert. dismissed*, 516 U.S. 1005 (1995); see also *Basic Books, Inc. v. Kinko’s Graphics Corp.*, 758 F. Supp. 1522 (S.D.N.Y. 1991) (approving a settlement in a dispute over the photocopying of college textbooks).

66. See Richard Delgado & David R. Millen, *God, Galileo, and Government: Toward Constitutional Protection for Scientific Inquiry*, 53 WASH. L. REV. 349 (1978); Gary L. Francione, *Experimentation and the Marketplace Theory of the First Amendment*, 136 U. PA. L. REV. 417 (1987); Harold P. Green, *Constitutional Implications on Scientific Research and Communication*, 60 UMKC L. REV. 619 (1992); John A. Robertson, *The Scientist’s Right to Research: A Constitutional Analysis*, 51 S. CAL. L. REV. 1203 (1977). See generally Roy G. Spence Jr. & Jennifer Weinzell, *First Amendment Protection of Experimentation: A Critical Review and Tentative Synthesis/Reconstruction of the Literature*, 8 S. CAL. INTERDISC. L.J. 185 (1998).

67. *Keyishian v. Bd. of Regents*, 385 U.S. 589, 603 (1967) (observing the United States’ societal desire for a “robust exchange of ideas which discovers truth ‘out of a multitude of tongues’” (quoting *United States v. Associated Press*, 52 F. Supp. 362, 372 (S.D.N.Y. 1943))).

68. *Id.*; accord *Regents of the Univ. of Mich. v. Ewing*, 474 U.S. 214, 226 (1985); see also J. Peter Byrne, *Academic Freedom: A “Special Concern of the First Amendment,”* 99 YALE L.J. 251 (1989).

69. *Keyishian*, 385 U.S. at 603; accord *Healy v. James*, 408 U.S. 169, 180 (1972).

70. Julius G. Getman & Jacqueline W. Mintz, *Foreword: Academic Freedom in a Changing Society*, 66 TEX. L. REV. 1247, 1247 (1988).

scientific knowledge.”⁷¹ “[W]hatever constitutional protection is afforded by the First Amendment extends as readily to the scholar in the laboratory as to the teacher in the classroom.”⁷² Freedom to research matters even more to those who interpret human culture than it does to biologists who gather specimens or sequence genes, for the absence of “accepted . . . absolutes” exposes scholars in the arts, the humanities, and the social sciences to a heightened risk of being placed in ideological “strait jacket[s]” by politically powerful superiors.⁷³ As Justice Felix Frankfurter expressed the sentiment:

Progress in the natural sciences is not remotely confined to the findings made in the laboratory. Insights into the mysteries of nature are born of hypotheses and speculation For society’s good) if understanding be an essential need of society) inquiries into these problems, speculations about them, stimulation in others of reflection upon them, must be left as unfettered as possible.⁷⁴

American scientists, the intellectual force behind the life sciences juggernaut of the developed world, appear positively communal in their approach to the sharing of information.⁷⁵ Indeed, anyone who upsets the default norm of open access in the American scientific community is swiftly punished with the loss of goodwill among peers and the foreclosure of access to materials crucial to future research.⁷⁶ These scientists’ caricature as corporate lackeys is just that, a caricature. If anything, the Western “scientific ethos . . . promotes the sharing of information in the public domain” and treats

71. *Sweezy v. New Hampshire*, 354 U.S. 234, 266 (1957); *cf. id.* at 263 (Frankfurter, J., concurring in the result) (recognizing four separate elements of “academic freedom”: the ability of the university “to determine for itself on academic grounds [1] who may teach, [2] what may be taught, [3] how it shall be taught, and [4] who may be admitted to study”).

72. *Dow Chem. Co. v. Allen*, 672 F.2d 1262, 1275 (7th Cir. 1982).

73. *Sweezy*, 354 U.S. at 250 (plurality opinion of Warren, C.J.); *cf. id.* at 261-62 (Frankfurter, J., concurring in the result) (“[T]he respective preoccupations of anthropology, economics, law, psychology, sociology and related areas of scholarship are merely departmentalized dealing, by way of manageable division of analysis, with interpenetrating aspects of holistic perplexities.”).

74. *Id.* at 261-62 (Frankfurter, J., concurring in the result).

75. See generally CORYNNE McSHERRY, WHO OWNS ACADEMIC WORK?: BATTLING FOR CONTROL OF INTELLECTUAL PROPERTY (2001); Dan L. Burk, *Research Misconduct: Deviance, Due Process, and the Disestablishment of Science*, 3 GEO. MASON INDEP. L. REV. 305 (1995); Rebecca Eisenberg, *Proprietary Rights and the Norms of Science in Biotechnology Research*, 97 YALE L.J. 177 (1987); F. Scott Kieff, *Facilitating Scientific Research: Intellectual Property Rights and the Norms of Science* A Reply to Rai and Eisenberg, 95 NW. U.L. REV. 691 (2001); Arti Kaur Rai, *Regulating Scientific Research: Rights and the Norms of Science in Biotechnology Research*, 94 NW. U.L. REV. 77 (1999).

76. See Brian Uzzi, *The Sources and Consequences of Embeddedness for the Economic Performance of Organizations: The Network Effect*, 61 AM. SOC. REV. 674 (1996).

“scientific knowledge . . . ultimately [as] a shared resource.”⁷⁷ The Supreme Court of the United States came closer to the mark when it argued that “legislative or judicial fiat as to patentability” would never “deter the scientific mind from probing into the unknown any more than Canute could command the tides.”⁷⁸ The ability to patent any resulting inventions “may determine whether research efforts are accelerated by the hope of reward or slowed by want of incentives, but that is all.”⁷⁹

Significant drivers of invention and economic growth in the developed world rely on nonproprietary methods of innovation. Ever larger segments of the information technology industry are adopting an “open source” approach toward software development, in which source code is freely shared and members of the programming community agree to forswear all proprietary claims in any improvements they make.⁸⁰ Much of what we now recognize as the Internet owes its development to the explicit eschewing of proprietary standards.⁸¹ With the striking (and perhaps temporary) exception of the ubiquitous Microsoft Windows user interface,⁸² most elements of the Internet’s logical architecture, such as HTML and the TCP/IP protocol, lie in the public domain.⁸³ This consciously collective approach to innovation does require some form of centralized organization, though not necessarily in the form of a for-profit corporation. The fragility of “unified set[s] of code[] made available to everyone” on the Internet⁸⁴ suggests that some form of

77. Rai, *supra* note 75, at 90.

78. *Diamond v. Chakrabarty*, 447 U.S. 303, 317 (1980).

79. *Id.*

80. See generally, e.g., Marcus Maher, *Open Source Software: The Success of an Alternative Intellectual Property Paradigm*, 10 FORDHAM INTELL. PROP. MEDIA & ENT. L.J. 619 (2000); David McGowan, *Legal Implications of Open Source Software*, 2001 U. ILL. L. REV. 241. For a broadside against the open source concept, see Mathias Strasser, *A New Paradigm in Intellectual Property Law? The Case Against Open Sources*, 2001 STAN. TECH. L. REV. 4.

81. See Lawrence Lessig, *The Limits in Open Code: Regulatory Standards and the Future of the Net*, 14 BERKELEY TECH. L.J. 759 (1999).

82. See *United States v. Microsoft Corp.*, 253 F.3d 34 (D.C. Cir. 2001).

83. See Mark A. Lemley, *Standardizing Government Standard-Setting Policy for Electronic Commerce*, 14 BERKELEY TECH. L.J. 745, 752 (1999); Yochai Benkler, *Overcoming Agoraphobia: Building the Commons of the Digitally Networked Environment*, 11 HARV. J.L. & TECH. 287, 290 (1998); cf. TIM BERNERS-LEE, *WEAVING THE WEB: THE ORIGINAL DESIGN AND ULTIMATE DESTINY OF THE WORLD WIDE WEB BY ITS INVENTOR* 74 (1999) (describing the decision to release HTML into the public domain). See generally MARTIN LIBICKI ET AL., *SCAFFOLDING THE NEW WEB: STANDARDS AND STANDARDS POLICY FOR THE DIGITAL ECONOMY* (2001).

84. Mark A. Lemley, *The Law and Economics of Internet Norms*, 73 CHI.-KENT L. REV. 1257, 1288 (1998) (warning that the Internet’s current *modus operandi* “may change in the future”).

common ownership or internal self-governance is needed to counteract incentives to exploit common goods for individual gain.⁸⁵

The obsession with property rights in the debate over biodiversity and biotechnology carries a steep price: overlooking other drivers of scientific innovation and technological progress. To the extent that the law seeks to promote innovation, collective access to information may carry greater weight than proprietary incentives. Perfect interconnectivity and open access are the ideal conditions for facilitating scientific research and disseminating information. Consider, for example, what scientists really want from “a global supercomputing network”: not only “greater number-crunching power than in [their] wildest dreams,” but also “seamless access to mountains of raw data stored in colleagues’ labs worldwide.”⁸⁶ But the desire for “applause” from academic peers, which for genuine scholars “[i]n the long run” is “the only coin worth having,”⁸⁷ can derail the quest for unrestricted access to information within scientific communities.⁸⁸ The desire to secure credit among other scholars for a discovery evidently exerts greater pressure toward secrecy than patenting and other forms of commercial activity.⁸⁹ The scientific community struggles even to reward peer review, one of the most cooperative and communally beneficial behaviors in science, but also one of the most individually burdensome.⁹⁰

Ethnobiological knowledge should be available on an open source basis. The information industries shed some light on the problem and may offer a solution. In Eric Raymond’s celebrated division of software development models, proprietary approaches toward innovation are “cathedrals,” while the open source community and nature itself operate as “bazaars.”⁹¹ Contrary to

85. See David McGowan, *Legal Implications of Open Source Software*, 2001 U. ILL. L. REV. 241, 300.

86. Declan Butler, *The Grid: Tomorrow’s Computing Today*, 422 NATURE 799, 799 (2003).

87. Paul A. Samuelson, *Economists and the History of Ideas*, 52 AM. ECON. REV. 1, 18 (1962).

88. Cf., e.g., Steven Salzberg et al., *Unrestricted Free Access Works and Must Continue*, 422 NATURE 801 (2003) (criticizing official ambiguity regarding access to the Human Genome Project); *Sacrifice for the Greater Good?*, 421 NATURE 875 (2003). See generally Francis S. Collins et al., *A Vision for the Future of Genomics Research*, 422 NATURE 835 (2003).

89. See John P. Walsh & Wei Hong, *Secrecy Is Increasing in Step with Competition*, 422 NATURE 801, 802 (2003).

90. See Torben Clausen & Ole Baekgaard Nielsen, *Reviewing Should Be Shown in Publication List*, 421 NATURE 689 (2003); Eugene V. Koonin, *Swift Publication Would Reward Good Reviewers*, 422 NATURE 514 (2003).

91. See generally ERIC S. RAYMOND, *THE CATHEDRAL & THE BAZAAR: MUSINGS ON LINUX AND OPEN SOURCE BY AN ACCIDENTAL REVOLUTIONARY* (1999).

southern critics' suggestion that capitalist societies are tethered to the "cathedral"-style, proprietary method of development, nothing outperforms the Internet in illustrating the willingness of the profit-maximizing West to embrace the "bazaar" approach of community-based innovation. Raymond uses a biological metaphor to describe the software development model invented and maintained by Linus Torvalds: "The Linux world behaves in many respects like a free market or an ecology, a collection of selfish agents attempting to maximize utility which in the process produces a self-correcting spontaneous order more elaborate and efficient than any amount of central planning could have achieved"⁹² "[T]he naively simple strategy" of frequently releasing new versions of software and getting feedback from many users has "creat[ed] a sort of rapid Darwinian selection on the mutations introduced by developers."⁹³ Linux is far from alone in using the entire online community as an evaluative engine; the open source strategy has won adherents across a wide swath of the information technology industry.⁹⁴

The open source philosophy overtly acknowledges that the discoverer of a problem need not be its solver.⁹⁵ Other members of the creative community, despite coming late, may nevertheless solve a vexing problem after "star[ing] at the Pacific" "like stout Cortez . . . with eagle eyes."⁹⁶ Recipients of open source software enjoy an implied license to engage in any reasonably contemplated uses of the software, including the right to modify, or "repair," the software short of reconstructing it anew.⁹⁷ The open source approach

92. *Id.* at 64.

93. *Id.* at 24.

94. *See, e.g.*, STEVEN JOHNSON, EMERGENCE: THE CONNECTED LIVES OF ANTS, BRAINS, CITIES, AND SOFTWARE 152-62 (2001) (describing slashdot.org's system for rating the quality of its users' posts); *id.* at 221-22 (describing eBay's system for rating the reliability of sellers and of buyers).

95. *See* RAYMOND, *supra* note 91, at 41.

96. John Keats, *On First Looking Into Chapman's Homer* (1816), available at <http://englishhistory.net/keats/poetry/chapman.html>. Chapman's Homer was almost surely the second translation that Keats read; Alexander Pope's eighteenth-century translation had been the standard. Legend has it that Keats stayed awake all night reading Chapman's Homer and sent this poem to Charles Cowden Clarke the next morning. The reference to Cortez is therefore probably intentional and not mistaken. Balboa was the first European to see the eastern shore of the Pacific, but the poem addresses the euphoria of a *second* experience. *See generally, e.g.*, ANDREW MOTION, KEATS (1998).

97. *See* Aro Mfg. Co. v. Convertible Top Replacement Co., 365 U.S. 336, 346 (1961); Mitchell v. Hawley, 83 U.S. (16 Wall.) 544, 548 (1872); Hewlett-Packard Co. v. Repeat-O-Type Stencil Mfg. Corp., 123 F.3d 1445, 1451 (Fed. Cir. 1997); *see also* Bottom Line Mgmt., Inc. v. Pan Man, Inc., 228 F.3d 1352, 1354, 1356 (Fed. Cir. 2000) (extending this right to all subsequent purchasers of a patented article); Dana Corp. v. Am. Precision Co., 827 F.2d 755, 758 (Fed. Cir. 1987). *See generally* Sandvik Aktiebolag v. E.J. Co., 121 F.3d 669, 673-74 (Fed.

emulates the scientific method's reliance on shared information and assessments of quality based on peer review.⁹⁸ Open source development thus "use[s] the entire *world* as its talent pool".⁹⁹ "Given enough eyeballs, all bugs are shallow."¹⁰⁰ As with stewardship of natural resources, so too with human inventiveness: cooperation can turn the tragedy of the commons into a comedy) divinely beautiful in its conception, and beautifully human in its realization.¹⁰¹

II. DARWIN'S DUAL DYNAMIC

It is a shame that the term "impasse" is so strongly associated with American labor law.¹⁰² No other legally significant word more aptly describes the stalemate over the Convention on Biological Diversity. Nearly a decade after the United Nations Conference on Environment and Development met in Rio, commentators still describe bioprospecting either as a savior or as a scourge. True to the ongoing revival of Darwinian thought in social science¹⁰³ and legal scholarship,¹⁰⁴ I will now enlist ecological and evolutionary

Cir. 1997) (distinguishing between permissible "repair" and unlawful "reconstruction" of a patented article).

