

A Weed by any Other Name: Would the Rose Smell as Sweet if it Were a Threat to Biodiversity?

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1. INTRODUCTION

What do giant reed, mesquite, and common cord grass have in common? Self evidently, the species are all plants. More importantly, the species also are part of a group of approximately 350 plants¹ being considered as potential sources of environmentally friendly fuel,² which states hope will help resolve problems associated with the global energy crisis³ and climate change.⁴ However, as states

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1. See Ayhan Demirbas, *Importance of Biodiesel as Transportation Fuel*, 35 ENERGY POL'Y 4661, 4663 (2007).

2. The term environmentally-friendly fuel refers to the fact that plant-based fuels are seen as a less environmentally harmful alternative to fossil fuels. See DEBORAH O'CONNELL ET AL., *BIOFUELS IN AUSTRALIA—AN OVERVIEW OF ISSUES AND PROSPECTS* 3–8 (2007), available at <https://iridc.infoservices.com.au/items/07-071> (“Biofuels” is used to describe plant-based fuel species seen as an alternative to fossil fuels).

3. Global Invasive Species Programme, *Biofuel Crops and the Use of Non-native Species: Mitigating the Risks of Invasion*, at 3 (May 2008) [hereinafter GISP].

4. See O'CONNELL ET AL., *supra* note 2, at 2–3; Demirbas, *supra* note 1, at 4661; Sergio Ulgiati, *A Comprehensive Energy and Economic Assessment of Biofuels: When “Green” Is Not Enough*, 20 CRITICAL REVS. PLANT SCI. 71, 71 (2001).

move towards the use of plant-based fuels to replace fossil fuels, the issue arises whether they are replacing one host of environmental problems with another.⁵

In particular, scientists and other commentators have indicated that the injudicious use of biofuel plants is set to create the next wave of invasive alien species (IAS).⁶ IAS are alien species that threaten ecosystems, habitats, and other species,⁷ and have the potential to lead to species' extinctions.⁸ Regulatory issues centering on how to define and identify IAS lie at the heart of the problem. At present, numerous national and international regimes have developed a variety of terms and descriptions to identify and define an assortment of unwanted species. Yet, this abundance of terminology has not resulted in a comprehensive or unified coverage of the IAS issue. In addition, even when regimes provide broad definitions of IAS, states are reluctant to adopt these definitions if the species is considered a useful resource.

The purpose of this paper is to explore the challenges facing states in defining IAS, particularly where those species are useful to humans. The discussion focuses on the emerging issue of biofuel plants and their impact on biodiversity. However, as the definitional quandaries biofuels present are not isolated, examples also are drawn from other types of IAS.

The paper commences with a discussion of how species that are regarded as useful, though potentially harmful as an IAS, have historically been introduced without consideration of their invasive qualities. The discussion then turns to the issue of biofuels, highlighting how these plants can become invasive and subsequently harmful to biodiversity. This discussion flows into an examination of the difficulties states have in creating a workable definition of "invasive alien species." It is argued that without adequate direction, regulators face uncertainty with respect to their regulatory purpose, which potentially hinders the establishment of meaningful regimes. At the same time, however, comprehensive definitions are not a panacea, for states must have the political will to make definitions

5. Conference of the Parties to the Convention on Biological Diversity, Ninth Meeting, Bonn, May 19–30, 2008, *The Potential Impacts of Biofuels on Biodiversity, Matters arising from SBSTTA recommendation X11/7*, 2, U.N. Doc UNEP/CBD/COP9/26 (April 24, 2008); TIM LOW & CAROL BOOTH, *THE WEEDY TRUTH ABOUT BIOFUELS I* (Invasive Species Council 2007); Lian Pin Koh, *Potential Habitat and Biodiversity Losses from Intensified Biodiesel Feedstock Production*, 21 *CONSERVATION BIOLOGY* 1373, 1373–74 (2007).

6. Conference of the Parties to the Convention on Biological Diversity, *supra* note 5, ¶ 29; LOW & BOOTH, *supra* note 5, at 10.

7. Convention on Biological Diversity art. 8(h), June 5, 1992, 1760 U.N.T.S. 143, 146. The Convention had 191 Parties as of March 2009. *List of Parties*, CONVENTION ON BIOLOGICAL DIVERSITY, <http://www.cbd.int/convention/parties/list/> (last visited Oct. 28, 2009).

8. CABI BIOSCIENCE SWITZERLAND CENTRE, *AN INVENTORY OF ALIEN SPECIES AND THEIR THREAT TO BIODIVERSITY AND ECONOMY IN SWITZERLAND* 27 (Rudiger Wittenberg ed., 2005); Greg Sherley & Sarah Lowe, *Towards a Regional Invasive Species Strategy for the South Pacific: Issues and Options*, in *INVASIVE SPECIES IN THE PACIFIC: A TECHNICAL REVIEW AND DRAFT REGIONAL STRATEGY 7–8* (Greg Sherley ed., 2000); see DEP'T OF ENV'T AND CONSERVATION, *NEW SOUTH WALES STATE OF THE ENVIRONMENT REPORT 2006* § 6.4 (2006) [hereinafter *NEW SOUTH WALES STATE OF THE ENVIRONMENT REPORT 2006*], available at <http://www.environment.nsw.gov.au/soe/soe2006/index.htm>.

operational by implementing appropriate regulation.

2. INVASIVE ALIEN SPECIES OR USEFUL RESOURCE?

While biofuels present one solution to the problem of environmentally damaging fossil fuels, the value of biofuels as useful resources must be evaluated against the potential damage of introducing invasive alien species into fragile ecosystems. In particular, where an alien species poses a threat to biodiversity, but is also regarded as useful, state practice has been ill defined in the extent to which the threat to biodiversity is taken into account.⁹ In many cases, disruption of, or interference with, *human* activities traditionally has been decisive as to whether an alien species is classified and regulated as an invasive alien species,¹⁰ irrespective of the harm that it is causing to biodiversity.

This aspect of alien species is part of what Jeffrey McNeely has described as the human dimension of IAS.¹¹ As he has pointed out, many deliberate introductions of species “relate to the human interest in nurturing species that are helpful to people, for agricultural, forestry, ornamental or even psychological purposes”¹² However, neither economic, nor social interests, nor subjectively honest motives, necessarily guarantee benign consequences. Nor can “curing” one environmental problem be considered in isolation from other environmental problems.¹³ Although those who introduce species rarely set out to cause environmental harm,¹⁴ environmental harm often results. In a new location, free

9. Edwin M. Smith, *The Endangered Species Act and Biological Conservation*, 57 S. CAL. L. REV. 361, 364–67 (1984). For an example of how feral goats were treated as a resource rather than an IAS, see *Palila v. Haw. Dep’t of Land & Natural Res.*, 832 F.2d 1106, 1106–11 (9th Cir. 1988); *Palila v. Haw. Dep’t of Land & Natural Res.*, 471 F. Supp 985, 999 (D. Haw. 1979), *aff’d*, 639 F.2d 495 (9th Cir. 1981).

10. Mark A. Davis & Ken Thompson, *Invasion Terminology: Should Ecologists Define Their Terms Differently Than Others? No, Not if We Want to be of Any Help!*, 82 BULL. ECOLOGICAL SOC’Y AM. 206, 206 (2001); Robert I. Colautti & Hugh J. MacIsaac, *A Neutral Terminology to Define “Invasive” Species*, 10 DIVERSITY DISTRIBUTIONS 135, 135–36 (2004). For a discussion on the differences between the ecological meaning of “invasive” and the administrative meaning of the word, see generally Marcel Rejmánek et al., *Biological Invasions: Politics and the Discontinuity of Ecological Terminology*, 83 BULL. ECOLOGICAL SOC’Y AM. 131, 131–32 (2002).

11. See generally Jeffrey A. McNeely, *An Introduction to Human Dimensions of Invasive Alien Species*, in THE GREAT RESHUFFLING: HUMAN DIMENSIONS OF INVASIVE ALIEN SPECIES 5–20 (Jeffrey A. McNeely ed., 2001). The human dimension of invasive alien species is fostered by the desire of humans to create the type of ecosystems and environments they find pleasing or profitable. It is accelerated by globalization and increases in trade and travel. *Id.* at 6.

12. *Id.* at 6.

13. Richard Doornbosch & Ronald Steenblik, Organisation for Economic Co-operation and Development, Round Table on Sustainable Development, Paris, Sept. 11–12, 2007, *Biofuels: Is the Cure Worse Than the Disease?*, 4, 10, Doc. No. SG/SD/RT(2007)3, available at <http://media.ft.com/cms/fb8b5078-5fdb-11dc-b0fe-0000779fd2ac.pdf>.

14. There may be exceptions. The introduction of foxes into the Australian state of Tasmania has occurred both accidentally and deliberately, although the deliberate introductions have not necessarily been coupled with an intention to cause environmental harm. Foxes are known to have entered Tasmania accidentally in 1912 and 1998 after jumping ship. However, an ABC report in 2002 indicated that foxes may have been introduced

from its natural predators, pests, and diseases, every alien species has the potential to turn invasive and cause severe environmental damage.¹⁵ Thus, from a regulatory perspective, it is important to understand that whether the species is administered and regulated as an actual or potential IAS depends on how 'invasive alien species' is initially defined.