98. See RAYMOND, *supra* note 91, at 60-67; Maher, *supra* note 80, at 641-42; see also sources cited *supra* note 75.

99. RAYMOND, *supra* note 91, at 62.

100. *Id.* at 41 (quoting Torvalds for "Linus's law"); see also *id.* at 66 ("No closed source developer can match the pool of talent the Linux community can bring to bear on a problem.").

101. Compare Susan Jane Buck Cox, *No Tragedy of the Commons*, 7 ENVTL. ETHICS 49, 60 (1985) (noting that the commons was historically not a tragedy "but rather a triumph," whereby "for hundreds of years . . . land was managed successfully by communities") with Carol Rose, *The Comedy of the Commons: Custom, Commerce, and Inherently Public Property*, 53 U. CHI. L. REV. 711, 769 (1986) (describing the collective creative power of human communities as the "comedy of the commons").

102. See, e.g., *Laborers Health & Welfare Trust Fund v. Advanced Lightweight Concrete Co.*, 484 U.S. 539, 543 n.5 (1988); *NLRB v. Katz*, 369 U.S. 736, 741-43 (1962).

103. See generally THE ADAPTED MIND: EVOLUTIONARY PSYCHOLOGY AND THE GENERATION OF CULTURE (Jerome H. Barkow et al. eds., 1992); DONALD E. BROWN, HUMAN UNIVERSALS (1991); CARL N. DEGLER, IN SEARCH OF HUMAN NATURE: THE DECLINE AND REVIVAL OF DARWINISM IN AMERICAN SOCIAL THOUGHT (1991); GEOFFREY F. MILLER, THE MATING MIND: HOW SEXUAL CHOICE SHAPED THE EVOLUTION OF HUMAN NATURE (2000); STEVEN PINKER, HOW THE MIND WORKS (1997); STEVEN PINKER, THE LANGUAGE INSTINCT: HOW THE MIND CREATES LANGUAGE (1994); MATT RIDLEY, GENOME: THE BIOGRAPHY OF A SPECIES IN 23 CHAPTERS (2000).

104. See, e.g., Timothy H. Goldsmith & Owen D. Jones, *Evolutionary Biology and Behavior: A Brief Overview and Some Important Concepts*, 39 JURIMETRICS J. 131 (1999); Cheryl Hanna, *Can a Biological Inquiry Help Reduce Male Violence Against Females? Or What's a Nice "Gal" like Me Doing at a Conference like This?*, 22 VT. L. REV. 333 (1997);

metaphors in an effort to settle the grudge match between biodiversity and biotechnology.

Two pairs of biological distinctions, between phenotypes and genotypes and between genes and memes, enable us to reconceptualize more fruitfully the conflict between biodiversity and biotechnology. The standard distinction between phenotypes and genotypes clarifies the types of property at stake in disputes over biotechnology. Virtually all of the fury in this debate focuses not on the value of living things as chattels, but rather on their worth as sources of genetic information.

In resorting to the more controversial distinction between genes and memes, I hope to show that the global north and the global south are fighting over common conceptual ground. Both sides seek to confer proprietary status on valuable pieces of information that would display, in the absence of positive law, the attributes of public goods. The conflict arises from the fact that the two sides seek protection for different things. The developing world wishes compensation for its contribution to the natural and cultural foundations for modern biotechnology. The developed world wishes to protect the value added by its life scientists.

A. Phenotypes and Genotypes

“In a Darwinian world, there are two and only two forces that matter. One of them is food. The other is sex.”¹⁰⁵ Remarkably, the seed is both. “It

Cheryl Hanna, *Sometimes Sex Matters: Reflections on Biology, Sexual Aggression, and Its Implications for the Law*, 39 JURIMETRICS J. 261 (1999); Jack Hirshleifer, *Economics From a Biological Viewpoint*, 20 J.L. & ECON. 1 (1977); Owen D. Jones, *Law and Biology: Toward an Integrated Model of Human Behavior*, 8 J. CONTEMP. LEGAL ISSUES 167 (1997); John O. McGinnis, *The Human Constitution and Constitutive Law: A Prolegomenon*, 8 J. CONTEMP. LEGAL ISSUES 211 (1997); John O. McGinnis, *The Original Constitution and Our Origins*, 19 HARV. J.L. & PUB. POL'Y 251 (1996); Erin Ann O'Hara, *Brain Plasticity and Spanish Moss in Biologic Analysis*, 53 FLA. L. REV. 905 (2001); William H. Rodgers, Jr., *Where Environmental Law and Biology Meet: Of Pandas' Thumbs, Statutory Sleepers, and Effective Law*, 65 U. COLO. L. REV. 25 (1993); cf. Fred P. Bosselman, *Extinction and the Law: Protection of Religiously-Motivated Behavior*, 68 CHI.-KENT L. REV. 15, 15 (1993) (observing how extinction, a natural phenomenon, “also threatens things that do not fit” strict biological categories, such as “cultural behavior patterns” and cultural artifacts). See generally Richard A. Posner, *The Decline of Law as an Autonomous Discipline: 1962-1987*, 100 HARV. L. REV. 761 (1987).

105. Jim Chen, *Law as a Species of Language Acquisition*, 73 WASH. U. L.Q. 1263, 1278 n.99 (1995). See generally GEOFFREY F. MILLER, *THE MATING MIND: HOW SEXUAL CHOICE SHAPED THE EVOLUTION OF HUMAN NATURE* 8-9 (2000) (distinguishing between natural and sexual selection as evolutionary forces).

is both means of production and, as grain [or fruit], the product.”¹⁰⁶ Edible seed) the phenotype) is a mere chattel, but the genetic information embedded in that seed is amenable to an independent form of proprietary protection.¹⁰⁷ A genome is at once a set of instructions for assembling and operating an organism, and a dynamic record of that organism’s evolutionary history.¹⁰⁸ Whatever else might be said for the old biological slogan, this is one sense in which ontogeny truly does recapitulate phylogeny.¹⁰⁹ The distinction between chattel and intellectual property explains why mere possession of the stationery on which a letter is written does not entitle the possessor to quote or paraphrase the letter itself.¹¹⁰ So too with seeds. Analyzing the seed as food and as sex holds the key to that crucial task in any question of intellectual property, separating any claim in valuable information from the chattel to which the informational interest attaches.¹¹¹

Consider the Flavr Savr tomato, the first transgenically modified organism approved for human consumption by the United States Food and Drug Administration.¹¹² Calgene, Inc., “introduced into tomatoes” a gene “that produces, as messenger ribonucleic acid (mRNA), an antisense copy of the polygalacturonase gene,” which in turn “suppresses the production of an enzyme . . . that is associated with the breakdown of pectin, a constituent of

106. JACK RALPH KLOPPENBURG JR., *FIRST THE SEED: THE POLITICAL ECONOMY OF PLANT BIOTECHNOLOGY*, 1492-2000, at 10 (1988).

107. See Joseph Straus, *Bargaining Around the TRIPS Agreement: The Case for Ongoing Public-Private Initiatives to Facilitate Worldwide Intellectual Property Transactions*, 9 DUKE J. COMP. & INT’L L. 91, 104 (1998).

108. See generally ANTOINE DANCHIN, *THE DELPHIC BOAT: WHAT GENOMES TELL US* (Alison Quayle trans., 2003).

109. In ordinary language, “ontogeny recapitulates phylogeny” means that the life history of any individual organism replays the entire evolutionary history of that organism’s species. Ernst Haeckel, who incidentally is also credited with coining the term “ecology,” see STEPHEN JAY GOULD, *ONTOGENY AND PHYLOGENY* 76 n.* (1977), developed this convenient but sometimes misleading biological maxim. Compare *id.*, at 76-78 (describing Haeckel’s role in popularizing and in distorting Darwin’s theories) with *id.* at 202-06 (describing how the discovery of Mendelian genetics undermined Haeckel’s theories and rehabilitated those of his rival, Karl Ernst von Baer).

110. See *Salinger v. Random House, Inc.*, 811 F.2d 90, 94-95 (2d Cir. 1987), *supplemented*, 818 F.2d 252 (2d Cir. 1987).

111. Cf. 17 U.S.C. § 109(a) (2000) (enabling the purchaser of a particular copy or phonorecord of a copyrightable work to dispose of that copy or phonorecord); *id.* § 202 (providing that the sale of a particular copy or phonorecord does not of itself transfer the copyright in the work); *Forward v. Thorogood*, 985 F.2d 604 (1st Cir. 1993).

112. See Calgene, Inc.: Request for Advisory Opinion, 57 Fed. Reg. 22,772 (May 29, 1992); Statement of Policy: Foods Derived From New Plant Varieties, 57 Fed. Reg. 22,984 (May 29, 1992). See generally Judith E. Beach, *No “Killer Tomatoes”: Easing Federal Regulation of Genetically Engineered Plants*, 53 FOOD & DRUG L.J. 181 (1998).

the cell wall in tomato fruit.”¹¹³ The gene introduced into Calgene’s tomatoes produced complementary RNA that would bind itself to mRNA that ordinarily directs the production of polygalacturonase (the enzyme associated with the decomposition of pectin). Tomatoes with lower levels of polygalacturonase have a longer shelf life because their cell walls remain intact for a longer period of time.

In plain English, Calgene engineers cleverly tricked the tomato into abandoning its original genetic instructions as a delivery vehicle for seeds and accepting new commands better suited to long-term storage. Natural selection does not yield traits that are useful to humans but inimical to the organism’s well-being. In the tomato’s natural state, failure to decompose is lethal to reproductive success. That same trait, however, enhanced the Flavr Savr’s value to tomato-consuming humans. As with hogs and oysters, bad sex makes good eating.¹¹⁴

In their dual capacities as chattels and as carriers of chemical and genetic information, however, organisms exhibit starkly divergent economic

113. *Calgene*, 57 Fed. Reg. at 22,772; see also *Enzo Biochem, Inc. v. Calgene, Inc.*, 188 F.3d 1362, 1370-77 (Fed. Cir. 1999) (holding that Calgene’s Flavr Savr tomato did not infringe patents on the use of antisense technology in *Escherichia coli* bacteria). The FDA rightly referred to the tomato as a fruit, not vegetable. Love over gold; biology over law. But the Supreme Court disagrees:

Botanically speaking, tomatoes are the fruit of a vine, just as are cucumbers, squashes, beans and peas. But in the common language of the people, whether sellers or consumers of provisions, all these are vegetables, which are grown in kitchen gardens, and which, whether eaten cooked or raw, are, like potatoes, carrots, parsnips, turnips, beets, cauliflower, cabbage, celery and lettuce, usually served at dinner in, with, or after the soup, fish or meats which constitute the principal part of the repast, and not, like fruits generally, as dessert.

Nix v. Hedden, 149 U.S. 304, 307 (1893).

114. See *Ex parte Allen*, 2 U.S.P.Q.2d 1425 (Bd. Pat. Appeals & Interferences 1987) (recognizing a polyploid oyster as patentable subject matter, but denying the patent for failure to satisfy the obviousness requirement of 35 U.S.C. § 103), *aff’d without opinion*, 846 F.2d 77 (Fed. Cir. 1988). “[E]xposing newly fertilized oyster eggs to extreme water pressure disrupts the normal allocation of chromosomes during cell division, leaving . . . oysters with three copies of each chromosome, instead of the normal two This makes the oysters sterile and also eliminates their normal two-month reproductive cycle,” which in turn permits the oysters to “be harvested year-round.” Robert P. Merges, *Intellectual Property in Higher Life Forms: The Patent System and Controversial Technologies*, 47 MD. L. REV. 1051, 1053-54 (1988). On the impact of the obviousness requirement on high-risk, capital-intensive biotechnological research, see generally Karen I. Boyd, *Nonobviousness and the Biotechnology Industry: A Proposal for a Doctrine of Economic Nonobviousness*, 12 BERKELEY TECH. L.J. 311 (1997); Robert P. Merges, *One Hundred Years of Solicitude: Intellectual Property Law, 1900-2000*, 88 CAL. L. REV. 2187, 2225-26 (2001); Arti K. Rai, *Intellectual Property Rights in Biotechnology: Addressing New Technology*, 34 WAKE FOREST L. REV. 827 (1999).

characteristics. A harvested organism can provide useful information either as a chemical blueprint or as a source of genes and traits for further manipulation through conventional breeding or transgenic engineering.¹¹⁵ In other words, living things transmit information through either the proteins, lipids, and other molecules they manufacture or, more fundamentally, the nucleic acids that direct the production of those molecules.¹¹⁶ Unlike chattels, both types of information are public goods in that a single use does not preclude independent use by a different party.¹¹⁷ Like “public goods, such as national defense,” intellectual goods “often do not encompass natural physical barriers that exclude potential consumers,” “may be held by more than one person at a time,” can be distributed at “minimal or nonexistent” cost, and once disclosed face “no real barriers to free appropriation.”¹¹⁸ Ideas are as “free as the air to common use.”¹¹⁹ Proteins and genes are nonrivalrous, nonexclusive goods.¹²⁰ In stark contrast with the *rivalrous* nature of most property, whereby “possession by one party results in a gain that precisely corresponds to the loss endured by . . . [an]other party,” use of a *nonrivalrous* good “by one entity does not diminish necessarily the use and enjoyment of others.”¹²¹ This is the dynamic at the heart of the southern complaint: A single sample, either of a rare rainforest plant or of tribal lore, can be transformed by a northern life sciences company into a lucrative drug or plant variety, and the

115. See Roger A. Sedjo, *Property Rights, Genetic Resources, and Biotechnological Change*, 35 J.L. & ECON. 199, 201 (1992).

116. See generally Dennis S. Karjala, *A Legal Research Agenda for the Human Genome Initiative*, 32 JURIMETRICS J. 121, 129-33 (1992) (distinguishing between exons) which are regions within an organism’s DNA that are expressed as proteins produced via RNA transcription) and introns) which are DNA regions that are not so expressed).

117. See Christopher D. Stone, *What to Do About Biodiversity: Property Rights, Public Goods, and the Earth’s Biological Riches*, 68 S. CAL. L. REV. 577, 597 (1995); cf. *Graham v. John Deere Co.*, 383 U.S. 1, 9 n.2 (1965) (quoting Thomas Jefferson: “He who receives an idea from me, receives instruction himself without lessening mine; as he who lights his taper at mine, receives light without darkening me.”).