Some of the worst invasive species have been introduced on the assumption that they would be useful. The cane toad, for example, was introduced in June 1935 to control insects destroying sugar crops in the Australian state of Queensland.¹⁶ Though the toad proved valueless in controlling insects, it nevertheless developed into a significant IAS that eats and poisons many native Australian animals.¹⁷ Cane toads have now entered Kakadu National Park, where they are steadily advancing and are in position to begin a major assault on the park's biodiversity.¹⁸ Similar impacts have been felt in Australia with respect to other alien species, such as the Indian mynah¹⁹ and mosquito fish,²⁰ both of which were introduced to control insects.

Elsewhere in Australia, feral pigs, goats, and foxes transmit diseases, are responsible for land degradation, and compete with native animals for food and habitat.²¹ Yet, pigs, goats, and foxes are hunted commercially and recreationally,²² a situation that also occurs in many other states.²³ Often, attempts at

deliberately more recently for hunting purposes. Danny Kingsley, *Getting Foxes Out of Tasmania*, ABC SCIENCE ONLINE, May 27, 2002, <http://www.abc.net.au/science/articles/2002/05/27/561226.htm>. The Tasmanian Department of Primary Industries and Water has detailed the potential ecological disaster to one half of Tasmanian native land animals, should foxes become established in that state. Dep't of Primary Industries, Parks, Water & Env't, *Foxes in Tasmania—A Grave Threat to Our Wildlife*, ABC SCIENCE ONLINE, May 27, 2002, <http://www.dpiw.tas.gov.au/inter.nsf/webpages/sjon-52j8u3?open>.

15. See Subsidiary Body on Scientific, Technical & Technological Advice [SBSTTA], Sixth Meeting, Montreal, March 12–16, 2001, *Invasive Alien Species: Comprehensive review on the efficiency and efficacy of existing measures for their prevention, early detection, eradication and control*, 18–19, U.N. Doc. UNEP/CBD/SBSTTA/6/7 (Dec. 20, 2000) [hereinafter SBSTTA Sixth Meeting]; TIM LOW, *FERAL FUTURE 102* (The University of Chicago Press, 2002) (1999) (detailing how species, ranging from rabbits to green crabs and fire ants, have wreaked havoc on Australia's native biodiversity).

16. *Animal Species: Cane Toad*, AUSTRALIAN MUSEUM, June 10, 2009, <http://www.austmus.gov.au/factsheets/canetoad.htm>.

17. DEP'T OF THE ENV'T & HERITAGE, THE FERAL CANE TOAD (*Bufo marinus*)—INVASIVE SPECIES FACT SHEET 2 (April 2004), available at <http://www.environment.gov.au/biodiversity/invasive/publications/cane-toad/pubs/cane-toad.pdf>.

18. RA VAN DAM ET AL., DEP'T OF THE ENV'T & HERITAGE, UPDATE TO A PRELIMINARY RISK ASSESSMENT OF CANE TOADS IN KAKADU NATIONAL PARK, SUPERVISING SCIENTIST REP. NO. 164 1 (2002), available at <http://www.environment.gov.au/ssd/publications/ssr/pubs/ssr164-update.pdf>. See original report at <http://www.deh.gov.au/ssd/publications/ssr/pubs/ssr164-contents.pdf>.

19. *Common Myna*, BIRDS IN BACKYARDS, June 8, 2008, <http://www.birdsinbackyards.net/finder/display.cfm?id=36>.

20. MURRAY-DARLING BASIN COMMISSION, EASTERN GAMBUSIA FACTSHEET (2007).

21. BEN REDDIE & DAVID M. FORSYTH, DEP'T OF THE ENV'T AND HERITAGE, REVIEW OF EXISTING RED FOX, FERAL CAT, FERAL RABBIT, FERAL PIG AND FERAL GOAT IN AUSTRALIA, II. INFORMATION GAPS 3, 6 (2004) available at <http://www.environment.gov.au/biodiversity/invasive/publications/information-gaps/index.html>.

22. For a discussion on the hunting of pigs, see generally DAVID CHOQUENOT, ET AL., BUREAU OF RESOURCE

eradicating such animals have brought environmentalists into conflict with those who regard the species as an economically valuable resource.²⁴ More recently, in Australia, attempts at classifying the browsing and grazing activities of the introduced Sambar deer as a “threatening process”²⁵ were challenged by the Australian Deer Association Inc.²⁶ The Association argued, albeit unsuccessfully, that the deer’s activities did not constitute a threat.²⁷ The Association proposed this argument regardless of the fact that the damage caused by these animals had already been well documented.²⁸

Historically, the problem of IAS has been particularly noteworthy in countries with colonial links including Australia, New Zealand, and the United States of America, where the introduction of new species was fostered under the auspices of the “acclimatization societies.” These societies were nongovernmental organizations established in the second half of the nineteenth century to transfer plants and animals between the colonies and the mother country.²⁹ Although the societies were nongovernmental, they were often subsidized by governments, which gave them a degree of government approval. In addition, the popularity of the societies was enhanced by membership that included some of the most prominent scientists of the day.³⁰ The societies attained a degree of economic

SCIENCES, SCIENTIFIC, ECONOMIC AND SOCIAL ISSUES OF COMMERCIAL USE OF WILD ANIMALS IN AUSTRALIA (1998) (The authors examine a range of native and introduced species for their commercial use and point out that although commercial uses of introduced species may reduce population levels, the species must also be maintained at a commercially-viable level, which may not necessarily be compatible with protection of biodiversity).

23. See DAVID CHOQUENOT, ET. AL., BUREAU OF RESOURCE SCIENCES, MANAGING VERTEBRATE PESTS: FERAL PIGS § 6 (Mary Bomford ed., 1996), available at http://www.daff.gov.au/brs/land/feral-animals/apamp/managing_vertebrate_pests_feral_pigs.

24. See Douglas O. Linder, “Are All Species Created Equal?” *And Other Questions Shaping Wildlife Law*, 12 HARV. ENVTL. L. REV. 157, 163 (1988).

25. Application made pursuant to the Victorian FLORA AND FAUNA GUARANTEE ACT 1988 to list “Degradation and loss of terrestrial habitats caused by Sambar (*Cervus unicolor*)” as a threatening process. The nomination was accepted with some modifications in June 2006. See DEP’T. OF SUSTAINABILITY & ENV’T, FLORA AND FAUNA GUARANTEE ACT 1988, PROCESSES LIST (Nov. 2008) [hereinafter FLORA AND FAUNA GUARANTEE ACT 1988], available at [http://www.dse.vic.gov.au/CA256F310024B628/0/101E5CCD017DCBBBCA25753F0018F6A9/\\$File/FFG+processes+list+November+2008.pdf](http://www.dse.vic.gov.au/CA256F310024B628/0/101E5CCD017DCBBBCA25753F0018F6A9/$File/FFG+processes+list+November+2008.pdf) (“Reduction in biodiversity of native vegetation by Sambar (*Cervus unicolor*)”); DEPT. OF SUSTAINABILITY & ENV’T, DRAFT FLORA AND FAUNA GUARANTEE ACTION STATEMENT: REDUCTION IN BIODIVERSITY OF NATIVE VEGETATION BY SAMBAR (*CERVUS UNICOLOR*) (Austl.) [hereinafter DRAFT FLORA AND FAUNA GUARANTEE ACTION STATEMENT], available at [http://www.dse.vic.gov.au/CA256F310024B628/0/352922211DC08D48CA25754D00146FBC/\\$File/Reduction+in+biodiversity+by+Sambar+AS.pdf](http://www.dse.vic.gov.au/CA256F310024B628/0/352922211DC08D48CA25754D00146FBC/$File/Reduction+in+biodiversity+by+Sambar+AS.pdf).

26. See Australian Deer Ass’n, *Welcome to the A.D.A.*, AUSTDEER, <http://www.austdeer.com.au/index.php> (last visited Oct. 27, 2009).

27. Australian Deer Ass’n v. Victoria (2008) 20 V.R. 209 (Austl.).

28. DRAFT FLORA AND FAUNA GUARANTEE ACTION STATEMENT, *supra* note 25.

29. See Thomas R. Dunlap, *Remaking the Land: The Acclimatization Movement and Anglo Ideas of Nature*, 8 J. WORLD HIST. 303, 305 (1997).

30. Michael Osborne, *A Collaborative Dimension of the European Empires: Australian and French Acclimatization Societies and Intercolonial Scientific Cooperation*, in INTERNATIONAL SCIENCE AND NATIONAL SCIENTIFIC IDENTITY: AUSTRALIA BETWEEN BRITAIN AND AMERICA 100–02 (R.W. Home & Sally G. Kohstedt

success; however, this often came at the expense of native biodiversity.³¹

Although we may scoff at these nineteenth century acclimatizers, the underlying reasons for those introductions are not so very different from the reasons that species continue to be introduced in more recent times. In China, for example, 39.6% of all invasive alien species are believed to have been deliberately introduced for pasture and animal feed, or ornamental, textile, and medicinal plants.³² Similarly, in Switzerland, 75% of plants that are now prohibited were originally introduced as ornamentals.³³ In addition, a number of prohibited vertebrates, such as waterfowl, were originally introduced to improve the landscape in Switzerland.³⁴ Even today, garden clubs, horticultural societies, and seed exchanges transfer seeds and bulbs across great distances.³⁵

Part of the problem is that, from a policy perspective, states often shy away from viewing desirable species as potential IAS. This approach leads to inconsistent descriptions and definitions of IAS and gaps in the regulation and management of these species. Therefore, the issue becomes whether this scenario will repeat itself with the use of biofuels.

3. THE USE OF BIOFUELS

3.1 WHAT ARE BIOFUELS?

Biofuels are plants from which precursor alcohols, such as methanol and ethanol, are distilled. These alcohols are chemically treated and subsequently converted to plant-based fuels.³⁶ As previously indicated, biofuels are seen as a potential solution to the problems spurred by climate change and the energy crisis.³⁷ Fossil fuels are non-renewable, and oil "reserves may be 80% depleted within 35–84 years."³⁸ By way of contrast, biofuels derive from plant matter,

eds., 1991).

31. See Behavioral Ecology Symposium '94: Ted D. Center et al., *Biological Invasions: Stemming the Tide in Florida*, 78 FLA. ENTOMOLOGIST 45, 47 (1995).

32. Haigen Xu et al., *The Distribution and Economic Losses of Alien Species Invasion to China*, 8 BIOLOGICAL INVASIONS 1495, 1496–97 (2006).

33. CABI BIOSCIENCE SWITZERLAND CENTRE, *supra* note 8, at 13.

34. *Id.* at 13–14.

35. See The Global Invasive Species Programme (GISP), *The Internet as a Pathway for IAS Brochure*, 2004, <http://www.gisp.org/publications/brochures/FactsheetInternetPathway.pdf> (fact sheet issued by the British Columbian Ministry of Agriculture and Lands warning consumers about purchasing seeds and other plant material through mail-order seed catalogues, the Internet, and other sources); Ministry of Agriculture & Lands, *Wild Flowers or Invasive Noxious Weeds*, BRITISH COLUMBIA, <http://www.agf.gov.bc.ca/cropprot/invasiveplant.htm> (last visited Oct. 27, 2009) (describing the role of Botanical Gardens in importing plants that became invasive).

36. See Demirbas, *supra* note 1, at 4662.

37. See O'CONNELL ET AL., *supra* note 2, at 2–5; Demirbas, *supra* note 1; Ulgiati, *supra* note 4.

38. Dániel Puppán, *Environmental Evaluation of Biofuels*, 10 PERIODICA POLYTECHNICA SER. SOC. & MGMT. SCIENCES 95, 95 (2002).

which is a renewable source of energy.³⁹ Consequently, their manufacture likely will lead to improved fuel security.⁴⁰ Moreover, being plant-based, biofuels are biodegradable and are considered to “contribute to sustainability.”⁴¹ In particular, with respect to climate change, the use of biofuels can lead to lower greenhouse gas emissions compared to the use of fossil fuels.⁴²

Yet, the cultivation of biofuels also may lead to a number of problems.⁴³ To begin, the production of biofuels uses farmed plant species. Consequently, either land already used for agriculture will need to be diverted to biofuel production or additional land will need to be cleared for cultivation. The former case could lead to loss of food security.⁴⁴ In the latter case, land clearing would release “vast amounts of carbon”⁴⁵ and thus negate one of the reasons for using biofuels, which is to lower greenhouse gas emissions and improve a state’s response to climate change. Moreover, land clearing can also lead to loss of vegetation and habitat⁴⁶—factors widely acknowledged to be prime contributors to biodiversity depletion.⁴⁷

Moreover, the introduction and cultivation of alien species, without due regard to the potential for these species to become invasive, can lead to environmental

39. See generally Jason Hill et al., *Environmental, Economic, and Energetic Costs and Benefits of Biodiesel and Ethanol Biofuels*, 103 PROC. NAT’L ACAD. SCI. 11206, 11206 (2006) (Biofuels include fuels derived from corn, and biodiesel derived from soybeans. The article analyzes differing sources of biofuels and concludes that the best sources of biofuel are “low-input biomass grown on agriculturally marginal land or from waste biomass”).

40. See O’CONNELL ET AL., *supra* note 2, at 2–3, 6.

41. Puppán, *supra* note 38, at 96.

42. See O’CONNELL ET AL., *supra* note 2, at 5–6. Greenhouse gases are gases, such as carbon dioxide and methane, which trap heat inside the earth’s atmosphere. Current greenhouse gas levels “are pushing the global temperature to artificially high levels,” leading to climate disruption and species’ extinctions. *Feeling the Heat*, UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE, http://unfccc.int/essential_background/feeling_the_heat/items/2917.php (last visited Oct. 27, 2009). See United Nations Framework Convention on Climate Change [UNFCCC], May 9, 1992, 1771 U.N.T.S. 107 (entered into force Mar. 21, 1994) [hereinafter UNFCCC].

43. Conference of the Parties to the Convention on Biological Diversity, *supra* note 5, ¶¶ 14–37; Joseph Farigione et al., *Land Clearing and the Biofuel Carbon Debt*, 319 SCIENCE 1235, 1235 (2008); Puppán, *supra* note 38, at 96.

44. Demirbas, *supra* note 1, at 4663; C. Ford Runge & Benjamin Senauer, *How Biofuels Could Starve the Poor*, 86 FOREIGN AFF. 41, 42–43 (2007); Josef Schmidhuber, *Impact of an Increased Biomass Use on Agricultural Markets, Prices and Food Security: A Longer-Term Perspective 27–28* (International Symposium of Notre Europe, Working Paper, 2006).

45. O’CONNELL ET AL., *supra* note 2, at 15.

46. With respect to forest biodiversity, see Conference of the Parties to the Convention on Biological Diversity, Sixth Meeting, The Hague, Neth., Apr. 7–19, 2002, *Report of the Sixth Meeting of the Conference of the Parties to the Convention of Biological Diversity*, 229, U.N. Doc UNEP/CBD/COP/6/20 (May 27, 2002). The report refers to the fact that “human-induced uncontrolled clearing” has led to loss of forest biodiversity.

47. See ANDREAS GLANZING, DEPT. OF THE ENV’T, SPORT AND TERRITORIES, NATIVE VEGETATION CLEARANCE, HABITAT LOSS AND BIODIVERSITY DECLINE: AN OVERVIEW OF RECENT NATIVE VEGETATION CLEARANCE IN AUSTRALIA AND ITS IMPLICATIONS FOR BIODIVERSITY, BIODIVERSITY SERIES, PAPER NO. 6 (1995), <http://www.environment.gov.au/biodiversity/publications/series/paper6/index.html>; O’CONNELL ET AL., *supra* note 2, at 15; S. Raghu et al., *Adding Biofuels to the Invasive Species Fire?*, 313 SCI. 1742, 1742 (2006).

degradation.⁴⁸ This is a significant consideration because the cultivation of plants for biofuel largely involves the use of non-native, or alien, plants. These include species already mentioned, such as giant reed, mesquite, and common cord grass, as well as many others, such as varieties of willow,⁴⁹ reed canary grass,⁵⁰ hawthorn, and breadfruit. The latter four, in particular, already have proved to be invasive in many parts of the world, including the United States of America, South Africa, and Central America.⁵¹

3.2 WHAT ARE INVASIVE ALIEN SPECIES?

Invasive alien species are alien species that threaten ecosystems, habitats, or other species. The threats posed by IAS have been the subject of numerous reports,⁵² papers,⁵³ and publications.⁵⁴ These threats include reduction of biodiversity by direct predation on native species,⁵⁵ modifying habitat,⁵⁶ introducing

48. See discussion *infra* part 2.2.

49. Low & Booth, *supra* note 5, at 13–31.

50. Raghu et al., *supra* note 47.

51. GISP, *supra* note 3, at 4–7. For a more detailed examination of eighteen biofuel plants, see Low & Booth, *supra* note 5, at 15–27.

52. For example reports see generally CHERYL M. BROWN, TED CASE STUDIES, TILAPIA AND THE ENVIRONMENT (1997), <http://www.american.edu/TED/tilapia.htm> (Tilapia, or Nile Perch, as the species is otherwise known, is a carnivorous fish that has reduced the biodiversity of native fish in Lake Victoria); ELLEN GROSMAN, TED CASE STUDIES, NILE PERCH TRADE AND ENVIRONMENT (2000), <http://www.american.edu/TED/perch.htm>.

53. This ever-increasing body of literature provides recognition of the fact that states need to implement tighter regulatory controls over invasive alien species. For examples of papers, see Center et al., *supra* note 31; S. L. Coles & L. G. Eldredge, *Nonindigenous Species Introductions on Coral Reefs: A Need for Information* 56 PAC. SCI. 191 (2002); Peter T. Jenkins, *Paying for Protection from Invasive Species*, 19 ISSUES SCI. & TECH. 67 (2002); Anne M. Perrault & William Carroll Muffett, *Turning Off the Tap: A Strategy to Address International Aspects of Invasive Alien Species*, 11 REV. EUR. CMTY. & INT'L ENVTL. L. 211 (2002); Lyle Glowka, *Bioprospecting, Alien Invasive Species, and Hydrothermal Vents: Three Emerging Legal Issues in the Conservation and Sustainable Use of Biodiversity*, 13 TUL. ENVTL. L.J. 329 (2000); Todd E. McDowell, *Slow-Motion Explosion: The Global Threat of Exotic Species and the International Response to the Problem in the South Pacific*, 9 COLO. J. INT'L ENVTL. LAW & POL'Y 187 (1998); Lyle Glowka & Cyrille de Klemm, *International Instruments, Processes and Non-Indigenous Species Introductions—Is a Protocol Necessary?*, 26 ENVTL. POL'Y & LAW 247 (1996); Jeff McNeely, *Invasive Species: A Costly Catastrophe for Native Biodiversity*, LAND USE & WATER RES. RESEARCH, Nov. 2002, <http://www.luwt.com>.