118. Dan L. Burk, *Protection of Trade Secrets in Outer Space Activity: A Study in Federal Preemption*, 23 SETON HALL L. REV. 560, 584-85 (1993); see also U.S. CONGRESS, OFFICE OF TECHNOLOGY ASSESSMENT, FINDING A BALANCE: COMPUTER SOFTWARE, INTELLECTUAL PROPERTY AND THE CHALLENGE OF TECHNOLOGICAL CHANGE 185 (1992) (explaining how “free riders” impede the efficient production of public goods).

119. *Int’l News Serv. v. Associated Press*, 248 U.S. 215, 250 (1918) (Brandeis, J., dissenting).

120. See William M. Landes & Richard A. Posner, *An Economic Analysis of Copyright Law*, 18 J. LEGAL STUD. 325 (1989). See generally ROBERT P. BENKO, PROTECTING INTELLECTUAL PROPERTY RIGHTS 16-17 (1987).

121. *Ala. Power Co. v. FCC*, 311 F.3d 1357, 1369 (11th Cir. 2002).

physical means ordinarily used to confine chattels can scarcely stem the outward flow of information and wealth.

B. Genes and Memes

Therein lies a second, more important distinction. The southern “package” at issue in many commercial applications of biodiversity actually consists of two distinct components: the chemical and genetic information encoded in a biological specimen, plus ethnobiological knowledge of the traits and traditional uses of that species. “Matter and spirit) earth and heaven) have both done their part . . .”¹²² Claims of biopiracy often stress the sociological component to the exclusion of the biological, or else treat the two components as if they were inseparable.¹²³ But genetic information is readily distinguished from communal knowledge of plants and animals.

The crucial distinction is the one that separates genes from memes. A “meme” is “a unit of cultural transmission,” such as “tunes, ideas, catch-phrases, clothes fashions, ways of making pots or of building arches.”¹²⁴ The sociological equivalent of a gene, the meme as “a new kind of replicator . . . is [already] achieving evolutionary change at a rate that leaves the old gene panting far behind.”¹²⁵ Every ethnobiological tale is a meme, easily severed from the chemical and genetic information that inspired it. Even legal concepts are memes.¹²⁶ For purposes of economic exploitation and legal protection, gene and meme deserve separate consideration.

122. NATHANIEL HAWTHORNE, *The Birthmark*, in *THE COMPLETE SHORT STORIES OF NATHANIEL HAWTHORNE* 227, 237 (1959).

123. See, e.g., STEPHEN A. HANSEN & JUSTIN W. VANFLEET, *TRADITIONAL KNOWLEDGE AND INTELLECTUAL PROPERTY: A HANDBOOK ON ISSUES AND OPTIONS FOR TRADITIONAL KNOWLEDGE HOLDERS IN PROTECTING THEIR INTELLECTUAL PROPERTY AND MAINTAINING BIOLOGICAL DIVERSITY* 5 (2003); Johan Galtung, *After Camelot*, in *THE RISE AND FALL OF PROJECT CAMELOT: STUDIES IN THE RELATIONSHIP BETWEEN SOCIAL SCIENCE AND PRACTICAL POLITICS* 281, 300 (Irving Louis Horowitz ed., 1967); Winona LaDuke, *Traditional Ecological Knowledge and Environmental Futures*, 5 *COLO. J. INT'L ENVTL. L. & POL'Y* 127 (1994); Naomi Roht-Arriaza, *Of Seeds and Shamans: The Appropriation of the Scientific and Technical Knowledge of Indigenous and Local Communities*, 17 *MICH. J. INT'L L.* 919 (1996); June Starr & Kenneth C. Hardy, Note, *Not by Seeds Alone: The Biodiversity Treaty and the Role for Native Agriculture*, 12 *STAN. ENVTL. L.J.* 85 (1993); Lester I. Yano, Comment, *Protection of the Ethnobiological Knowledge of Indigenous Peoples*, 41 *UCLA L. REV.* 443 (1993).

124. RICHARD DAWKINS, *THE SELFISH GENE* 192 (1989).

125. *Id.*; cf. EDWARD O. WILSON, *CONSCIENCE: THE UNITY OF KNOWLEDGE* 136 (1998) (proposing the unification of the meme concept with “node[s] of semantic memory” recognized in neuroscience).

126. See Michael S. Fried, *The Evolution of Legal Concepts: The Memetic Perspective*, 39 *JURIMETRICS J.* 291 (1999).

The World Intellectual Property Organization (WIPO) defines traditional knowledge as “tradition-based literary, artistic, or scientific works; performances; inventions; scientific discoveries; designs; marks, names, and symbols; undisclosed information; and all other tradition-based innovations and creations resulting from intellectual activity in the industrial, scientific, literary or artistic fields.”¹²⁷ The sheer breadth of WIPO’s definition confirms a sharp turn in the politics of traditional knowledge as intellectual property. The developing world is no longer attacking intellectual property as an institution, but rather seeking to create new forms of property better suited to its economic interests. A leading handbook for advocates of indigenous peoples states the new objective in simple, unequivocal terms: “to seek intellectual property rights . . . for indigenous peoples is to seek a legally workable basis by which indigenous societies would own their cultural knowledge.”¹²⁸

This project is not devoid of legal plausibility. Intellectual property can be structured to protect traditional as well as “scientific” knowledge.¹²⁹ To be sure, copyright law explicitly stops short of covering an “idea, procedure, process, system, method of operation, concept, principle or discovery.”¹³⁰ Patent law denies protection to principles deemed to be laws of nature.¹³¹ But

127. WIPO Intergovernmental Committee on Intellectual Property & Genetic Resources, Traditional Knowledge & Folklore, *Traditional Knowledge) Operational Terms and Definitions* 11, WIPO/GRTKF/IC/3/9 (May 20, 2002), available at http://www.wipo.org/documents/en/meetings/2002/igc/pdf/grtkfic3_9.pdf.

128. INTELLECTUAL PROPERTY RIGHTS FOR INDIGENOUS PEOPLES, A SOURCE BOOK 4 (Tom Greaves ed., 1994).

129. See *id.*; GRAHAM DUTFIELD, CAN THE TRIPS AGREEMENT PROTECT BIOLOGICAL AND CULTURAL DIVERSITY? (1997); DARRELL A. POSEY & GRAHAM DUTFIELD, BEYOND INTELLECTUAL PROPERTY: TOWARD TRADITIONAL RESOURCE RIGHTS FOR INDIGENOUS PEOPLES AND LOCAL COMMUNITIES (1996); Coombe, *supra* note 6; David R. Downes, *How Intellectual Property Could Be a Tool to Protect Traditional Knowledge*, 25 COLUM. J. ENVTL. L. 253 (2000); Craig D. Jacoby & Charles Weiss, *Recognizing Property Rights in Traditional Biocultural Contribution*, 16 STAN. ENVTL. L.J. 74 (1997); Paul Kuruk, *Protecting Folklore Under Modern Intellectual Property Regimes: A Reappraisal of the Tensions Between Individual and Communal Rights in Africa and the United States*, 48 AM. U. L. REV. 769 (1999); Traci L. McClellan, *The Role of International Law in Protecting the Traditional Knowledge and Plant Life of Indigenous Peoples*, 19 WIS. INT’L L.J. 249 (2001); Robert K. Paterson & Dennis S. Karjala, *Looking Beyond Intellectual Property in Resolving Protection of the Intangible Cultural Heritage of Indigenous Peoples*, 11 CARDOZO J. INT’L & COMP. L. 633, 670 (2003).

130. 17 U.S.C. § 102(b) (2000).

131. See *Funk Bros. Seed Co. v. Kalo Inoculant Co.*, 333 U.S. 127, 130 (1948); see also Convention on the Grant of European Patents, Oct. 5, 1973, art. 52(2)(a), 13 I.L.M. 270, 285 [hereinafter European Patent Convention] (excluding “discoveries, scientific theories and mathematical methods” from the definition of “inventions which are susceptible of industrial

neither copyright nor patent is dictated by nature; intellectual property in any form is a creature of positive law, consciously crafted to achieve one regulatory goal or another.¹³² At one time, American law enforced a “law of nature” barrier to patentability that would not be recognizable today. The patent law of the United States denied protection to all naturally occurring substances, even those that had been isolated and purified by human agency.¹³³ The Supreme Court reversed course radically in 1980 with *Diamond v. Chakrabarty*,¹³⁴ the celebrated case that upheld a patent on a *Pseudomonas* bacterium that had been genetically altered to degrade several components of crude oil. Today we no longer ask whether life forms can be patented, but merely how far those rights can and should extend.

In the realm of traditional knowledge, the initial, admittedly descriptive question is whether some form of intellectual property (either one already in place, a modification of an existing model, or a sui generis approach) can provide some measure of protection. A workable model arguably already exists, for traditional knowledge may satisfy certain elements of the definition of trade secrets.¹³⁵ One way to achieve “principled consistency” in the treatment of the northern and southern contributions to biotechnology may lie in resorting to “principles operating at a low or intermediate level of abstraction.”¹³⁶

A good starting point is the constitutional requirement in the United States that just compensation be granted for the abrogation of trade secrets.¹³⁷ To extend the constitutional analogy, we need to classify proteins, genes, and memes among the types of informational goods that the public systematically undervalues.¹³⁸ Public law typically “responds to this undervaluation of information by granting special constitutional protection” for the expression and exchange of ideas.¹³⁹ The Convention on Biological Diversity, writ large,

application, which are new and which involve an inventive step”).

132. See Lloyd L. Weinreb, *Copyright for Functional Expression*, 111 HARV. L. REV. 1149, 1240 (1998).

133. See Linda J. Demaine & Aaron Xavier Fellmeth, *Reinventing the Double Helix: A Novel and Nonobvious Reconceptualization of the Biotechnology Patent*, 55 STAN. L. REV. 303, 366-84 (2002).

134. 447 U.S. 303 (1980).

135. See Gelvina Rodriguez Stevenson, Note, *Trade Secrets: The Secret to Protecting Indigenous Ethnobiological (Medicinal) Knowledge*, 32 N.Y.U. J. INT’LL. & POL. 1119 (2000).

136. Cass R. Sunstein, *On Analogical Reasoning*, 106 HARV. L. REV. 741, 746 (1993).

137. See *Ruckelshaus v. Monsanto Co.*, 467 U.S. 986, 1001-04 (1984); see also Susan Rose-Ackerman & Jim Rossi, *Disentangling Deregulatory Takings*, 86 VA. L. REV. 1435, 1469 (2000) (identifying structural and economic similarities between American takings law and the “much larger problem of the political risk of investing in emerging markets”).

138. See *supra* text accompanying notes 115-21.

139. See Daniel A. Farber, *Free Speech Without Romance: Public Choice and the First*

arguably establishes a comparable sort of fundamental legal support on the international level for undervalued ethnobiological knowledge. If indeed the ethnobiological lore of indigenous peoples and other forms of traditional knowledge can be reconceptualized as suitable subjects of intellectual property, the south's complaint is simply that international law has failed so far to protect its most valuable memes.¹⁴⁰

The case for treating traditional knowledge as property requires little more than a fairly modest conceptual leap. Economically speaking, all that matters is that traditional knowledge lacks "common currency in the intellectual life of the" outside world where such knowledge would attain proprietary status.¹⁴¹ Conventional definitions of trade secrets easily embraces ethnobiological knowledge. The *Restatement of Torts*' formulation has won the Supreme Court's endorsement on multiple occasions:

[A] trade secret may consist of any formula, pattern, device or compilation of information which is used in one's business, and which gives him an opportunity to obtain an advantage over competitors who do not know or use it. It may be a formula for a chemical compound, a process of manufacturing, treating or preserving materials, a pattern for a machine or other device, or a list of customers.¹⁴²

Similarly, the Uniform Trade Secrets Act protects "a formula, pattern, compilation, program, device, method, technique, or process" as long as the information in question not only "derives independent economic value, actual or potential, from not being generally known to, and not being readily ascertainable by proper means by, other persons who can obtain economic value from its disclosure or use," but also "is the subject of efforts that are reasonable under the circumstances to maintain its secrecy."¹⁴³

More recently, the *Restatement (Third) of Unfair Competition* has simplified these definitions into a single, brief sentence: "A trade secret is any information that can be used in the operation of a business or other enterprise and that is sufficiently valuable and secret to afford an actual or potential economic advantage over others."¹⁴⁴ This definition was intended to expand

Amendment, 105 HARV. L. REV. 554, 555 (1991).

140. See, e.g., *Mataatua Declaration on Cultural and Intellectual Property Rights of Indigenous Peoples*, U.N. Commission on Human Rights, U.N. Doc. E/CN.4/Sub.2/AC.4/1993/CRP.5 (1993).

141. Justin Hughes, *The Philosophy of Intellectual Property*, 77 GEO. L.J. 287, 294 (1988); accord Karen W. Baer, Note, *A Theory of Intellectual Property and the Biodiversity Treaty*, 21 SYRACUSE J. INT'L L. & COM. 259, 261 (1995).

142. RESTATEMENT OF TORTS § 757, cmt. b (1939); accord, e.g., *Ruckelshaus v. Monsanto Co.*, 467 U.S. 986, 1002 (1984); *Kewanee Oil Co. v. Bicron Corp.*, 416 U.S. 470, 474-75 (1974).

143. UNIF. TRADE SECRETS ACT § 1(4) (amended 1985), 14 U.L.A. 437 (1990).

144. RESTATEMENT (THIRD) OF UNFAIR COMPETITION § 39 (1995); accord, e.g., Reingold

older formulations such as that of the *Restatement of Torts* in several significant ways.¹⁴⁵ The newer *Restatement's* definition of trade secret embraces confidential information related to a single event or information with a short lifespan, such as a marketing plan. Critically, it also protects negative information) namely, information regarding what will *not* work. Finally, the range of individuals who may share trade secret information has expanded to include employees, agents, and licensees) anyone who can help a business exploit confidential information.

The requirement of secrecy under trade secret law need not meet the test of "novelty" under patent law or TRIPS.¹⁴⁶ Even where no patent could issue, trade secret protection may be available.¹⁴⁷ Recognition of a trade secret does not depend upon an "inventive step," a requirement of patent law that traditional knowledge rarely if ever satisfies.¹⁴⁸ When the recipient of knowledge enjoys a licensing arrangement or some other business relationship with its originator, the law of trade secrets readily imposes a duty to respect its confidentiality.¹⁴⁹ "The protections of . . . trade secret law are most effective at the developmental stage, before a product has been marketed and the threat of reverse engineering becomes real."¹⁵⁰ "A trade secret law, however, does not offer protection against discovery by fair and honest means. . . ." ¹⁵¹ Later innovators may freely exploit "independent invention, accidental disclosure, or by so-called reverse engineering, that is by starting with the known product and working backward to divine the process which aided in its development or manufacture."¹⁵²

We cannot be content, however, merely to recognize how easily the law can be redefined to confer proprietary status on traditional biological knowledge. Whether such knowledge *deserves* to be treated as property presents a distinct and politically (if not intellectually) confounding question.

v. *Swiftships, Inc.*, 126 F.3d 645, 650, 652 (5th Cir. 1997).