54. For examples of papers see MARY BOMFORD, BUREAU OF RURAL SCIENCES, RISK ASSESSMENT FOR THE IMPORT AND KEEPING OF EXOTIC VERTEBRATES IN AUSTRALIA (Penny Olsen ed., 2003), available at http://www.feral.org.au/feral_documents/PC12803.pdf; GLOBAL INVASIVE SPECIES PROGRAMME, GLOBAL STRATEGY ON INVASIVE ALIEN SPECIES (Jeffrey A. McNeely et al. eds., 2001), available at <http://www.cbd.int/doc/principles/ais-strategy-gisp.pdf>; QUENTIN C.B. CRONK & JANICE L. FULLER, PLANT INVADERS: A 'PEOPLE AND PLANTS' CONSERVATION MANUAL (Chapman & Hall 1995); Keith Hart, *Legal and Policy Responses to the Problem of Pest Animal Impacts on Natural Resources in NSW*, 19 ENVTL. & PLAN. L.J. 355 (2002); D.A. Andow, *Biological Invasions: Assessment and Management of Environmental Risk*, FOOD & FERTILIZER TECH. CENTER FOR THE ASIAN & PAC. REGION (2003), available at <http://www.agnet.org/library/eb/538/>.

55. See generally BROWN, *supra* note 52 (detailing how carnivorous alien fish prey on native fish); see also United Nations Environment Programme, *Yellow-Eyed Penguin—Megadyptes antipodes*, WORLD CONSERVATION MONITORING CENTRE, http://www.unep-wcmc.org/species/data/species_sheets/yellowey.htm (last visited

pests and diseases,⁵⁷ and hybridizing with native species.⁵⁸ The International Union for the Conservation of Nature (IUCN) has described the problem of invasive alien species as “one of the major threats to native biological diversity.”⁵⁹ Certainly, the deleterious impacts of IAS have the potential to lead to irreversible outcomes for the protection of biodiversity, such as species’ extinctions.⁶⁰

The Convention on Biological Diversity (CBD)⁶¹ defines biodiversity as the “the variability among living organisms . . . and the ecological complexes of which they are part [including] diversity within species, between species and of ecosystems.”⁶² In order to protect biodiversity, it is therefore necessary to protect individual species, the variability among species, their genetic diversity, the interrelationship of species to each other, and the interrelationship of species to their ecosystems and to other ecosystems.

However, although the definition of “biodiversity” under the CBD is wide enough to include alien and invasive alien species, this does not automatically mean that every species will be protected under it. Species that are harmful, such as those that cause disease in humans, or species that are considered invasive alien species, will often be subject to measures designed to prevent or control

Oct. 27, 2009); BirdLife International 2008, *Megadyptes antipodes*, IUCN RED LIST OF THREATENED SPECIES 2009.1 <http://www.iucnredlist.org/details/144808/0> (last visited Oct. 27, 2009) (explaining that the Yellow-Eyed Penguin is under threat from predation by introduced mammals).

56. See Doria A Gordon, *Effects of Invasive, Non-Indigenous Plant Species on Ecosystem Processes: Lessons from Florida*, 8 (4) ECOLOGICAL APPLICATIONS 975 (1998) (examining how non-native species alter habitats at many ecosystem levels), available at [http://www.esajournals.org/doi/abs/10.1890/1051-0761\(1998\)008%5B0975:EOINIP%5D2.0.CO%3B2](http://www.esajournals.org/doi/abs/10.1890/1051-0761(1998)008%5B0975:EOINIP%5D2.0.CO%3B2).

57. CLARE SHINE ET AL., A GUIDE TO DESIGNING LEGAL AND INSTITUTIONAL FRAMEWORKS ON ALIEN INVASIVE SPECIES 8–9 (IUCN 2000).

58. Convention on Biological Diversity, Subsidiary Body on Sci. Technical & Technological Advice, Ninth Meeting, Montreal, Nov. 10–14, 2003, *Pilot Assessments: The Ecological and Socio-Economic Impact of Invasive Alien Species on Island Ecosystems*, §§ 32–34, U.N. Doc. UNEP/CBD/SBSTTA/9/INF/33 (Nov. 5, 2003), available at <http://www.cbd.int/doc/meetings/sbstta/sbstta-09/information/sbstta-09-inf-33-en.pdf>.

59. SSC Invasive Species Specialist Group, 51st Meeting of the International Union for Conservation of Nature [IUCN] Council, Gland, Switz., Feb. 2000, *IUCN Guidelines for the Prevention of Biodiversity Loss Caused by Alien Invasive Species*, § 1 [hereinafter IUCN Guidelines], available at http://intranet.iucn.org/webfiles/doc/SSC/SSCwebsite/Policy_statements/IUCN_Guidelines_for_the_Prevention_of_Biodiversity_Loss_caused_by_Alien_Invasive_Species.pdf.

60. CABI BIOSCIENCE SWITZERLAND CENTRE, *supra* note 8; NEW SOUTH WALES STATE OF THE ENVIRONMENT REPORT 2006, *supra* note 8; Sherley & Lowe *supra* note 8; H. A. Mooney & E. E. Cleland, *The Evolutionary Impact of Invasive Species*, 98 (10) PROCEEDINGS OF THE NAT’L ACAD. OF SCI. OF THE UNITED STATES OF AMERICA 5446, 5448 (2001) (noting that three species listed as endangered in the United States of America have become extinct as a result of hybridization with alien species). For a different approach to the issue of extinctions, see generally Jessica Gurevitch & Dianna K. Padiilla, *Are Invasive Species a Major Cause of Extinctions?*, 19 (9) TRENDS IN ECOLOGY & EVOLUTION 470 (2004) (The authors question the widely accepted view of scientists that invasive alien species lead to extinctions. They conclude that more research and empirical data is needed in this field of study).

61. Convention on Biological Diversity, *supra* note 7, art. 2.

62. *Id.*

their entry, establishment, and spread.⁶³

3.3 BIOFUELS AS INVASIVE ALIEN SPECIES

Because the production of biofuels largely relies on the introduction and cultivation of alien plants, states need to be aware of the potential for these plants to become invasive.⁶⁴ The Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA)⁶⁵ of the CBD has cautioned that biofuel production can have adverse effects associated with the “uncontrolled introduction and spread of invasive alien species.”⁶⁶ In a similar vein, the International Union for the Conservation of Nature (IUCN)⁶⁷ lists giant reed, mesquite, and common cord grass on a database comprising one hundred of the world’s worst invasive species.⁶⁸ Moreover, many other plants being considered as a source of biofuels, including the neem tree, the giant milkweed, and the olive tree, have also been identified elsewhere as invasive.⁶⁹

As with many invasive alien plants, biofuels can be particularly difficult, indeed impossible, to eradicate and control once they have become established.⁷⁰ More specifically, eradication and control procedures are complicated by the fact that birds and animals widely spread plant species,⁷¹ giving regulators little command over where the plant is introduced. Consequently, preventative mea-

63. For example, the khapra beetle is one in Australia. AUSTRALIAN ACADEMY OF SCIENCE, SUBMISSION TO THE REVIEW OF THE AUSTRALIAN QUARANTINE INSPECTION SERVICE § 3.1.1 (1996), available at <http://www.science.org.au/reports/aqiscont.htm>.

64. GISP, *supra* note 3, at 1; Conference of the Parties to the Convention on Biological Diversity, *supra* note 5, ¶ 29.

65. The Subsidiary Body on Scientific, Technical and Technological Advice is constituted in accordance with Article 25 of the Convention on Biological Diversity to provide scientific and technical assessments on the status of biodiversity, as well to provide advice relating to conservation and sustainable use of biodiversity. Convention on Biological Diversity art. 25, June 5, 1992, 1760 U.N.T.S. 79, 158, 31 I.L.M. 818, 833.

66. Conference of the Parties to the Convention on Biological Diversity, Bonn, May 19–30, 2008, *Report of the Subsidiary Body on Scientific, Technical, and Technological Advice on the Work of its Twelfth Meeting*, 36, U.N. Doc. UNEP/CBD/COP/9/2 (July 16, 2007).

67. The IUCN was founded on Oct. 5, 1948. It draws its membership from over 140 countries and currently has more than 10,000 acknowledged scientists and other experts who volunteer their services. The IUCN applies ecosystem management principles aligning both environmental and economic issues. *About IUCN*, IUCN, Mar. 24, 2009, <http://www.iucn.org/about/>.

68. *About GISP*, THE GLOBAL INVASIVE SPECIES PROGRAMME, 2008, <http://www.gisp.org/species/index.asp>. See *Ecology of Arundo donax (grass)*, GLOBAL INVASIVE SPECIES DATABASE, Mar. 23, 2006, <http://www.issg.org/database/species/ecology.asp?si=112&fr=1&sts=&lang=EN>; *Ecology of Prosopis glandulosa (tree)*, GLOBAL INVASIVE SPECIES DATABASE, Apr. 13, 2005, <http://www.issg.org/database/species/ecology.asp?si=137&fr=1&sts=&lang=EN>; *Ecology of Spartina anglica (grass)*, GLOBAL INVASIVE SPECIES DATABASE, Apr. 13, 2005, <http://www.issg.org/database/species/ecology.asp?si=76&fr=1&sts=&lang=EN>. Other plants being considered for biofuel purposes such as sugar cane, peanuts, and wheat are not considered invasive. GISP, *supra* note 3, Table.

69. Low & BOOTH, *supra* note 5, at 18–26.

70. See GISP, *supra* note 3, at 1; Raghuram et al., *supra* note 47.

71. GISP, *supra* note 3, at 1.

asures that stop IAS from gaining a foothold often are advocated as the best management option.⁷² However, in order to prevent IAS from gaining entry, regulators need clarity and certainty with respect to the object of regulation, something that starts with the challenging task of defining invasive alien species.

4.0 THE DIFFICULTY OF DEFINING INVASIVE ALIEN SPECIES

Deciding upon an appropriate definition of invasive alien species can be a complex and politically-charged undertaking—a fact that is illustrated by the amazing array of terminology used to describe what may loosely be termed invasive alien species. International law, for example, has developed an abundance of terms to describe a proliferation of unwanted species. In the farming context where the protection of crops or livestock health has been at issue, terms such as pest,⁷³ weed,⁷⁴ disease,⁷⁵ and noxious⁷⁶ have been used. In the conservation context, terms include exotic,⁷⁷ alien,⁷⁸ indigenous,⁷⁹ native,⁸⁰ non-

72. See Conference of the Parties to the Convention on Biological Diversity, Sixth Meeting, The Hague, Neth., April 7–19, 2002, *Report of the Sixth Meeting of the Conference of the Parties to the Convention on Biological Diversity, Guiding Principles for the Prevention, Introduction and Mitigation of Impacts of Alien Species that Threaten Ecosystems, Habitats or Species*, 256, U.N. Doc. UNEP/CBD/COP/6/20 (Sept. 23, 2002) [hereinafter *CBD Guiding Principles*].

73. International Plant Protection Convention, Dec. 6, 1951, 150 U.N.T.S. 67. Before the text of this convention was superseded, 127 governments had adhered to it. The convention was superseded by the International Plant Protection Convention, Nov. 1997, 2367 U.N.T.S. 1963. As of July 31, 2009, the International Plant Protection Convention 1997 (IPPC) had 172 parties. *The International Plant Protection Convention (IPCC)*, INTERNATIONAL PHYTOSANITARY PORTAL (IPP), 2009, <http://www.fao.org/Legal/TREATIES/004s-e.htm>.

74. Agreement Concerning Co-Operation in the Quarantine of Plants and Their Protection Against Pests and Diseases pmbl., Dec. 14, 1959, 422 U.N.T.S. 42.

75. Agreement Concerning Epizootic Diseases between the Kingdom of Greece and the Federal People's Republic of Yugoslavia, Greece-Yugo., Feb. 2, 1952, *reprinted in* 4 INTERNATIONAL PROTECTION OF THE ENVIRONMENT 1833 (B. Rüster & B. Simma, eds., 1975).

76. North American Plant Protection Agreement art. 1c, Oct. 13, 1976, 1086 U.N.T.S. 336.

77. Code of Conduct for the Import and Release of Exotic Biological Control Agents, Nov. 1, 1995, *reprinted in* INTERNATIONAL PROTECTION OF THE ENVIRONMENT: CONSERVATION IN SUSTAINABLE DEVELOPMENT 1, 01–11/95/1 (Wolfgang Burhenne & Nicholas Robinson, eds., 1996); North American Agreement on Environmental Cooperation art. 10(2)(h), Sept. 8, 1993, 32 I.L.M. 1482.

78. Convention on the Conservation of Antarctic Marine Living Resources art. II(3)(c), May 20, 1980, 1329 U.N.T.S. 48.

79. Convention Relative to the Preservation of Fauna and Flora in their Natural State art. 2(2), Nov. 8, 1933, 172 U.N.T.S. 241. Before the text of this convention was superseded, it had ten parties. *Treaties: record details*, ECOLEX, <http://www.ecolex.org/ecolex/ledge/view/RecordDetails?jsessionid=08051CC7914A7DE3CE1C56C5A7A01614?id=TRE-000069&index=treaties> (last visited Oct. 27, 2009). The Convention was superseded by the African Convention on the Conservation of Nature and Natural Resources. African Convention on the Conservation of Nature and Natural Resources, Sept. 15, 1968, 1001 U.N.T.S. 3. As March 2009, the Convention had thirty parties. *Treaties: record details*, ECOLEX, <http://www.ecolex.org/ecolex/ledge/view/RecordDetails?jsessionid=08051CC7914A7DE3CE1C56C5A7A01614?id=TRE-000492&index=treaties> (last visited Oct. 27, 2009); African Convention on the Conservation of Nature and Natural Resources (Revised Version), July 11, 2003, Afr. Union, *available at* <http://www.africa-union.org/root/au/Documents/Treaties/Text/nature%20and%20natural%20resource.pdf>. (The convention is not yet in force. *Treaties: record details*, ECOLEX, <http://www.ecolex.org/ecolex/ledge/view/RecordDetails>;

indigenous,⁸¹ non-native,⁸² and invasive alien.⁸³ From the marine sector come references to “harmful aquatic organism”⁸⁴ while more recent terminology from international plant protection instruments refer to a “quarantine pest.”⁸⁵

A similar profusion of terminology has emerged in national policy formulation and accompanying legislation. In some cases, native species that interfere with agriculture, or other human activities, may be declared “pests.”⁸⁶ In other cases, descriptions include traditional labels, such as “noxious” (which could apply to plants, animals, or aquatic species),⁸⁷ “weed,”⁸⁸ “environmental weed,”⁸⁹ “pest,”⁹⁰ “feral,”⁹¹ and “exotic.”⁹² More recently-evolved terms include ‘alien’⁹³ and

jsessionid=E7FE61390CD56E04CD4FC00EA74B3626?id=TRE-001395&index=treaties (last visited Oct. 27, 2009)).

80. Convention on the Conservation of European Wildlife and Natural Habitats art. 11(2)(a), (b), Sept. 19, 1979, 1284 U.N.T.S. 210 (1982) (entered into force June 1, 1982). As of March 2009, the Convention had forty-eight parties. *Treaties: record details*, ECOLEX, <http://www.ecolex.org/ecolex/ledge/view/RecordDetails;jsessionid=E3852BD0AC8CCE3BB6310F0F8889947?id=TRE-000473&index=treaties> (last visited Oct. 27, 2009).

81. Agreed Measures for the Conservation of Antarctic Fauna and Flora art. 9, ¶ 1, June 2, 1964, available at <http://sedac.ciesin.org/entri/texts/acrc/aff64.txt.html>.

82. Agreement on the conservation of African-Eurasian migratory waterbirds, June 16, 1995, 6 Y.B. INT'L. ENVTL. L. 907, 910 (1995), available at http://www.unep-aewa.org/documents/agreement_text/eng/pdf/aewa_agreement_text_2009_2012_complete.pdf; BASIC LEGAL DOCUMENTS ON INTERNATIONAL ANIMAL WELFARE AND WILDLIFE CONSERVATION 617 (Mark Austen & Tamara Richards eds., 2000). As of March 2009, the Agreement had sixty-two parties. *About AEWA: Introduction*, AFRICAN-EURASIAN WATERBIRD AGREEMENT, 2006, <http://www.unep-aewa.org/about/introduction.htm>.

83. Convention on Biological Diversity art. 8(h), June 5, 1992, 1760 U.N.T.S. 143, 146.

84. International Conference on Ballast Water Management for Ships, *Adoption of the Final Act and Any Instruments, Recommendations and Resolutions Resulting from the Work of the Conference, International Convention for the Control and Management of Ships' Ballast Water and Sediments 2004*, art. 1, ¶ 8, BWM/CONF/36 (Feb. 16, 2004) (not yet in force).

85. International Plant Protection Convention art. II(1), Nov. 1997, 2367 U.N.T.S. 1963.

86. Rural Lands Protection Act, 1998, §§ 143(1)–(2) (N.S.W. Austl.) (explaining that the Minister may “declare any non-human mammal or any bird, insect, amphibian, fish, reptile, arthropod, insect, mollusc, crustacean or other member of the animal kingdom” to be a “pest”).

87. *See Fisheries (Further Amendment) Act, 1997*, § 75 (Vict. Austl.) (creating a procedure for declaration of an aquatic species as “noxious” unless the species is protected pursuant to another Act, such as the *Wildlife Act 1975* (Vict.) and the *Flora and Fauna Guarantee Act 1988* (Vict.)).

88. In the Australian state of New South Wales, the Minister may make a weed control order under the Noxious Weeds Act. Noxious Weeds Act, 1993, § 7 (N.S.W. Austl.) The Act also defines the different classes of controlled weeds. *Id.* § 8(2)(a)–(e).