145. See Benjamin A. Emmert, *Keeping Confidence with Former Employees: California Courts Apply the Inevitable Disclosure Doctrine to California Trade Secret Law*, 40 SANTA CLARA L. REV. 1171, 1177 (2000).

146. See *W.R. Grace & Co. v. Hargadine*, 392 F.2d 9, 14 (6th Cir. 1968).

147. See *Aronson v. Quick Point Pencil Co.*, 440 U.S. 257, 264 (1979).

148. Cf. Doris Estelle Long, *The Impact of Foreign Investment on Indigenous Culture: An Intellectual Property Perspective*, 23 N.C.J. INT'L L. & COM. REG. 229, 277 (1998) (arguing that folk knowledge rarely exhibits the sort of inventive step that patent law demands).

149. See, e.g., *Kewanee Oil Co. v. Bicron Corp.*, 416 U.S. 470, 475, 476 n.4 (1974); *Lear, Inc. v. Adkins*, 395 U.S. 653, 670-71 (1969).

150. *Bonito Boats, Inc. v. Thunder Craft Boats, Inc.*, 489 U.S. 141, 161 (1989).

151. *Kewanee Oil Co.*, 416 U.S. at 476.

152. *Id.* See generally Pamela Samuelson & Suzanne Scotchmer, *The Law and Economics of Reverse Engineering*, 111 YALE L.J. 1575 (2002).

The harsh reality is that there is no economically justifiable reason for protecting ethnobiological knowledge as property. Ethnobiological knowledge already lies in a public domain of sorts, albeit perhaps a very small public consisting of the members of an indigenous tribe whose culture itself is endangered.¹⁵³ The advocates of proprietary protection for traditional knowledge need to transcend “current intellectual property law” in order to deter biopiracy precisely because “the resources maintained by long-term occupant communities usually consist of *existing* plant germ plasm or knowledge about the special properties of plants.”¹⁵⁴ Biopiracy, by spreading knowledge of an organism’s useful properties, is “locally objectionable but globally beneficial.”¹⁵⁵ Once ideas enter a global public domain, they should stay. Thomas Jefferson, the first administrator of patents in the United States, observed: “He who receives an idea from me, receives instruction himself without lessening mine; as he who lights his taper at mine, receives light without darkening me.”¹⁵⁶

This discussion of the values underlying commodification of ethnobiological knowledge began with an analogy from free speech and takings doctrine in the United States. Another reference to American constitutional law can help us determine the proper legal treatment of ethnobiological knowledge. The United States Constitution addresses freedom of expression not only through its Bill of Rights, but also through its grant of congressional authority to confer intellectual property on authors and inventors.¹⁵⁷ The Constitution promotes preservation) indeed, expansion) of

153. Cf. CBD, *supra* note 2, art. 9(j) (exhorting all contracting parties, as part of their obligation to conserve biodiversity *in situ*, to “respect . . . indigenous . . . knowledge” and to “encourage . . . equitable sharing” of the benefits derived from biological resources).

154. Paul J. Heald, *The Rhetoric of Biopiracy*, 11 *CARDOZO J. INT’L & COMP. L.* 519, 522 (2003) (emphasis in original). Professor Heald uses the admittedly awkward term “long-term occupant communities” instead of “indigenous persons” in order to avoid “the problem of establishing racial or cultural tests” and to “make inhabitants of rain forests and other bio-rich areas . . . sound less like exotic ‘others.’” *Id.* at 519 n.3; see also Gregory F. Maggio, *Recognizing the Vital Role of Local Communities in International Legal Instruments for Conserving Biodiversity*, 16 *UCLA J. ENVTL. L. & POL’Y* 179, 181 (1998).

155. Dan L. Burk, *The Trouble with Trespass*, 4 *J. SMALL & EMERGING BUS. L.* 27, 52 (2000).

156. See *Graham v. John Deere Co.*, 383 U.S. 1, 9 n.2 (1966).

157. See, e.g., *Campbell v. Acuff-Rose Music, Inc.*, 510 U.S. 569, 579 (1994) (acknowledging the “transformative value” of parody); *Feist Publ’ns, Inc. v. Rural Tel. Serv. Co.*, 499 U.S. 340, 349-50 (1991) (“copyright assures authors the right to their original expression, but encourages others to build freely upon the ideas and information conveyed by a work”); *Harper & Row Publishers, Inc. v. Nation Enters.*, 471 U.S. 539, 556-57 (1985); cf. Marci A. Hamilton, *Farewell Madison Avenue*, 16 *CONST. COMMENT.* 529, 529 (1999) (“Standing behind the Supreme Court’s free speech jurisprudence like the shadow behind Alfred

the public domain by requiring that patents and copyrights be limited in time and that these proprietary grants promote the progress of science. Specifically, the Constitution authorizes Congress “[t]o promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries.”¹⁵⁸ This clause is “both a grant of power and a limitation,”¹⁵⁹ insofar as the “constitutional command” requires that such patent or copyright laws as Congress enacts must create a “system” that “promote[s] the Progress of . . . useful Acts.”¹⁶⁰

The Supreme Court of the United States has held that “Congress may not authorize the issuance of patents whose effects are to remove existent knowledge from the public domain, or to restrict free access to materials already available.”¹⁶¹ A contrary approach effectively assumes “that the public interest in free access to copyright works is entirely worthless and that authors [and inventors], as a class, should receive a windfall solely based on completed creative activity.”¹⁶² As the Supreme Court recognized twelve decades ago:

It was never the object of [the patent] laws to grant a monopoly for every trifling device, every shadow of a shade of an idea, which would naturally and spontaneously occur to any skilled mechanic or operator in the ordinary progress of manufactures. Such an indiscriminate creation of exclusive privileges tends rather to obstruct than to stimulate invention. It creates a class of speculative schemers who make it their business to watch the advancing wave of improvement, and gather its foam in the form of patented monopolies, which enable them to lay a heavy tax upon the industry of the country, without contributing anything to the real advancement of the arts.¹⁶³

Hitchcock (always there and always substantial) . . . are the Court’s copyright decisions.” (citation omitted)). For comprehensive analysis of the relationship between copyright and the First Amendment, see Marci A. Hamilton, *Art and the Marketplace of Expression*, 17 CARDOZO ARTS & ENT. L.J. 167 (1999); William W. Van Alstyne, *Reconciling What the First Amendment Forbids with What the Copyright Clause Permits: A Summary Explanation and Review*, 66 LAW & CONTEMP. PROBS. 225 (2003).

158. U.S. CONST. art. I, § 8, cl. 8.

159. *Graham*, 383 U.S. at 5.

160. *Id.* at 6; *accord* *Eldred v. Ashcroft*, 537 U.S. 186, 212 (2003); *see also* *Feist Publ’ns, Inc.*, 499 U.S. at 349 (“The primary objective of copyright is . . . [t]o promote the Progress of Science”); *In re Shao Wen Yuan*, 188 F.2d 377, 380 (C.C.P.A. 1951) (observing that this grant of power “is the only one of the several powers conferred upon the Congress which is accompanied by a specific statement . . . for it”); Edward C. Walterscheid, *To Promote the Progress of Science and Useful Arts: The Background and Origin of the Intellectual Property Clause of the United States Constitution*, 2 J. INTELL. PROP. L. 1, 32 (1994).

161. *Graham*, 383 U.S. at 6.

162. *Eldred*, 537 U.S. at 241 (Stevens, J., dissenting).

163. *Atl. Works v. Brady*, 107 U.S. (17 Otto) 192, 200 (1883); *accord* *Slawson v. Grand*

To similar effect, some advocates for the global south concede that protecting indigenous knowledge on a northern model would stifle the free exchange of ideas that gave rise to this information in the first place.¹⁶⁴

Moreover, trade secret law, the mode of intellectual property most often invoked to extend proprietary protection to ethnobiological knowledge, provides an exceptionally poor vehicle for delivering information of any sort into the public domain. Trade secret law, by design, keeps information concealed. By contrast, patent and copyright laws are designed to deliver privately held information into public hands. Proprietary protection of ideas should be designed to spur “release to the public of the products of . . . creative genius”; incidental “reward to the owner [is] a secondary consideration.”¹⁶⁵ Introducing an idea to the global community in the broadest sense is the very purpose of intellectual property.¹⁶⁶ “[I]n respect to works already created,” however, any grant of intellectual property “*creates no economic incentive at all.*”¹⁶⁷ Indeed, protecting existing work constitutes an economically destructive, preemptive strike against future innovation.¹⁶⁸

Intellectual property rights are not and should not be “given as favors.”¹⁶⁹ Rather, they “are meant to encourage invention by rewarding the inventor with the right, limited to a term of years . . . , to exclude others from the use of his [or her] invention.”¹⁷⁰ A patent “is a privilege which is conditioned by a

St., P.P. & F.R. Co., 107 U.S. (17 Otto) 649, 654 (1883); *Phillips v. City of Detroit*, 111 U.S. 604, 608 (1884); *Thompson v. Boisselier*, 114 U.S. 1, 12 (1885); *R.R. Supply Co. v. Elyria Iron & Steel Co.*, 244 U.S. 285, 293 (1917); *Great Atl. & Pac. Tea Co. v. Supermarket Equip. Corp.*, 340 U.S. 147, 155 (1950) (Douglas, J., concurring).

164. See Coombe, *supra* note 6, at 78; Gary P. Nabhan, *Sharing the Benefits of Plant Resources and Indigenous Scientific Knowledge*, in VALUING LOCAL KNOWLEDGE: INDIGENOUS PEOPLE AND INTELLECTUAL PROPERTY RIGHTS 186, 192 (Stephen B. Brush & Doreen Stabinsky eds., 1996).

165. *United States v. Paramount Pictures, Inc.*, 334 U.S. 131, 158 (1948); *accord, e.g.*, *Mazer v. Stein*, 347 U.S. 201, 219 (1954). Admittedly, the second sentence of 35 U.S.C. § 103(a), which provides that “[p]atentability shall not be negated by the manner in which the invention was made,” was added to the statute in 1952, *see* Act of July 19, 1952, ch. 950, § 103, 66 Stat. 792, 798, in order to counteract earlier judicial suggestions that an inventor’s eligibility for a patent hinged on his or her showing of a “flash of genius.” See STAFF OF THE HOUSE COMM. ON THE JUDICIARY, 82D CONG., REVISION OF TITLE 35, UNITED STATES CODE: REPORT TO ACCOMPANY H.R. 7794, at 18 (Comm. Print 1952).

166. See *Fox Film Corp. v. Doyal*, 286 U.S. 123, 127 (1932) (“The sole interest of the United States and the primary objective in conferring the monopoly lie in the general benefits derived by the public from the labor of authors.”).

167. *Eldred*, 537 U.S. at 257 (Breyer, J., dissenting).

168. See Dennis S. Karjala, *The Term of Copyright*, in GROWING PAINS: ADAPTING COPYRIGHT FOR LIBRARIES, EDUCATION, AND SOCIETY 33, 42-44 (Laura N. Gasaway ed., 1997).

169. *Sears, Roebuck & Co. v. Stiffel Co.*, 376 U.S. 225, 229 (1964).

170. *Id.*; *cf.* *Twentieth Century Music Corp. v. Aiken*, 422 U.S. 151, 156 (1975)

public purpose”: a spur to innovation and a product of realized invention, a patent “is limited to the invention which it defines.”¹⁷¹ Intellectual property serves a modest but important goal that can and should be couched in strictly economic terms: proprietary exceptions to a global commons in information are justified solely to the extent that they overcome the so-called “appropriability problem.” Although unfettered access to information ordinarily provides the ideal environment for human creativity, a lower, “indeed suboptimal level of innovation” may result if a would-be inventor cannot “recover the costs of invention because the resulting information [is] available to all.”¹⁷² This is the sense in which private property of any sort, including property in inventions and artistic works, shares the core mission of free trade, that of minimizing deadweight losses stemming from the failure of private parties to complete economically efficient transactions.¹⁷³

The United States Constitution commits American intellectual property law to a strictly utilitarian mission. The “economic philosophy behind” both “patents and copyrights is the conviction that encouragement of individual effort by personal gain is the best way to advance public welfare through the talents of authors and inventors in ‘Science and useful Arts.’”¹⁷⁴ Under this constitutional mandate, American intellectual property law’s exclusive mission of advancing knowledge and generating useful innovations take precedence over abstract concepts such as personal autonomy and self-expression.¹⁷⁵ Just as the Fourteenth Amendment did not “enact Mr. Herbert Spencer’s Social Statics,”¹⁷⁶ the patent and copyright clause of the original Constitution did not endorse the property-rights philosophy of John Locke, Immanuel Kant, or Georg Wilhelm Friedrich Hegel.¹⁷⁷

(describing copyright as designed “to stimulate artistic creativity for the general public good”).

171. *Mercoid Corp. v. Mid-Continent Inv. Co.*, 320 U.S. 661, 666 (1944).

172. Kenneth W. Dam, *The Economic Underpinnings of Patent Law*, 23 J. LEGAL STUD. 247, 247 (1994). *But cf.* Michele Boldrin & David K. Levine, *The Case Against Intellectual Monopoly*, 45 INT’L ECON. REV. 327 (2004) (arguing that monopoly, especially when conferred through intellectual property, is neither a prerequisite to nor a necessary consequence of innovation and that intellectual property, as a practical matter, is more likely to stunt innovation and growth).

173. See Robert C. Ellickson, *Property in Land*, 102 YALE L.J. 1315, 1326 (1993).

174. *Mazer v. Stein*, 347 U.S. 201, 219 (1954).

175. See, e.g., Yochai Benkler, *Siren Songs and Amish Children: Autonomy, Information, and Law*, 76 N.Y.U. L. REV. 23, 59 (2001); Linda R. Cohen & Roger G. Noll, *Intellectual Property, Antitrust and the New Economy*, 62 U. PITT. L. REV. 453, 461 (2001).

176. *Lochner v. New York*, 198 U.S. 45, 75 (1905) (Holmes, J., dissenting).

177. For explanations of the impact of these philosophers on European intellectual property law, see Thomas F. Cotter, *Pragmatism, Economics, and the Droit Moral*, 76 N.C. L. REV. 1 (1997); Hughes, *supra* note 141.