89. *See NEW SOUTH WALES STATE OF THE ENVIRONMENT REPORT 2006*, *supra* note 8, ch. 5.2 (explaining the “environmental weeds” are not the primary cause of a species decline but instead become a threat when invading remaining habitats and thus are a “constantly increasing pressure on these vulnerable ecological communities”).

90. *See Endangered Species (Control of International Trade and Traffic) Act, (1985)* ch. 108 (Nigeria) (giving the relevant minister the power to provide for the “declaration and control of internationally recognized pests”).

91. *See Australian Government, Department of Agriculture, Fisheries & Forestry, Feral Animals*, BUREAU OF RURAL SCIENCES, Aug. 10, 2009, <http://www.daff.gov.au/brs/land/feral-animals> (discussing how rabbits, foxes and feral goats and pigs have established large and widespread populations in Australia and have had a major impact on Australia’s biodiversity).

92. *See Mission Statement*, FLORIDA EXOTIC PEST PLANT COUNCIL, Oct. 22, 2009, <http://www.fleppc.org/>

'invasive species',⁹⁴ reflecting growing concern about the environmental impacts of some alien species.

In essence, different product sectors and regulatory regimes have succeeded in developing terminology that accommodates their own specific objectives. Although these objectives are influenced by the divergent uses and values humans place on certain plants and animals, this assortment of terminology may not necessarily convert well from one sector or regime to the other.⁹⁵ The multiplicity of terms makes it difficult to identify what ought to be regulated; furthermore, as previously indicated, the fact that a species is regarded as a resource by one sector may obscure the fact that it is also a potential IAS. The difficulties associated with the use of biofuels typify these problems.⁹⁶ In seeking to alleviate dilemmas associated with climate change and fuel shortages, states focus on the end use of biofuels without necessarily taking into account the potential for biofuel plants to become invasive at the cultivation stage of production.⁹⁷

5. COMPARING DEFINITIONS OF INVASIVE ALIEN SPECIES

At the international level, Article 8(h) of the CBD calls on states to "prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species."⁹⁸ Yet, the CBD does not specifically use the terminology of invasive alien species, nor does it define what an invasive alien species is. The questions thus become: what is an "alien" species and at what stage does an alien species threaten ecosystems, habitats, or other species such that it may be described as an "invasive alien species"?

To assist member states in identifying alien and invasive alien species, the Conference of the Parties to the CBD has adopted the Guiding Principles for the Prevention, Introduction and Mitigation of Impacts of Alien Species that Threaten

(stating that its mission "is to support the management of invasive exotic plants in Florida's natural areas").

93. See Japanese Invasive Alien Species Act, Law No. 78 of 2004, art. 2 (using "alien" to refer to organisms that "exist outside their original habitats as a result of introduction from overseas into [Japan]").

94. See Exec. Order No. 13112, 64 C.F.R. 6183 (1999) (defining "invasive species" as a non-native species "whose introduction does or is likely to cause economic or environmental harm or harm to human health"). An executive order, in this instance, is a legally binding order issued by the President of the United States of America directing federal agencies in their execution of existing laws. In the case of Executive Order No. 13112, the authority to make the order is vested in the President by virtue of: the National Environmental Policy Act of 1969, *as amended* (42 U.S.C. § 4321 et seq.), the Non-indigenous Aquatic Nuisance Prevention and Control Act of 1990, *as amended* (16 U.S.C. § 4701 et seq.), the Lacey Act, *as amended* (18 U.S.C. § 42), the Federal Plant Pest Act (7 U.S.C. 150aa et seq.), the Federal Noxious Weed Act of 1974, *as amended* (7 U.S.C. § 2801 et seq.), and the Endangered Species Act of 1973, *as amended* (16 U.S.C. § 1531 et seq.). *Id.*

95. See, e.g., SENATE RURAL AND REG'L AFFAIRS AND TRANSPORT COMM., COMMERCIAL UTILISATION OF AUSTRALIAN NATIVE WILDLIFE ch. 4.25, 4.27-4.32 (1998).

96. See LOW & BOOTH, *supra* note 5, at 11; Raghu et al., *supra* note 47.

97. *Id.*

98. Convention on Biological Diversity art. 8(h), June 5, 1992, 1760 U.N.T.S. 143, 146.

Ecosystems, Habitats or Species (CBD Guiding Principles).⁹⁹ The IUCN also has adopted its own Guidelines for the Prevention of Biodiversity Loss Caused by Alien Invasive Species (2000) (the IUCN Guidelines).¹⁰⁰ Although neither of these instruments is binding,¹⁰¹ they still influence state practice. The CBD Guiding Principles, for example, have been adopted by the Conference of the Parties to the CBD as a means of implementing Article 8(h),¹⁰² and the IUCN Guidelines form part of the international corpus of “soft law” that represents a political commitment by states to prevent environmental harm from IAS.¹⁰³

5.1 THE MEANING OF ALIEN

The CBD Guiding Principles offers this definition of alien species:

“[A]lien species” refers to a species, subspecies or lower taxon, introduced outside its natural past or present distribution; includ[ing] any part, gametes, seeds, eggs, or propagules of such species that might survive and subsequently reproduce.¹⁰⁴

The introduction refers to the “movement by human agency, indirect or direct, of an alien species outside of its natural range (past or present).”¹⁰⁵

The IUCN Guidelines provide a similar definition for alien species:

“Alien species” (non-native, non-indigenous, foreign, exotic) means a species, subspecies, or lower taxon occurring outside of its natural range (past or present) and dispersal potential (i.e. outside the range it occupies naturally or could not occupy without direct or indirect introduction or care by humans) and includes any part, gametes or propagule of such species that might survive and subsequently reproduce.¹⁰⁶

These definitions are similar because they both stress the “natural” range or distribution of a species. In a different context, the Food and Agriculture Organization’s Technical Guidelines for Responsible Fisheries—Precautionary

99. *CBD Guiding Principles*, *supra* note 72.

100. *IUCN Guidelines*, *supra* note 59.

101. *See CBD Guiding Principles*, *supra* note 72, at Introduction (these instruments by their very nature are non-binding soft law).

102. Convention on Biological Diversity art. 8, June 5, 1992, 1760 U.N.T.S. 143, 148–49 (establishing the role of the Conference of the Parties in implementing the CBD). For a discussion of the role of the Conference of the Parties as a means of making international environmental law, *see* Jutta Brunneé, *COPing with Consent: Law-Making Under Multilateral Environmental Agreements*, 15 LEIDEN J. INT’L L. 1 (2007).

103. *See* Alan Boyle, *Some Reflections on the Relationship of Treaties and Soft Law*, 48 INT’L & COMP. L.Q. 901, 901 (1999); *see generally* Armin Schäfer, *Resolving Deadlock: Why International Organisations Introduce Soft Law*, 12 EUR. L.J. 194 (2006) (The authors examine the utility of soft law in reaching agreement amongst states in circumstances where hard law might fail to achieve the same results).

104. *CBD Guiding Principles*, *supra* note 72, at 257.

105. *Id.* at 257.

106. *IUCN Guidelines*, *supra* note 59, § 3.

Approach to Capture Fisheries and Species Introductions (2)¹⁰⁷—(the FAO Technical Guidelines (2)) describe the aquatic alien species as an “introduced species,” namely “any species intentionally or accidentally transported and released by humans into an environment beyond its present range.”¹⁰⁸

The concept of range is pivotal to whether or not the species is defined and regulated as an alien species. At the same time, the use of the word “range” differs in each instrument in accordance with the objectives of the instrument.

The CBD Guiding Principles are designed to assist parties in implementing Article 8(h) of the CBD,¹⁰⁹ whereas the IUCN Guidelines are designed to assist members in preserving natural and semi-natural areas from the “deleterious effects” of IAS.¹¹⁰ Consequently, both instruments reflect broad environmental objectives, and the definition of an alien species is determined in both by the natural range or distribution of a species or, in other words, by the range or distribution the species would occupy without human intervention.

Although the CBD Guiding Principles and the IUCN Guidelines do not define the terms “natural range” or “natural distribution,” an analogy may be drawn with the “range” of a species as used in the Convention on the Conservation of Migratory Species of Wild Animals.¹¹¹ In that Convention, the range of a species includes “all the areas of land or water that a migratory species inhabits, stays in temporarily, crosses or overflies at any time on its normal migration route.”¹¹² The fact that the species’ range is determined by its “normal migration route” emphasizes the presence of the species without interference by humans.

By way of contrast, the provisions of the FAO Technical Guidelines (2), which are intended to enhance aquaculture safety in a commercial setting, use the phrase “present range.” This phrase describes the location of a farmed species and references the distribution of a species introduced as a result of human activity.¹¹³ The species will not be located in its present range if it escapes from its human-created environment. Consequently, the difference between present

107. Food and Agriculture Organization of the United Nations [FAO] & Technical Consultation on the Precautionary Approach to Capture Fisheries, Lysekil, Sweden, June 6–13, 1995, *FAO Technical Guidelines for Responsible Fisheries: Precautionary Approach to Capture Fisheries and Species Introductions*, 7, 29 (1996) [hereinafter FAO Guidelines]. These guidelines are the second technical guidelines issued pursuant to the FAO Code of Conduct for Responsible Fisheries 1995. The code was adopted at the Twenty-eighth session of the Food and Agriculture Organization (FAO) on Oct. 31, 1995. *Id.* at 2.

108. *Id.* at 7.

109. *CBD Guiding Principles*, *supra* note 72, at 249.

110. IUCN Guidelines, *supra* note 59, § 2.

111. Convention on the Conservation of Migratory Species of Wild Animals art. 1(f), June 23, 1979, 1651 U.N.T.S. 333, 359. As of October 2009, the Convention had 112 parties. *Parties to the Convention on the Conservation of Migratory Species of Wild Animals*, Convention on Migratory Species, Aug. 1, 2009, http://www.cms.int/about/part_lst.htm.

112. Convention on the Conservation of Migratory Species of Wild Animals, *supra* note 111, art. 1(f).

113. FAO Guidelines *supra* note 107, § 2. The Food and Agriculture Organization of the United Nations helps states devise agricultural policies and draft appropriate legislation. See *About FAO*, Food and Agriculture Organization of the United Nations, 2009, <http://www.fao.org/about/about-fao/en/>.

and natural range is fundamental to whether a species is classified as alien. Yet, a species' present range may still serve a comparable regulatory function to a species' natural range, for both establish parameters for the distribution of a species and act as a focal point for the generation of measures. A major difference between the terms, however, is that a present range is artificially created; it is a human-related notion, dependent upon human will and a substantial degree of human interference.

If the natural range or distribution of a species is the range or distribution a species would have occupied without human influence, then farmed plants, animals, and aquatic organisms should be classified as alien species (although not necessarily as *invasive* alien species).¹¹⁴ The use of the term "present range" largely avoids these types of considerations. In the context of the FAO Technical Guidelines (2), the present range is the range a species currently occupies. Both the origin of the species and the extent of human interference or assistance to the species' current location are irrelevant to this determination. As already suggested, it is a term well-suited to the development of regulatory regimes for farmed and cultivated regions.

In addition to the use of present and natural range, other ways of defining and identifying alien species focus on the use of nominated areas, such as geographical or jurisdictional areas, or the use of naturally-occurring parameters, such as ecosystem boundaries. Indeed, state practice reveals a variety of ways of describing and defining alien species.

In some cases, states do not directly define alien species but rather classify a species as native or non-native by reference to a fixed geographical or jurisdictional area.¹¹⁵ By implication, species not located within this geographical or jurisdictional area are alien. In Australia, for example, a native species is defined as one that "is indigenous to Australia or an external Territory."¹¹⁶ While the use of geographical or jurisdictional parameters may be administratively convenient, this approach does not conform with either the IUCN or the CBD definitions that refer to a "natural" distribution or range.

A better approach is one that is based on a species' natural distribution or range

114. See e.g., United Nations Environment Programme [UNEP], *Conservation and Sustainable Use of Agricultural Diversity 1996*, § 7(a), 82, UNEP/CBD/COP/3/38 (Feb. 11, 1997) (Where farm plants are introduced by humans, agriculture relies on alien species. In accordance with both the CBD and IUCN definition, the fact that these plants were introduced means that they are "alien" plants. To be classified as an invasive alien species, the plants would need to constitute a threat to biodiversity).

115. In the United Kingdom, the Wildlife and Countryside Act creates an offense if a person releases an animal or allows it to escape where the animal is "not ordinarily resident in and is not a regular visitor to Great Britain." Wildlife and Countryside Act, 1981, c. 69, § 14 (U.K.). In Nigeria, "wild life" is defined according to whether it is located in Nigeria. Endangered Species Act, (1995) Cap. 108, § 8(a) (Nigeria). In the Cook Islands "wildlife" is defined as animals and plants either indigenous to the Cook Islands or migratory to them. Conservation Act 1986-87, 1987, § 2 (Cook Islands); Mere Pulea, *Cook Islands*, in ENVIRONMENTAL LAW IN THE SOUTH PACIFIC 40 (Ben Boer ed., IUCN 1996).

116. Environment Protection and Biodiversity Conservation Act, 1999, § 528 (Austl.).

or their ecosystem. For instance, the Murray-Darling Basin Commission,¹¹⁷ an Australian agency, implements management practices in accordance with the “natural range” of species. Similarly, in the United States, Executive Order No. 13112 uses ecosystem parameters to define invasive alien species.¹¹⁸

In accordance with the CBD, an ecosystem is defined as a “dynamic complex of plant, animal, and micro-organism communities and their non-living environment interacting as a functional unit.”¹¹⁹ A species’ ecosystem thus would coincide with its natural area of evolution and distribution and hence parallel those areas designated as the natural distribution or natural range of a species, as determined in the CBD Guiding Principles and IUCN Guidelines.

Nevertheless, the words ‘range’ and ‘ecosystem’ are not synonymous. The range of a species examines the location of a species, without necessarily taking into account its relationship with other living or non-living components within that range. On the other hand, the concept of ecosystem *does* consider the relationship of a species with other components of its range.¹²⁰ Moreover, a species’ range could cover more than one ecosystem, and the same species may react differently in a variety of ecosystems.

Given that the concept of biodiversity includes the relationship of species to their ecosystems and to other ecosystems,¹²¹ an ecosystem approach to the definition and management of alien species is preferred. Indeed, for states that have ratified the CBD, the ecosystem approach is a recommended and agreed upon management strategy and therefore should be incorporated into environmental management practices that address IAS.¹²²

Notwithstanding these differences, the use of either a species’ natural range or its ecosystem, as opposed to a fixed geographical or jurisdictional area, generally

117. The Murray-Darling River basin is located within the jurisdiction of three Australian states—New South Wales, Victoria, and South Australia. The Commission is an organization that represents a partnership between these state governments and the community to use the Murray-Darling river systems in a sustainable manner. *About MDB Initiative*, MURRAY-DARLING BASIN COMMISSION, May 18, 2007, http://www.mdbc.gov.au/about/murraydarling_basin_initiative__overview (last visited Sept. 22, 2009).

118. See Exec. Order No. 13112, *supra* note 94, § 1(a).

119. Convention on Biological Diversity art. 2, June 5, 1992, 1760 U.N.T.S. 146.

120. See Conference of the Parties to the Convention on Biological Diversity, Fifth Meeting, Nairobi, May 15–26, 2000, *Ecosystem Approach*, Decision V/6, 103, UNEP/CBD/COP/5/23 (June 22, 2000) [hereinafter COP to CBD] (adopting the ecosystem approach), available at <http://www.cbd.int/decision/cop/?id=7148>. An ecosystem is specified to incorporate more than the “habitat” of a species and can refer to “any functioning unit at any scale.” *Id.* at 104. Hence, the principles of this approach, such as Principle 3, indicate that managers should consider the effects (actual or potential) of their activities on adjacent and other ecosystems; Principle 5 states that conservation of ecosystem structure and functioning, in order to maintain ecosystem services, should be a priority target of the ecosystem approach. *Id.* at 105. The explanation to this principle stresses that “[e]cosystem functioning and resilience depends on a dynamic relationship within species, among species and between species and their abiotic environment, as well as the physical and chemical interactions within the environment.” *Id.* at 106.

121. See Convention on Biological Diversity, *supra* note 119.

122. The Ecosystem Approach was adopted by the Conference of the Parties to the Convention on Biological Diversity. COP to CBD, *supra* note 119.

affords a number of benefits in identifying whether or not a species should be classified as alien. To begin, using natural or ecological parameters not only includes alien species introduced from another country, but also identifies indigenous species "which have been transplanted or translocated to areas within the country, but outside their natural range."¹²³ Many species may only be harmful in certain locations, or harmful to certain organisms and not to others.¹²⁴ Therefore, a species that is native to one part of a country is not necessarily native to the entire country; it may become invasive outside its natural range or ecosystem.¹²⁵ This matter is particularly significant for countries with large landmasses such as Australia,¹²⁶ the United States, and Canada.

To illustrate, the pongamia tree, which is being considered as a source of biofuel in Australia,¹²⁷ is native to Asia and northern Australia and is not considered to be invasive if it is cultivated in northern Australia. However, where the tree is grown elsewhere, it may become invasive. This already has occurred in southern Queensland, where the tree is grown for landscaping purposes and has spread into wild areas.¹²⁸

The concepts of present range, natural range, natural distribution, and ecosystem also are relevant to the broader issue of the extent to which human interference is relevant to the definition of an alien species. The difference in the degree of human interference tolerated within each concept can alter the meaning of the concept and, hence, the very definition of an alien species itself. For example, in management terms, the present range of a species represents those areas where humans anticipate the species to thrive. The problem, however, is that while such an approach might promote fisheries or agricultural systems, it does not always adequately take into account the fact that those same systems operate as part of the general environment;¹²⁹ that which suits the farming or fisheries sectors may lead to environmental degradation elsewhere.¹³⁰

123. Paul L. Shaftand & William M. Lewis, *Terminology Associated With Introduced Organisms* 9(4) FISHERIES 17, 18 (1984).

124. See Low *supra* note 15, at 172–76 (providing examples, such as pittosporum, a native plant of south-eastern Australia, that is invasive in Western and South Australia).

125. Low, *supra* note 15, at 172–76.

126. *Id.* at 175.