Many decisive consequences flow from the adoption of a utilitarian approach to intellectual property. Viewing patents strictly as another step in the quotidian economic process of commercializing an invention¹⁷⁸) nothing more and nothing less than one of many factors of production wielded by a profit-seeking firm or individual) dissipates much of their mostly symbolic power. From a legal perspective, a purely utilitarian model places greater emphasis on formalities: “the stringent requirements for patent protection seek to assure that ideas in the public domain remain there for the free use of the public.”¹⁷⁹ “Innovation, advancement, and things which add to the sum of useful knowledge are inherent requisites in a patent system”¹⁸⁰ In order to avoid “monopolies which stifle competition without any concomitant advance in scientific progress,”¹⁸¹ patents demand immediate disclosure of an invention as “the *quid pro quo* of the right to exclude.”¹⁸² In this sense “[t]he patent system represents a carefully crafted bargain that encourages both the creation and *the public disclosure* of new and useful advances in technology, in return for an exclusive monopoly for a limited period of time.”¹⁸³

Patent law’s ultimate goal of stimulating disclosure is perhaps best expressed by section 112 of the Patent Act.¹⁸⁴ That section provides:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.¹⁸⁵

By requiring every patent applicant to describe his or her invention in writing, section 112 enables comparably skilled experts to duplicate that invention once patent protection expires.¹⁸⁶ Disclosure through section 112 must teach

178. See generally Edmund W. Kitch, *The Nature and Function of the Patent System*, 20 J.L. & ECON. 265 (1977).

179. *Aronson v. Quick Point Pencil Co.*, 440 U.S. 257, 262 (1979).

180. *Graham v. John Deere Co.*, 383 U.S. 1, 6 (1996).

181. *Bonito Boats, Inc. v. Thunder Craft Boats, Inc.*, 489 U.S. 141, 146 (1989).

182. *Keweenaw Oil Co. v. Bicorn Corp.*, 416 U.S. 470, 484 (1974); *accord J.E.M. Ag Supply, Inc. v. Pioneer Hi-Bred Int’l, Inc.*, 534 U.S. 124, 142 (2001).

183. *Pfaff v. Wells Elecs., Inc.*, 525 U.S. 55, 63 (1998) (emphasis added); see also *Bonito Boats*, 489 U.S. at 161; *Brenner v. Manson*, 383 U.S. 519, 534 (1966); *Pennock v. Dialogue*, 27 U.S. (2 Pet.) 1, 23 (1829).

184. See Rebecca S. Eisenberg, *Patents and the Progress of Science: Exclusive Rights and Experimental Use*, 56 U. CHI. L. REV. 1017, 1027 (1989).

185. 35 U.S.C. § 112 (2000).

186. See *W.L. Gore & Assoc., Inc. v. Garlock, Inc.*, 721 F.2d 1540, 1556-58 (Fed. Cir. 1983); *In re Howarth*, 654 F.2d 103, 105-06 (C.C.P.A. 1981); *cf. In re Wertheim*, 541 F.2d 257, 262-63 (C.C.P.A. 1976) (distinguishing between section 112’s two distinct requirements) namely, that the applicant provide a “written description” and that this description

those in the art to make and use the invention without undue experimentation.¹⁸⁷ Narrowly construing the range of follow-on technologies enabled by a patent has the effect of curbing the patent's scope. For instance, disclosing how to transform tobacco so that it expresses the *Bacillus thuringiensis* (*Bt*) gene has been construed as not enabling a skilled plant geneticist to conduct a similar transformation of the tomato plant.¹⁸⁸ Likewise, disclosing a technique for transforming dicots so that they express the *bar* gene (which confers herbicide tolerance) does not enable similar transformation of all other plants, including monocots.¹⁸⁹ More importantly, the written description and enabling disclosure demanded by section 112 do more than raise hurdles to patenting in the first instance or limit the scope of the patents that are granted. These apparent formalities also facilitate the patent law's "ultimate goal": that of "bring[ing] new designs and technologies into the public domain through disclosure."¹⁹⁰

In short, ethnobiological knowledge should be treated as a global commons. As the legacy of humanity, all ethnobiological knowledge belongs in an international public domain. Paul Heald says it plainly and eloquently: "A theory aimed at providing incentives for new creations does a poor job of justifying protection for existing knowledge."¹⁹¹ The principal "economic rationale" justifying the privatization of land and other tangible objects) namely, rivalry among competing users of a finite, exhaustible resource) "simply does not apply to" traditional knowledge or any other kind of "information good."¹⁹² A utilitarian attitude toward intellectual property dictates a very simple answer: "From an economic perspective, the more people who can use information, the better."¹⁹³ Precisely because successive uses of a public good do not diminish its value, proponents of property rights

enables "one skilled in the art" to duplicate the invention).

187. *Hybritech, Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 1384 (Fed. Cir. 1986); *accord, e.g.*, *Genentech Inc. v. Novo Nordisk A/S*, 108 F.3d 1361, 1365 (Fed. Cir. 1997); *see also In re Wands*, 858 F.2d 731, 736-37 (Fed. Cir. 1988) (observing that a later practitioner of the relevant art may be required to conduct routine screening and other types of experimentation, as long as the necessary experimentation is not "undue").

188. *See Adang v. Fischhoff*, 286 F.3d 1346, 1355-58 (Fed. Cir. 2002).

189. *See Plant Genetic Sys. N.V. v. DeKalb Genetics Corp.*, 315 F.3d 1335, 1344 n.4 (Fed. Cir. 2003). *But cf. Monsanto Co. v. Bayer Bioscience N.V.*, 363 F.3d 1235, 1244-45 (Fed. Cir. 2004) (observing that disclosure through a patent on transforming dicots to express a truncated *Bt* gene might enable the transformation of other plants, including monocots, to express the same truncated *Bt* gene).

190. *Bonito Boats*, 489 U.S. at 151.

191. Heald, *supra* note 154, at 524.

192. Mark A. Lemley, *Place and Cyberspace*, 91 CAL. L. REV. 521, 536 (2003).

193. *Id.*

that would limit the number of users of a public good bear the burden of persuasion.¹⁹⁴

No such resolution of the “biodiversity versus biotechnology” debate will win global acceptance, however, unless it addresses two overriding concerns that the global south and its advocates have tried to answer by securing proprietary status for traditional knowledge of biological properties and applications. First, a global commons approach must keep alleged acts of biopiracy from forming the basis for patents under existing intellectual property laws. Second, developing countries will continue to seek a mechanism, whether or not it is grounded in the law of intellectual property, for securing compensation for their contributions to the global commons. Motivated by “post-colonial theories of obligation to peoples in areas long exploited by the northern hemisphere,” much of the international community seeks some way to alleviate “the extreme distress of those living in bio-rich areas of the world.”¹⁹⁵ Thanks to the “deep antagonism” generated by even the mere perception of illicit “appropriation of knowledge and germ plasm without . . . permission” and without compensation, the life sciences companies of the north will continue to make a big target for the developing world’s political grievances.¹⁹⁶

Of these concerns, the fight against biopiracy is more easily satisfied. Defeating biopiracy does not demand the creation of new forms of property; all that is needed is a legal basis for denying intellectual property rights to the outsiders who export and exploit knowledge originally developed within a traditional community. Within the United States, a relatively modest modification of the Patent Act of 1935 would achieve this objective. As the Act now reads,

A patent may not be obtained . . . if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.¹⁹⁷

Prior art, if found, has a devastating effect on a patent. Prior art that defeats section 102’s novelty requirement can also be used to crush a patent for failure to overcome section 103’s hurdle of nonobviousness.¹⁹⁸

194. See ROBERT P. MERGES ET AL., *INTELLECTUAL PROPERTY IN THE NEW TECHNOLOGICAL AGE* 12-18 (2d ed. 2000).

195. Heald, *supra* note 154, at 521.

196. *Id.*

197. 35 U.S.C. § 103 (2000).

198. See *OddzOn Prods., Inc. v. Just Toys, Inc.*, 122 F.3d 1396, 1401-04 (Fed. Cir. 1997); *In re Bass*, 474 F.2d 1276, 1290 (C.C.P.A. 1973).

The trouble lies in the *definition* of prior art. The Patent Act's definition of prior art embraces patenting or publication in any country, but includes public use or sale solely "in this country."¹⁹⁹ To be exact:

A person shall be entitled to a patent unless . . . the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for patent, or . . . the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of the application for patent in the United States.²⁰⁰

In other words, "while almost all domestic prior knowledge, use, or invention is considered against a later United States patent, almost all similar foreign activity is not."²⁰¹

This limitation of prior art to domestic knowledge is out of step with patent law in other parts of the developed world. The European Union considers evidence of foreign public use in assessing the validity of its patents.²⁰² Indeed, on the basis of foreign public use (specifically, widespread applications of the neem tree in India) the European Patent Office revoked W.R. Grace's patent on "Neemix," a pesticide and insect repellent derived from azadirachtin, a chemical naturally occurring in neem.²⁰³ Redefining "prior art" to include traditional knowledge found in other countries would limit the complicity of American patent law in instances of alleged biopiracy.²⁰⁴ Even under the existing definition of prior art, the Patent and Trademark Office

199. 35 U.S.C. § 102(b) (2000). See generally *Garrett Corp. v. United States*, 422 F.2d 874 (Ct. Cl. 1970); Donald S. Chisum, *Foreign Activity: Its Effect on Patentability Under United States Law*, 11 INT'L REV. INDUS. PROP. & COPYRIGHT L. 26 (1980).

200. 35 U.S.C. § 102(a), (b) (2000).

201. Shayana Kadidal, *Subject-Matter Imperialism? Biodiversity, Foreign Prior Art and the Neem Patent Controversy*, 37 IDEA 371, 376 (1997); accord Emily Marden, *The Neem Tree Patent: International Conflict over the Commodification of Life*, 22 B.C. INT'L & COMP. L. REV. 279, 284 (1999); see also Margo A. Bagley, *Patently Unconstitutional: The Geographical Limitation on Prior Art in a Small World*, 87 MINN. L. REV. 679, 695-96 (2003); Stevenson, *supra* note 135, at 1146-48. On the territoriality of American patent law, see generally Curtis A. Bradley, *Territorial Intellectual Property Rights in an Age of Globalism*, 37 VA. J. INT'L L. 505, 520-23 (1997).

202. See European Patent Convention, *supra* note 131, at art. 54(2) ("The state of the art shall be held to comprise *everything* made available to the public by means of a written or oral description, by use, or in any other way, before the date of filing of the European patent application." (emphasis added)).

203. See Decision Revoking European Patent No. 0436257 (Eur. Patent Off. Feb. 13, 2001); Geeta Nair, *European Patent Office Revokes WR Grace's Neem Patent*, FIN. EXPRESS, May 18, 2000; Frederick Nzwili, *Multinationals Lose Exclusive Rights over Neem Tree*, AFR. NEWS SERV. (May 22, 2000), available at 2000 WL 2161415.

204. See Bagley, *supra* note 201, at 724-27; Downes, *supra* note 129, at 275.

revoked a patent on turmeric after prior art on medicinal uses of the spice was demonstrated through an ancient Sanskrit text and a scientific paper published in 1953 by the Indian Medical Association.²⁰⁵ Eliminating American patent law's existing geographical limitation on prior art would, however, still allow "inventions based on traditional knowledge and genetic resources" to be "patentable as long as they are novel and nonobvious in view of [that] prior art."²⁰⁶

Legislative reform of American patent law's treatment of foreign prior art will not satisfy the southern quest for a legal requirement "that inventors compensate traditional knowledge holders for sharing that knowledge."²⁰⁷ The question of compensation therefore remains unresolved. How can beneficiaries of open access to traditionally held forms of biological knowledge (including the wealthy life science industries of the global north) compensate traditional communities for a massive transfer of this knowledge into an international public domain? Direct rewards are a more appropriate, less socially destructive way of compensating the holders of traditional biological knowledge. American law offers numerous precedents. For example, James Madison and Alexander Hamilton favored a system of prizes and awards over an intellectual property regime based on copyrights and patents.²⁰⁸ Even as it has barred patents for civilian advances in nuclear technology, Congress has authorized prizes for inventors in this field.²⁰⁹ Federal copyright law directs ad hoc arbitration panels to set reasonable royalties for a variety of works, including secondary transmissions by cable television systems, networks, and superstations; phonorecords of nondramatic musical works; public performance of musical compositions through jukeboxes; and artwork and music used in public radio and television broadcasts.²¹⁰

III. "PHARMS" AND FARMERS

I shall temper my enthusiasm for the concept of a global public domain with a sober assessment of the politics behind this debate. Advocates for the global south have clamored for proprietary treatment of traditional knowledge

205. See INTERNATIONAL INTELLECTUAL PROPERTY LAW, *supra* note 4, at 1056.

206. Bagley, *supra* note 201, at 725 n.180.

207. *Id.*

208. See Donald W. Banner, *An Unanticipated, Nonobvious, Enabling Portion of the Constitution: The Patent Provision* *The Best Mode*, 69 J. PAT. & TRADEMARK OFF. SOC'Y 631, 639 (1987).

209. See 42 U.S.C. §§ 2181, 2183 (2000).

210. See 17 U.S.C. §§ 119, 801, 802 (2000).

for many years, and that demand shows no sign of abating. For the time being, potential property interests abound whenever biodiversity is exploited for commercial gain. In order to resolve the conflicting claims of the north and the south, let us consider two hypothetical cases drawn from the annals of the biodiversity battles, one “pharmaceutical” in flavor and the other “agricultural.”

Consider first the “pharm.” Imagine a wonder plant teeming with extraordinary chemical properties. The local population and professional botanists agree that it deserves the title of “village pharmacy.”²¹¹ The developing country where this wonder plant is native supplies both the genetic material and the ethnobiological knowledge that an American life sciences company uses to develop pesticides, antiseptics, even contraceptives. One product in particular, a pesticide and insect repellent, is markedly more stable and effective than traditional formulations known to and used by farmers in the source country. Not only does the American company fail to compensate the source country, it also asserts patent rights in this pesticide and other products developed from that wonder plant and traditional knowledge of its uses. In other words, it stands in position to collect a patent-driven premium from the very villagers who informed the company of the wonder plant’s properties and who helped harvest the company’s first samples of the plant.

This is the paradigmatic biopiracy narrative. Indeed, almost all allegations of biopiracy follow a single script:

<Large northern corporation> <seeks / is developing> a highly sophisticated <plant variety / pharmaceutical product> and sends researchers to <exotic place>. After interviewing local <farmers / foragers>, the company’s researchers identify a <species / variety / breed> of <life form> that seems responsible for <desirable trait>. The researchers collect a few specimens and collate their interviews. The samples and the local lore inspire a successful program of <cross-breeding / genetic engineering / pharmaceutical development>, which saves the company thousands of hours and enables it to eclipse its competition. The company never shares its profits, however, with the local community from which it derived genetic resources and traditional knowledge.²¹²

The real story of W.R. Grace’s encounter with India’s neem tree reflects some elements of this hypothetical.²¹³ Almost as notorious is the story of Eli Lilly & Co.’s derivation of vinblastine and vincristine, two cancer-fighting

211. See EDWARD O. WILSON, *THE DIVERSITY OF LIFE* 285 (1992).

212. This fill-in-the-blank biopiracy form is inspired by Heald, *supra* note 154, at 520.

213. See generally NATIONAL RESEARCH COUNCIL, *NEEM: A TREE FOR SOLVING GLOBAL PROBLEMS* (1992); SHIVA, *supra* note 13; Kadidal, *supra* note 201; Marden, *supra* note 201; Charles R. McManis, *The Interface Between International Intellectual Property and Environmental Protection: Biodiversity and Biotechnology*, 76 WASH. U. L.Q. 255, 257-59 (1998).

alkaloids, from the rosy periwinkle (*Catharanthus roseus*, formerly classified as *Vinca rosea*).²¹⁴ Vinblastine is used in treating Hodgkin's disease;²¹⁵ vincristine has become the drug of choice for treating childhood leukemia.²¹⁶ The commercialization of products derived from neem and the rosy periwinkle has sparked controversies over alleged acts of biopiracy.

Grace has no patent on neem-derived products in India,²¹⁷ and it is "not clear that the Grace patent,"²¹⁸ granted under American law,²¹⁹ "will have any [negative] economic or social effect in India."²²⁰ The European Patent Office's decision to revoke the Grace patent further weakens its impact on India.²²¹ The fear that the Grace patent and TRIPS would work together to deprive Indian villagers of the right to continue traditional uses of neem (including the use of the tree's branches as toothbrushes) is purely scurrilous. Neem in its natural form is unpatentable;²²² so are improvements made by Grace unless the inventive step taken by the company was not obvious from preexisting uses of neem.

As for the rosy periwinkle, Madagascar has an even weaker claim of unjust treatment.²²³ The rosy periwinkle is native to Madagascar but grows throughout the tropics. In 1952, Robert Laing Noble, a member of the medical faculty at the University of Western Ontario, received 25 rosy periwinkle leaves from his brother, Clark Noble, who in turn reported that the leaves were used in Jamaica for treating diabetes when insulin was unavailable. The

214. See, e.g., Richard Stone, *The Biodiversity Treaty: Pandora's Box or Fair Deal?*, 256 SCIENCE 1624 (1992); Christopher J. Hunter, Comment, *Sustainable Bioprospecting: Using Private Contracts and International Legal Principles and Policies to Conserve Raw Medicinal Materials*, 25 B.C. ENVTL. AFF. L. REV. 129, 130 (1997).

215. See Richard Little et al., *Vinblastine for Recurrent Hodgkin's Disease Following Autologous Bone Marrow Transplant*, 16 J. CLINICAL ONCOLOGY 584, 584 (1998).

216. See A.J. P. Veerman et al., *High Cure Rate with a Moderately Intensive Treatment Regimen in Non-High-Risk Childhood Acute Lymphoblastic Leukemia: Results of Protocol ALL VI from the Dutch Childhood Leukemia Study Group*, 14 J. CLINICAL ONCOLOGY 911, 916 (1996).

217. See George K. Foster, Comment, *Opposing Forces in a Revolution in International Patent Protection: The U.S. and India in the Uruguay Round and Its Aftermath*, 3 UCLA J. INT'L L. & FOREIGN AFF. 283, 308 (1998).

218. Marden, *supra* note 201, at 285.

219. See U.S. Patent No. 5,281,618 (issued Jan. 25, 1994).

220. Marden, *supra* note 201, at 285.

221. See sources cited *supra* note 203.

222. See Funk Bros. Seed Co. v. Kalo Inoculant Co., 333 U.S. 127, 130 (1948).

223. The story of the rosy periwinkle's contribution to chemotherapy is told vividly in Alain Marie, *The Rosy Periwinkle: The Little Flower That Saves Lives* (June 2003), available at http://www.symbiosisonline.com/print_jun03_periwinkle.htm. Details in this paragraph are drawn from Mr. Marie's article.

leaves had little effect on blood sugar but strongly inhibited white blood cells. By 1958, Robert Noble's research team at Western Ontario successfully isolated and purified the potent alkaloid extract now known as vinblastine. Working independently, Eli Lilly researcher Gordon Svoboda found that a crude extract of the whole periwinkle plant prolonged the lives of mice afflicted with leukemia. Eli Lilly eventually synthesized vincristine. Insofar as Jamaica has a much stronger claim as the source of traditional knowledge that facilitated the development of vinblastine and vincristine, even advocates of benefit-sharing find it difficult, if not altogether impossible, to fashion a convincing case that Eli Lilly should compensate Madagascar as the source country for rosy periwinkle.²²⁴

The cactus *Hoodia gordonii*, prized for its appetite-suppressing, thirst-quenching, and awareness-heightening qualities, is one of the latest entries in the derby of biopiracy narratives.²²⁵ What the San people of South Africa have known for thousands of years about the plant they call "Xhoba" languished for three decades in the laboratories of the Council for Scientific and Industrial Research (CSIR). Through CSIR and the British firm Phytopharm, Pfizer Corporation acquired the rights to a hoodia-derived compound called P57 (so named because it was the 57th chemical tested) and at one time planned to market a diet drug that would compete against currently available concoctions that rely on the troubled combination of ephedra and caffeine.²²⁶ It is easy enough to imagine that such a concoction, if successfully tested and marketed, would earn massive profits; "[p]urchasers of diet products are often 'pathetically eager' to obtain a more slender figure."²²⁷ As of July 30, 2003, however, Pfizer withdrew from the P57 project and discontinued clinical development of P57.²²⁸ The absence of commercial exploitation renders moot the question of whether P57's developers owe the

224. See A.B. CUNNINGHAM, ETHICS, ETHNOBIOLOGICAL RESEARCH, AND BIODIVERSITY 6 (1993); POSEY & DUTFIELD, *supra* note 129; Karen Anne Goldman, *Compensation for Use of Biological Resources Under the Convention on Biological Diversity: Compatibility of Conservation Measures and Competitiveness of the Biotechnology Industry*, 25 LAW & POL'Y IN INT'L BUS. 695, 717 (1994).

225. See generally Dr. Gerard Bodeker, *Traditional Medical Knowledge, Intellectual Property Rights & Benefit Sharing*, 11 CARDOZO J. INT'L & COMP. L. 785, 795-96 (2003).

226. See, e.g., Regulations on Statements Made for Dietary Supplements Concerning the Effect of the Product on the Structure or Function of the Body, 65 Fed. Reg. 1000 (Jan. 6, 2000); Dietary Supplements Containing Ephedrine Alkaloids, 65 Fed. Reg. 17,474 (Apr. 3, 2000).

227. *United States v. An Article of Food . . . "Manischewitz . . . Diet Thins" etc.*, 377 F. Supp. 746, 749 (E.D.N.Y. 1974).

228. See *Pfizer Returns Rights of P57*, July 30, 2003, available at <http://www.phytopharm.com/press/Rel%2080finalfinal.htm>.

San people any compensation. Ultimately, stories of biopiracy based on the neem tree, the rosy periwinkle, and hoodia cactus are so thoroughly riddled with inconsistencies, misrepresentations, and outright lies that all of these narratives, pending further notice of definitive clarification, must be consigned to the realm of “rural legend.”

Now the farm. Contrast the stories of the neem tree and the rosy periwinkle with a more explicitly agricultural hypothetical. A commercial plant breeder in the United States develops a pest-resistant variety of soybeans. Although public support for plant breeding research has declined in the United States,²²⁹ publicly sponsored public agricultural research in America spans a broad spectrum of advanced genomic technologies.²³⁰ Nevertheless, perhaps aware that classical plant breeding continues to hold the key to food security in a world with a burgeoning population,²³¹ the breeder in question eschews transgenic modification in favor of conventional techniques such as cross-breeding and chemical mutagenesis. In developing the new variety, the company draws on older public varieties, available free of charge from the nearest land grant university,²³² and on previously

229. See KENNETH J. FREY, NATIONAL PLANT BREEDING STUDY (1996).

230. Compare, e.g., Robert F. Service, *Seed Sterilizing ‘Terminator Technology’ Sows Discord*, 282 SCIENCE 850 (1998) (describing the controversy surrounding a transgenic technology designed to prevent germination in treated seeds) with Andrew Pollack, *Gene Research Finds New Use in Agriculture*, N.Y. TIMES, Mar. 7, 2001, at A1 (describing the application of marker-assisted selection, an advanced genomic technology, to enhance the effectiveness of conventional methods of plant and animal breeding).

231. See Jonathan Knight, *Crop Improvement: A Dying Breed*, 421 NATURE 568 (2003); Ann Marie Thro & Paul Zankowski, *Classical Plant Breeding Is the Route to Food Security*, 422 NATURE 559 (2003). See generally, e.g., C. Ford Runge & Benjamin Senauer, *A Removable Feast*, FOREIGN AFF., May/June 2000, at 39, 41 (reporting that “135 million children under the age of 5 are projected to remain hungry in 2020,” even though “per capita food availability in most developing countries will rise by about 10 percent from 1995 to 2020”); Vernon W. Ruttan, *Sustainability Is Not Enough*, 3 AM. J. ALTERNATIVE AGRIC. 128, 129 (1988) (predicting annual increases in agricultural productivity of less than one percent, which will fail to keep pace with 1.0 to 2.0 percent annual increases in global demand, much less the 3.0 to 5.0 percent annual increases that the least developed countries will experience); Luther Tweeten, *Dodging a Malthusian Bullet in the 21st Century*, 14 AGRIBUSINESS 15 (1998) (assessing the prospects for global food security in next 100 years).

232. See 7 U.S.C. § 304 (2000) (donating land in each state for “the endowment, support, and maintenance of at least one college where the leading object shall be . . . to teach such branches of learning as are related to agriculture and the mechanic arts”); cf. *id.* § 2201 (directing the Department of Agriculture “to acquire and to diffuse among the people of the United States useful information on subjects connected with agriculture . . . in the most general and comprehensive sense of [that word], and to procure, propagate, and distribute among the people new and valuable seeds and plants”); THE GARDEN AND FARM BOOKS OF THOMAS JEFFERSON 509 (Robert C. Baron ed., 1987) (“The greatest service which can be rendered any

registered proprietary varieties. After combining the collective wisdom of America's publicly supported agricultural universities with its own research, the company markets protected seed in the United States and abroad. True to traditional agricultural practice, however, farmers in the developing world save seeds for future planting and even engage in "brown-bag" sales to other farmers, all without compensation to the commercial breeder.²³³

This latter story is rarely if ever treated as one creating a conflict between biodiversity and biotechnology. Its legal roots, however, predate the Rio convention by nearly a decade. The conflict between commercial breeders and traditional farmers became known as the "seed wars" of the early 1980s.²³⁴ In 1983 the Food and Agriculture Organization of the United Nations (FAO) adopted a resolution called the International Undertaking on Plant Genetic Resources.²³⁵ In order "to ensure that plant genetic resources of economic and/or social interest, particularly for agriculture, will be explored, preserved, evaluated and made available for plant breeding and for scientific purposes," the Undertaking invoked the "universally accepted principle that plant genetic resources are a heritage of mankind and consequently should be available without restriction."²³⁶ Furthermore, the Undertaking proclaimed that plant genetic resources should be available "free of charge, on the basis of mutual exchange or on mutually agreed terms."²³⁷ The Undertaking negated not only plant breeders' intellectual property rights but also farmers' rights) namely, the traditional agricultural practices of saving seed for future planting, for resale to neighboring farmers, and perhaps even for development of other varieties through conventional cross-breeding.

Crippled by the bitter division between north and south on biodiversity and by its own failure to clarify the common heritage principle,²³⁸ the FAO eventually answered some of the concerns raised by a skeptical north. In a 1989 "interpretation" of the 1983 Undertaking, the FAO declared that "[p]lant

country is to add a useful plant to its culture."). See generally Jim Chen, *The American Ideology*, 48 VAND. L. REV. 809, 838-44 (1995) (describing America's land grant college system).

233. See generally *Asgrow Seed Co. v. Winterboer*, 513 U.S. 179, 182 (1995).

234. See Jack Kloppenburg, Jr. & Daniel Lee Kleinman, *Seed Wars: Common Heritage, Private Property, and Political Strategy*, 95 SOCIALIST REV. 6 (1989).

235. See International Undertaking on Plant Genetic Resources, *Report of the Conference of the United Nations Food and Agriculture Organization*, 22d Sess., U.N. Doc. C/83/REP (1983).

236. *Id.* ¶ 285, art. 1.

237. *Id.* ¶ 285, art. 5.

238. See generally Harold J. Bordwin, *The Legal and Political Implications of the International Undertaking on Plant Genetic Resources*, 12 ECOLOGY L.Q. 1053, 1062-68 (1985).

breeders' rights as provided for under UPOV [the International Convention for the Protection of New Varieties of Plants] are not incompatible with the International Undertaking."²³⁹ It also acknowledged that "the term 'free access' does not mean free of charge."²⁴⁰ At the same time, the 1989 interpretation endorsed the "concept of farmers' rights," acknowledging "that farmers of all regions have made" an "enormous contribution . . . to the conservation and development of plant genetic resources, which constitute the basis of plant production throughout the world."²⁴¹

Before Rio, farmers' rights were regarded as a basis for redirecting some profits from biotechnological inventions toward farmers in "Vavilov centres," or "original sources of plant genetic material."²⁴² Russian botanist Nikolai I. Vavilov theorized that the world's crops originated in eight definable centers of origin.²⁴³ It was in these centers (all located in less developed countries) that agriculture had originated and that "the greatest genetic diversity was to be found."²⁴⁴ Equating Vavilov's eight centers (China, India, central Asia, the Middle East, the Mediterranean, Ethiopia, southern Mexico and Central America, and the Andes) with the "Third World" stretches credibility, however.²⁴⁵ China, India, and certain parts of the Mediterranean, though less wealthy than the top tier of developed nations, are by no means destitute. A quick glance at Vavilov's map also demonstrates that the agronomist, the pharmacologist, and the ecologist have distinct maps of biodiversity. Simply put, the geography of biodiversity varies considerably when viewed through any of a diverse range of anthropocentric lenses.

239. *Interpretation of the International Undertaking on Plant Genetic Resources*, U.N. Doc. C89/24 (Nov. 11-30, 1989).

240. *Id.*

241. *Id.*

242. David Godden, *Induced Institutional Innovation: Plant Variety Rights, Patents and Genetic Engineering*, 19 OXFORD AGRARIAN STUD. 3, 8 (1991). See generally David A. Cleveland & Stephen C. Murray, *The World's Crop Genetic Resources and the Rights of Indigenous Farmers*, 38 CURRENT ANTHROPOLOGY 477 (1997).

243. See David S. Tilford, *Saving the Blueprints: The International Legal Regime for Plant Resources*, 30 CASE W. RES. J. INT'L L. 373, 384-85 (1998) (describing Vavilov's work as one of three contemporary developments) along with the discovery of Mendelian genetics and advances in plant hybridization) that have severed agricultural success from biological diversity).

244. CARY FOWLER & PAT MOONEY, SHATTERING: FOOD, POLITICS, AND THE LOSS OF GENETIC DIVERSITY 32 (1990).

245. Among the Vavilov centers, "India" includes Indo-Malaya. In addition to the Andes, South America contains two additional centers of somewhat lesser significance: the island of Chiloe off the coast of southern Chile and a region straddling Brazil and Paraguay. See *id.*

The principle of directing profits toward farmers in Vavilov centers coexisted comfortably with at least nominal adherence to the common heritage principle. Both notions would soon evaporate from international law. At its 25th session, the same meeting that generated the 1989 “interpretation” of the International Undertaking on Plant Genetic Resources, the FAO conference adopted Resolution 5/89, which repeatedly stressed the “particular” importance of farmers’ rights “in the centres of origin/diversity” (also described as “the areas of origin/diversity of plant genetic resources”).²⁴⁶ The same resolution “recogniz[ed] that . . . plant genetic resources are a common heritage of mankind to be preserved, and to be freely available for use, for the benefit of present and future generations.”²⁴⁷

Resolution 5/89 would represent one of the last endorsements of the common heritage principle in the international law on ownership of plant genetic resources. Two years later, at the next session of the FAO conference, the Resolution 3/91 declared that “the concept of mankind’s heritage, as applied in the International Undertaking on Plant Genetic Resources, is subject to the sovereignty of the states over their plant genetic resources.”²⁴⁸ This resolution explicitly endorsed the principle “that nations have sovereign rights over their plant genetic resources.”²⁴⁹ Simultaneously, all hints of special consideration of farmers in centers of genetic origin and diversity disappeared. As of 1991, the FAO claimed farmers’ rights on behalf of all “farmers of the world.”²⁵⁰ By its 27th session, in 1993, the FAO conference explicitly aligned the Undertaking “with the outcome of the negotiations of a Convention on Biological Diversity” and that treaty’s explicit “recogni[tion] that the authority to determine access to genetic resources rests with . . . national governments.”²⁵¹

The Convention on Biological Diversity expressly repudiated the “heritage of mankind” approach that animated the original 1983 FAO Undertaking. The adoption of its central principle, that “States have . . . the sovereign right to exploit their own resources pursuant to their own environmental policies,” capped the FAO’s abandonment of the common heritage principle in favor of sovereign control.²⁵² By declining to treat the

246. Farmers’ Rights, Resolution 5/89, FAO Conf., 25th Sess., U.N. Doc. 89/REP (1989), available at <ftp://ext-ftp.fao.org/waicent/pub/cgrfa8/Res/C5-89E.pdf>.

247. *Id.*

248. Farmers’ Rights, Resolution 3/91, FAO U.N. Doc. 91/REP (1991), available at <ftp://ext-ftp.fao.org/waicent/pub/cgrfa8/Res/C3-91E.pdf>.

249. *Id.*

250. *Id.*

251. Resolution 7/93, FAO Conf., 27th Sess., U.N. Doc. 93/REP (1993), available at <ftp://ext-ftp.fao.org/waicent/pub/cgrfa8/Res/C7-93E.pdf>.

252. CBD, *supra* note 2, at art. 3.

genetic world as a global commons, the Biodiversity Convention strengthened not only breeders' rights but also farmers' rights. This is the ultimate legacy of the International Undertaking, especially after its reinterpretation in 1989 and the FAO Conference's rapid renunciation of the common heritage principle. In the transition from the original Undertaking's "heritage of mankind" principle to the Convention on Biological Diversity's exclusive reliance on "sovereign right[s]," the FAO and the United Nations at large abjured their commitment to plant genetic resources as a common heritage of humanity and endorsed entitlements under international law for the two most powerful stakeholder groups in the controversy, commercial plant breeders and farmers.

Whatever its fate as positive law, the Undertaking serves an indispensable jurisprudential function. Its emphasis on farmers' rights reminds us that agriculture is also a life science. Prosperity in farming depends on the very practices that southern critics ascribe to northern biotechnology companies. "Copying" (often a deviant and difficult deed for would-be infringers in many other industries) is the essence of agriculture. Whether cultivating plants or raising animals, farmers specialize in applying reproductive techniques and technology. Whoever wields the plow and the scythe controls thereby the power to create and the power to kill.²⁵³ Stories of origin, especially those stressing humanity's fall, dominate legal narratives about agriculture and environmental protection.²⁵⁴ After all, "there is one story in the world, and only one";²⁵⁵ "[f]or every constitution there is an epic, for every decalogue a scripture."²⁵⁶ Little wonder, then, that biologists derive "intense spiritual feelings" from the "unfathomable complexity and . . . sublime beauty" of the biosphere at its fullest and most diverse.²⁵⁷ Human food production has profound ecological significance. Agriculture enabled humanity to increase its food supply by shifting "one whole trophic

253. See, e.g., JOSEPH CAMPBELL, *THE MASKS OF GOD: PRIMITIVE MYTHOLOGY* 177 (1959); ALDO LEOPOLD, *A SAND COUNTY ALMANAC AND SKETCHES HERE AND THERE* 214-20 (1949); cf. *Acts* 10:13 (King James) ("Rise, Peter; kill and eat.").

254. See sources cited *supra* note 23.

255. JOHN STEINBECK, *EAST OF EDEN* 413 (2002).

256. Robert M. Cover, *The Supreme Court, 1982 Term: Foreword: Nomos and Narrative*, 97 *HARV. L. REV.* 4, 4 (1983); see also Robert M. Cover, *The Folktales of Justice: Tales of Jurisdiction*, 14 *CAP. U. L. REV.* 179, 180 & n.7 (1985) (describing the origins of law in "the sacred narratives of our world"). See generally Milner S. Ball, *Stories of Origin and Constitutional Possibilities*, 87 *MICH. L. REV.* 2280 (1989).

257. DAVID TAKACS, *THE IDEA OF BIODIVERSITY: PHILOSOPHIES OF PARADISE* 255 (1996).

level”: “For the first time [in natural history] an animal had adopted a new niche without speciating.”²⁵⁸

Although the stakes are smaller and the relative economic strengths of the players are reversed, the brown-bagging farmer takes a free ride on the intellectual contributions of American land grant universities and plant breeders, just as American and European biopirates have expropriated the ethnobiological traditions of the developing world. After sufficient iterations of this game, it becomes impossible to tell where the creative process begins and ends, to distinguish inventor from infringer. When innovative acts follow each other as if they were so many pancakes in a stack, there is no coherent way to identify one side as the “inventive” one.²⁵⁹

In other words, the global south cannot decry “biopiracy” and proclaim “farmers’ rights” in the same breath. Both practices exploit the reproductive capacity of nonhuman organisms in order to expropriate ideas developed by human beings. The only difference is the magnitude of the pecuniary stakes. Indeed, even the contrast between “pharm” and “farm” evaporates upon closer inspection. Pharmaceutical products are almost as susceptible as seeds to unauthorized duplication. Drugs tend to be durable, subject to intense demand, relatively inexpensive to produce, easily transported, and readily imitated at a minute fraction of the original research and production costs.²⁶⁰ In their struggle against drug copying enterprises, pharmaceutical companies do not so much rue the loss of retail sales in less developed countries as they fear gray-market “leakage” of those drugs back into the lucrative markets of the developed world.²⁶¹ Economically speaking, seeds are no different.

The southern countries that urge recognition of intellectual property in indigenous knowledge are often proponents of *weakening* proprietary protection on pharmaceuticals, agricultural chemicals, and educational materials in the name of increased access.²⁶² A study by the World Intellectual

258. PAUL COLINVAUX, WHY BIG FIERCE ANIMALS ARE RARE: AN ECOLOGIST’S PERSPECTIVE 218 (1979). On the concept of trophic levels, see generally S. L. Pimm & J. H. Lawton, *Number of Trophic Levels in Ecological Communities*, 268 NATURE 329 (1977).

259. See Mark A. Lemley, *The Economics of Improvement in Intellectual Property Law*, 75 TEX. L. REV. 989, 997 (1997). See generally Suzanne Scotchmer, *Standing on the Shoulders of Giants: Cumulative Research and the Patent Law*, 5 J. ECON. PERSP. 29 (1991).

260. See Otto A. Stamm, *GATT Negotiations for the Protection of New Technologies*, 73 J. PAT. & TRADEMARK OFF. SOC’Y 680, 685 (1991).

261. See F.M. Scherer & Jayashree Watal, *Post-TRIPS Options for Access to Patented Medicines in Developing Nations*, 5 J. INT’L ECON. L. 913, 928 (2002) (describing this phenomenon as “parallel trade”). See generally *K Mart Corp. v. Cartier, Inc.*, 486 U.S. 281 (1988).

262. See Frank Emmert, *Intellectual Property in the Uruguay Round) Negotiating Strategies of the Western Industrialized Countries*, 11 MICH. J. INT’L L. 1317, 1383 (1990);

Property Organization) a United Nations organization not known for its friendliness toward the legal and economic preferences of the United States) found that respondents in 28 less developed countries, despite their misgivings about intellectual property as a legal concept and about aspects of specific intellectual property laws, often “expressed interest in exploring further the actual and potential role” of intellectual property in protecting traditional knowledge.²⁶³ Subsequent WIPO publications have committed the organization to the project of developing models for protecting genetic resources, traditional knowledge, and folklore at the international level.²⁶⁴ North and south, the local attitude toward intellectual property depends on what is being protected and what posture toward protection delivers the greatest benefit to local interests.

One further note of caution is in order. The southern campaign to enhance the proprietary status of its genes and memes) its germplasm and its ethnobiological knowledge) will engage not only the law of property, but also the entire legal apparatus of the industrialized world. This is especially true of southern memes, the cultural practices that distinguish the countries of the south from a world whose normative baselines in cultural and political matters are set by the wealthy and powerful north. Like every other “living thing,” the meme is a selfish “imperialist, seeking to transform as much as possible of its environment into itself and its seed.”²⁶⁵ Some ethnobiological memes may affirmatively harm the environment, or at least conflict with competing values expressed through environmental law. Asian folk medicine drives global demand for rhinoceros horns and black bear claws.²⁶⁶ On opposite sides of the Pacific, Japanese appetites²⁶⁷ and Makah rituals²⁶⁸ clash with the International

Muria Kruger, Note, *Harmonizing TRIPs and the CBD: A Proposal from India*, 10 MINN. J. GLOBAL TRADE 169, 170 (2001).

263. Intellectual Property Needs and Expectations of Traditional Knowledge Holders: WIPO Report on Fact-Finding Missions on Intellectual Property and Traditional Knowledge (1998-1999), at 223 (2001), available at <http://www.wipo.int/tk/en/tk/ffm/report/final/pdf/part1.pdf>.

264. See, e.g., World Intellectual Property Organization, *Matters Concerning Intellectual Property and Genetic Resources, Traditional Knowledge and Folklore*, WIPO Doc. WO/GA/26/6 (Aug. 25, 2000); World Intellectual Property Organization, *Matters Concerning the Intergovernmental Committee on Intellectual Property and Genetic Resources, Traditional Knowledge and Folklore*, WIPO Doc. WO/GA/31/8 (July 23, 2004).

265. BERTRAND RUSSELL, AN OUTLINE OF PHILOSOPHY 30 (1974).

266. See, e.g., William Carroll Muffett, *Regulating the Trade in Bear Parts for Use in Asian Traditional Medicine*, 80 MINN. L. REV. 1283 (1996).

267. See *Japan Whaling Ass'n v. Am. Cetacean Soc'y*, 478 U.S. 221 (1986) (interpreting the International Whaling Convention); Kazuo Sumi, *The Whale War Between Japan and the United States: Problems and Prospects*, 17 DENV. J. INT'L L. & POL'Y 317 (1989).

268. See *North Pacific Eastern Stock of Gray Whales*, 48 REP. INT'L WHALING COMM'N

Convention on Whaling.²⁶⁹ Consumers in Florida who prize the eggs of endangered sea turtles as aphrodisiacs pay \$36 per dozen.²⁷⁰ The shocking prevalence of “analogics”) aphrodisiacs by zoological analogy that have at most placebo value for men seeking enhanced sexual performance) makes it plausible to contemplate whether widespread distribution of erectile dysfunction drugs at low or no cost could be justified as a pro-conservation measure.²⁷¹

More generally, the “[s]mall-scale communities” celebrated in the standard protest against globalization “are seldom as humane and ecologically sound” as their advocates “portray them to be.”²⁷² “Small firms . . . are responsible for a massively disproportionate share of water and air pollution.”²⁷³ Agriculture, perhaps the world’s most decentralized industry,²⁷⁴ is especially suspect. “One would be hard pressed to identify another industry with as poor an environmental record and as light a regulatory burden.”²⁷⁵ Lest the perceived hegemony of the north lend undue currency to the romantic

28 (1997) (applying the whaling convention’s exemption for “traditional uses of whale product by local aboriginal, indigenous or native communities in meeting their nutritional, subsistence and cultural requirements”); *United States v. Washington*, 730 F.2d 1314 (9th Cir. 1984); Alma Soongi Beck, *The Makahs’ Decision to Reinstate Whaling: When Conservationists Clash with Native Americans over an Ancient Hunting Tradition*, 11 J. ENVTL. L. & LITIG. 359 (1996); Leesteffy Jenkins & Cara Romanzo, *Makah Whaling: Aboriginal Subsistence or a Stepping Stone to Undermining the Commercial Whaling Moratorium?*, 9 COLO. J. INT’L ENVTL. L. & POL’Y 71 (1998).

269. International Convention for the Regulation of Whaling with Schedule of Whaling Regulations, Dec. 2, 1946, 62 Stat. 1716, 161 U.N.T.S. 361.

270. See Dana Canedy, *Eggs of Endangered Turtles Fall Prey to Florida Dealers*, N.Y. TIMES, Aug. 2, 2002, at A1, A19.

271. Cf. *Why Rhinos Recommend Viagra*, ECONOMIST, May 30, 1998, at 76.

272. MARTIN W. LEWIS, GREEN DELUSIONS: AN ENVIRONMENTALIST CRITIQUE OF RADICAL ENVIRONMENTALISM 91 (1992).

273. Richard J. Pierce, Jr., *Small Is Not Beautiful: The Case Against Special Regulatory Treatment of Small Firms*, 50 ADMIN. L. REV. 537, 559 (1998); see also Linda K. Lee, *The Impact of Landownership Factors on Soil Conservation*, 62 AM. J. AGRIC. ECON. 1070, 1073 (1980) (observing that larger nonfamily corporate farms outperform family-owned farms in soil conservation and erosion control); Luther Tweeten, *The Economics of Small Farms*, 219 SCIENCE 1037, 1038 (1983).

274. See Nancy L. Johnson & Vernon W. Ruttan, *Why Are Farms So Small?*, 22 WORLD DEV. 691 (1994).

275. J.B. Ruhl, *Farms, Their Environmental Harms, and Environmental Law*, 27 ECOLOGY L.Q. 263, 269 (2000); J.B. Ruhl, *The Environmental Law of Farms: 30 Years of Making a Mole Hill Out of a Mountain*, 31 ENVTL. L. REP. 10,203 (2001); see also Jim Chen, *Get Green or Get Out: Decoupling Environmental from Economic Objectives in Agricultural Regulation*, 48 OKLA. L. REV. 333 (1995).

myth of the “noble savage,”²⁷⁶ we should remember “that the propensity to destroy the environment flourishes in any cultural setting.”²⁷⁷

With respect to environmental norms, the developing world enjoys no moral superiority over the developed world. Any advantage on either side of the developmental divide favors those countries whose legal systems have adopted the most comprehensive and coherent rules for managing their citizens’ contact with the living world in an age of growing scarcity and declining diversity. In industrialized societies, the law has comfortably assimilated the achievements of life scientists and shaped their attitudes. Nations such as the United States routinely confer patents, plant variety certificates, and other intellectual property rights for biological innovations. With equal vigor, however, western nations also subject those scientists to rigorous regulatory schemes in order to preserve the environment and to prevent ethical abuses.²⁷⁸ Nature over nurture, leisure over labor: in domestic and international legal conflicts, environmental imperatives should prevail over cultural claims and in all events over full employment.²⁷⁹

Ethnobiological knowledge has likewise come of age. In contemplating whether to make cultural knowledge eligible for proprietary protection, we should immediately subject cultural practices to legal scrutiny.²⁸⁰ Whether ethnobiological knowledge becomes a full-fledged form of intellectual property, or whether (as I propose) a sophisticated understanding of ethnobiological knowledge counsels strongly against unduly expanding intellectual property within the laws of the industrialized world, the exercise of determining the status of this knowledge under the law of property should

276. See, e.g., JEAN-JACQUES ROUSSEAU, DISCOURSE ON THE ORIGIN OF INEQUALITY (Franklin Philip trans. & Patrick Coleman ed., 1994).

277. Chen, *Globalization and Its Losers*, *supra* note 14, at 184; cf. Elizabeth Mensch & Alan Freeman, *The Politics of Virtue: Animals, Theology and Abortion*, 25 GA. L. REV. 923, 961 (1991) (warning of the moral danger that “lies in forgetting that we live, after all, in a ‘fallen world’”). See generally DONALD WORSTER, NATURE’S ECONOMY: A HISTORY OF ECOLOGICAL IDEAS 115-29 (1977) (noting how such famed ecological observers as Darwin, Melville, and Thoreau recognized the moral ambivalence of nature).

278. See, e.g., Agricultural Risk Protection Act of 2000, Pub. L. No. 106-224, 114 Stat. 358 (2000) (codified as amended in scattered sections of 7 U.S.C.); Animal Welfare Act, 7 U.S.C. §§ 2131-2156 (2000); Plant Protection Act, Pub. L. No. 106-224, § 412, 114 Stat. 358, 441 (2000).

279. Chen, *Globalization and Its Losers*, *supra* note 14, at 214-18; see also Chen, *Epiphytic Economics*, *supra* note 14, at 2-4. But cf. Mark Kelman, *Could Lawyers Stop Recessions? Speculations on Law and Macroeconomics*, 45 STAN. L. REV. 1215, 1224-25 (1993) (describing unemployment as “the economic problem” for social progressives).

280. See generally Guido Calabresi & A. Douglas Melamed, *Property Rules, Liability Rules, and Inalienability: One View of the Cathedral*, 85 HARV. L. REV. 1089 (1972).

represent merely the first step toward the complete integration of human traditions into positive law.

IV. WHAT CROWS KNOW: A STORY OF DEVOTION TO INNOVATIVE FREEDOM

No one in this debate honestly wishes to abandon intellectual property as a legal construct. What the international legal community has called the “biotechnology versus biodiversity” debate can be reduced to an almost purely abstract and jurisprudential struggle over the appropriate conceptualization of the valuable inputs needed to facilitate the commercial development of biological treasures. Generally speaking, property responds to scarcity, which in turn stems from competing uses for a single object.²⁸¹ Crows know: because property rules are expensive to create and maintain, “crows dispense with their normal territoriality when food is plentiful.”²⁸²

Even John Locke, who is credited with inventing the “sweat of the brow” theory of property rights, accepted the corvid critique of property.²⁸³ Although the Lockean instinct to treat intellectual property as a reward for hard work has served as a legal leitmotif,²⁸⁴ neither Locke nor contemporary legal institutions treat hard work alone as a sufficient basis for intellectual property. Rather, Locke admitted that overwhelming abundance, if placed “in the middle of the in-land parts of” a remote continent, with “no hopes of

281. See Harold Demsetz, *Towards a Theory of Property Rights*, 57 AM. ECON. REV. 347 (1967).

282. Carol M. Rose, *The Several Futures of Property: Of Cyberspace and Folk Tales, Emission Trades and Ecosystems*, 83 MINN. L. REV. 129, 134 (1998).

283. See JOHN LOCKE, *The Second Treatise of Government* § 27, in TWO TREATISES OF GOVERNMENT 265, 288 (Peter Laslett ed., Cambridge Univ. Press 1988) (1690) (“Whatsoever, then, he removes out of the State that Nature hath provided, and left it in, he hath mixed his *Labour* with it, and joined to it something that is his own, and thereby makes it his *Property*.”).

284. See, e.g., *Ruckelshaus v. Monsanto Co.*, 467 U.S. 986, 1002-03 (1984); *Mazer v. Stein*, 347 U.S. 201, 219 (1954) (“The economic philosophy behind the clause empowering Congress to grant patents and copyrights is the conviction that encouragement of individual effort by personal gain is the best way to advance public welfare Sacrificial days devoted to . . . creative activities deserve rewards commensurate with the services rendered.”); *Int’l News Serv. v. Associated Press*, 248 U.S. 215, 239-40 (1918) (condemning the “taking [of] material that has been acquired by [a competitor] as the result of organization and the expenditure of labor, skill, and money” insofar as the alleged copyright infringer “endeavor[ed] to reap where it has not sown” and thereby “appropriat[ed] to itself the harvest of those who have sown”); see also *Jeweler’s Circular Publ’g Co. v. Keystone Publ’g Co.*, 281 F. 83, 88 (2d Cir. 1922). For a comprehensive overview of the “sweat of the brow” or “reap where one has sown” model of intellectual property, see Wendy J. Gordon, *On Owning Information: Intellectual Property and the Restitutionary Impulse*, 78 VA. L. REV. 149, 166-96 (1992).

Commerce with other Parts of the World,” would not be worth enclosing.²⁸⁵ Contemporary musicians Amy Ray and Emily Saliers, better known as the Indigo Girls, have brilliantly summarized this fundamental limitation on the Lockean theory of property:

I've had enough temporary aquisition
and building fences for no gain²⁸⁶

For its part, the Supreme Court has authoritatively repudiated the “sweat of the brow” as a basis for copyright protection.²⁸⁷

The points of agreement between Lockean philosophy and Supreme Court jurisprudence can be reduced to a manageable set of simple principles. Property rules should be set aside when wealth abounds or rival uses have not yet emerged. Nor should the Lockean theory of property justify the conversion of public goods to private control, least of all the intellectual commons.²⁸⁸ Before contact with the outside world, traditional societies had no occasion to erect costly property rules. In the debate over biodiversity and biotechnology, advocates for the south argue that the developing world should not be punished for its failure to establish a property regime that would satisfy northern legal and cultural standards. The rational (if not altogether sympathetic) response to the south's *retrospective* plea lies in emphasizing the *prospective* impact of tightening property law's conceptual grip on the world of biotechnology. Sunk costs are just that, sunk. Historical accidents have no relevance to forward-looking business decisions that weigh nothing more than the current value of information and the balance between current prices and current costs.²⁸⁹ The economic imperative to look forward) that is, the dismal

285. LOCKE, *supra* note 283, § 48, at 301.

286. INDIGO GIRLS, *Devotion, on RETROSPECTIVE* (Sony 2000).

287. See *Feist Publ'ns, Inc. v. Rural Tel. Serv. Co., Inc.*, 499 U.S. 340, 353-60 (1991). Intimations of this posture can be found as early as the Marshall Court. See *Wheaton v. Peters*, 33 U.S. (8 Pet.) 591, 661 (1834).

288. See generally PETER DRAHOS, *A PHILOSOPHY OF INTELLECTUAL PROPERTY LAW* 41-68 (1996); Wendy J. Gordon, *A Property Right in Self-Expression: Equality and Individualism in the Natural Law of Intellectual Property*, 102 *YALE L.J.* 1533 (1993); Heald, *supra* note 154, at 527-28.

289. See, e.g., *Alenco Communications, Inc. v. FCC*, 201 F.3d 608, 615 (5th Cir. 2000); DALE E. LEHMAN & DENNIS WEISMAN, *THE TELECOMMUNICATIONS ACT OF 1996: THE "COSTS" OF MANAGED COMPETITION* 66 (2000) (recognizing how any regulatory or business strategy with any pretense to economic efficiency must focus on prospective costs to the exclusion of embedded costs); ROBERT S. PINDYCK & DANIEL L. RUBINFELD, *MICROECONOMICS* 199 (2d ed. 1992) (observing that sunk costs “are usually visible,” but arguing nevertheless that “they should always be ignored when making economic decisions”); RICHARD A. POSNER, *ECONOMIC ANALYSIS OF LAW* § 1.1, at 7 (3d ed. 1986) (“[C]ost to an economist is a forward-looking concept”; costs already incurred “do not affect decisions on price and quantity.”).

scientist's mandate to ignore history) is "particularly significant in industries . . . which depend heavily on technological innovation."²⁹⁰ After all, "progress in a scientific discipline can be measured by how quickly its founders are forgotten,"²⁹¹ and a "science which hesitates to forget its founders is lost."²⁹²

In light of the economic stakes, let alone the ecological and evolutionary consequences of bad decisions regarding biodiversity conservation, we have enormously elevated incentives to resolve these issues properly. Innovation is a slippery phenomenon to describe, much less regulate. It "is intangible, uncertain, unmeasurable, and often even unobservable, even in retrospect."²⁹³ Yet the wealth of nations, gene donors and recipients alike, hangs in the balance. "The static gains and losses from regulation" and other similar policy choices "are probably small compared to the historical gains in welfare resulting from innovation and productivity growth."²⁹⁴ The literature on commercial bioprospecting and its relationship with biodiversity conservation has fallen into a very common and treacherous trap; like their counterparts throughout the academy, scholars exploring this topic rarely "give adequate attention to considerations of dynamic efficiency."²⁹⁵ Most writers stress, albeit in varying degrees, how important it is to compensate the gene donor communities of the global south and how bioprospecting promises to deliver the income streams that will be needed to restore a measure of historical justice to traditional communities whose genetic wealth and accumulated knowledge have enriched the world at large. The literature falls short, however, in analyzing the potential impact of introducing a novel form of intellectual property and thereby redirecting the flow of information) genes *and* memes) that thus far has dictated the course of biotechnological innovation.

It is not abundance but scarcity that defines today's biodiversity crisis. The scarcity at issue is twofold. First, the global interest in biodiversity

290. MCI Communications Corp. v. Am. Tel. & Tel. Corp., 708 F.2d 1081, 1116-17 (7th Cir. 1983).

291. WILSON, *supra* note 125, at 182-83.

292. ALFRED NORTH WHITEHEAD, *THE AIMS OF EDUCATION* 162 (1932).

293. Richard T. Rapp, *The Misapplication of the Innovation Market Approach to Merger Analysis*, 64 ANTITRUST L.J. 19, 27 (1995).

294. Paul L. Joskow & Nancy L. Rose, *The Effects of Economic Regulation*, in 2 HANDBOOK OF INDUSTRIAL ORGANIZATION 1449, 1484 (Richard Schmalensee & Robert D. Willig eds., 1989).

295. Ha-Joon Chang, *The Economics and Politics of Regulation*, 21 CAMBRIDGE J. ECON. 703, 721 (1997); *see also* Joskow & Rose, *supra* note 294, at 1484 (lamenting how "so little effort has been devoted to measuring the effects of regulation on innovation and productivity growth").

conservation often conflicts with local subsistence, which requires immediate and often nonsustainable consumption of resources. Second, because the genes and the ethnobiological lore at issue have the characteristics of public goods, any value in them is effectively extinguished upon first use. In many instances, value evaporates almost as quickly as it becomes apparent. On many occasions researchers operating under western notions of “informed consent” have extracted ethnobiological knowledge and even human tissues from “illiterate Third World villagers with little knowledge about modern medicine.”²⁹⁶ Although outsiders usually place a higher value on the uses of these items and the non-uses of biodiversity in general, efforts to compensate source countries and peoples can be frustrated by the ease with which the value of biodiversity in its most beneficial uses can be dissipated.

Ironically enough, both sides in this debate fetishize property²⁹⁷ as the foundation of a capitalist economy.²⁹⁸ This shared attraction to property as an organizing jurisprudential principle suggests at a minimum that both sides have conceded the triumph of markets over central planning in the economic realm and have moved on to disputes over the political terms by which global society should be governed. But this consensus also demonstrates that both sides understand the biosphere and its bounty as scarce, depletable, and increasingly unrecoverable. Smart crowds would do no less; they calibrate proprietary arrangements and other rules for social governance as the occasion demands. If anything, both the global north and the global south have underestimated not only the precariousness of the natural world, but also the resiliency of human innovation.

296. Ragavan, *supra* note 7, at 10,360.

297. Cf. Duncan Kennedy, *The Role of Law in Economic Thought: Essays on the Fetishism of Commodities*, 34 AM. U. L. REV. 939 (1985).

298. See generally JAMES W. ELY, JR., *THE GUARDIAN OF EVERY OTHER RIGHT: A CONSTITUTIONAL HISTORY OF PROPERTY RIGHTS* (1992).