127. Low & BOOTH, *supra* note 5, at 25.

128. *Id.*

129. See John Koehn & Rachel Mackenzie, *Priority Management Actions for Alien Freshwater Fish Species in Australia*, 38 N.Z. J. MARINE AND FRESHWATER RES. 457, 457–58 (2004) (discussing the difficulties in Australia of regulating alien fish species); see also ANN HAMBLIN, BUREAU OF RURAL SCIENCES, AUSTRALIAN STATE OF THE ENVIRONMENT: LAND 2001 70 (CSIRO 2001) (describing woody weeds as those impacting land use, rather than ecosystem functions).

130. See generally McNeeley, *supra* note 11 (describing the human dimension of invasive alien species—namely the use of alien species for human needs without adequate consideration of the effect of these species on the environment); Low, *supra* note 15, at 62–71, 81–91 (detailing how species introduced for the aquarium industry become invasive species, and explaining how pasture grasses, such as buffel grass, introduced for primary production, have become some of Australia's worst invaders).

In the United States, for example, grasses such as reed canary grass and giant reed have been studied as potential biofuel sources. Yet, giant reed is invasive in riparian areas, and reed canary grass is invasive in wetland systems, thus threatening wildlife habitat.¹³¹ A similar situation exists with the Chinese tallow tree, which is being considered for biofuel production in Australia.¹³² The tree already is one of the worst invasive species in the United States¹³³ and is a declared weed in the Australian state of New South Wales.¹³⁴ If a species is useful, however, its usefulness often obscures considering the species a potential IAS.

The notion of human interference is a flexible one, as illustrated by the differences in the terms of the CBD Guiding Principles and the IUCN Guidelines. The CBD Guiding Principles, for example, refer to human an introduction as the “movement by human agency, indirect or direct,”¹³⁵ whereas the IUCN criteria for alien species refers to “direct or indirect introduction or care by humans.”¹³⁶ Therefore, the IUCN criteria expand the notion of human interference to include “care” by humans as an equal consideration to “movement” by humans. Accordingly, where human “care” has assisted a species in establishing itself in a range that it normally would not occupy naturally, the IUCN definition would consider the species as alien, and the CBD definition would not.

To illustrate, seeds and fruits can drift along ocean currents.¹³⁷ This process does not involve movement by a human agency and hence would fall outside the CBD definition and that part of the IUCN definition that refers to “introduction” by humans. If humans collect and cultivate the seeds and fruits, however, the species potentially could be classified differently under each definition. The CBD definition would not classify the seeds or fruit as alien (because no human agency was involved in their introduction), but the IUCN definition’s “care by humans” component would lead to a classification of the species as alien.

From an environmental perspective, the IUCN definition of alien is preferred. It takes into account more precisely whether a species is a naturally established component of an ecosystem. From a regulatory perspective, however, an important policy consideration is that the IUCN definition can have implications for farming and aquaculture industries, including those associated with biofuel production. For example, farming and aquaculture rely almost entirely on introduced species¹³⁸ and “care” by humans. If these cultivated species escape,

131. Raghu et al., *supra* note 47.

132. Low & Booth, *supra* note 5, at 17.

133. *Id.*

134. *Weed Control Order No. 20*, 110 GOVERNMENT GAZETTE OF THE STATE OF N.S.W 6828, 6855 (2006).

135. *CBD Guiding Principles*, *supra* note 72, at 247.

136. IUCN Guidelines, *supra* note 59, § 3.

137. P.T. Green, *Greta's Garbo: Stranded Seeds and Fruits from Greta Beach, Christmas Island, Indian Ocean*, 26 J. BIOGEOGRAPHY 937, 939–41 (1999).

138. See Ash & Fazel, *Biodiversity*, in UNEP, GLOBAL ENVIRONMENTAL OUTLOOK 4, 158, 178 (2007)

they can cause environmental damage, leading to complex regulatory and containment issues.¹³⁹

At the same time, it is worth remembering that a species classification as an alien species does not automatically mean that it is an *invasive* alien species. Consideration of this matter leads directly to the next issue: what makes a species invasive?

4.2 THE MEANING OF INVASIVE: SPREAD AND ABUNDANCE VERSUS THREAT TO BIODIVERSITY

As indicated, regulators have developed a variety of terms to describe different types of invasive species. In addition, the regulatory meaning of "invasive" also has differed from the manner in which "invasive" historically has been used by ecologists.

In an ecological sense, labelling a species as invasive only operates as a designation of the species' geographical status, without conveying insinuations of damage and need for control. Such was the use of the word in 1882, when "invasion" was first used to describe "the spread of non-native species."¹⁴⁰ This early meaning persisted until the publication in 1958 of *The Ecology of Invasions by Animals and Plants*,¹⁴¹ a work that is regularly regarded by ecologists as heralding the start of invasion ecology.¹⁴² The use of the term "invasive" as a taxonomic description of the spread of non-native species is still understood in that sense by ecologists today.¹⁴³

The ecological use of the term is, however, at odds with the emergence of 'invasive' as an administrative classification, where it is used to describe a species whose spread and abundance are causing harm or damage.¹⁴⁴ Although not all alien species necessarily pose a threat to biodiversity, those species that do become invasive have the potential to cause significant environmental degradation that results in a loss or reduction of biodiversity.¹⁴⁵ Indeed, in international law, the threat that alien species pose to biodiversity is pivotal to a determination of whether the species are invasive. The CBD Guiding Principles, for example, define an invasive alien species as:

(warning of potential of monocultures in context of biofuel cultivation); see also Conference of the Parties to the Convention on Biological Diversity, Third Meeting, Buenos Aires, Argentina, Nov. 4–15, 1996, *Integrating Biological Diversity into Agricultural Development*, ¶ 3, U.N. Doc. UNEP/CBD/COP/3/Inf.7, (Oct. 29, 1996) available at <http://www.cbd.int/doc/meetings/cop/cop-03/information/cop-03-inf-07-en.pdf> (the document points out that the "conversion of natural habitats to agricultural use" reduces biological diversity).

139. See Low & BOOTH, *supra* note 5, at 10–11.

140. Rejmánek, *supra* note 10, at 131.

141. CHARLES S. ELTON, *THE ECOLOGY OF INVASIONS BY ANIMALS AND PLANTS* (2000) (1958).

142. Rejmánek et al., *supra* note 10, at 131.

143. See *id.*

144. *Id.*; Davis & Thompson, *supra* note 10; Colautti & MacIsaac, *supra* note 10, at 136.

145. SBSTTA Sixth Meeting, *supra* note 15.

an alien species whose introduction and/or spread threaten biological diversity (For the purposes of the present guiding principles, the term “invasive alien species” shall be deemed the same as “alien invasive species” in decision V/8 of the Conference of the Parties to the Convention on Biological Diversity).¹⁴⁶

The IUCN Guidelines define an alien invasive species as:

an alien species that becomes established in natural or semi-natural ecosystems or habitat, is an agent of change, and threatens native biological diversity.¹⁴⁷

As with the definition of alien species, there are a number of differences between the CBD and IUCN definitions. According to the IUCN, an invasive species is one that is an agent of change or threatens native biological diversity; the CBD definition defines an invasive species as one that threatens biological diversity.

Although the IUCN definition does not define an “agent of change,” the concept of “change” has been used in another international instrument, notably the 1980 Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR).¹⁴⁸ Article II of that Convention obliges parties to minimize “changes” to the marine ecosystem that are not potentially reversible over two or three decades.¹⁴⁹ One potential change that is specifically mentioned is the introduction of alien species.¹⁵⁰ Still, knowing or predicting which changes are reversible within two to three decades can be problematic.

In the case of IAS, lack of information and lengthy time between a species’ introduction and manifestation of its invasive qualities make predictions particularly difficult. Studies indicate that average lag times of 147 years are not unusual,¹⁵¹ with other studies increasing this time frame to 170 years.¹⁵² For example, giant reed, which is proposed as a biofuel plant, was first introduced in the early 1800s in order to stabilize stream banks.¹⁵³ It became invasive in California in the twentieth century, more than one hundred years after its first introduction.¹⁵⁴

A “threat” is defined by the IUCN Guidelines, but not by the CBD or the CBD Guiding Principles. The IUCN Guidelines refer to a threat in terms of risk to “the ecological welfare or to the well-being of humans, animals or plants.”¹⁵⁵ This

146. *CBD Guiding Principles*, *supra* note 72, at 257.

147. IUCN Guidelines, *supra* note 59, § 3.

148. Convention on the Conservation of Antarctic Marine Living Resources art. II(3)(c), May 20, 1980, 33 U.S.T. 3476, 1329 U.N.T.S. 48.

149. *Id.*

150. *Id.*

151. CABI BIOSCIENCE SWITZERLAND CENTRE, *supra* note 8, at 26.

152. Low, *supra* note 15, at 217.

153. Low & BOOTH, *supra* note 5, at 11.

154. *Id.*

155. IUCN Guidelines, *supra* note 59, § 3.

approach is consistent with the ordinary meaning¹⁵⁶ of the word threat as “a . . . thing likely to cause damage or danger.”¹⁵⁷ Accordingly, although the CBD does not define a threat, the ordinary meaning of the term includes the likelihood or potential for harm.

From policy, law, and practicality standpoints, the concern for states is in determining what threshold of harm, damage, or danger should equate to a threat. This is a crucial matter, for this threshold is the very feature that determines whether the species will be classified as an actual or potentially invasive species. By using the phrase “agent of change,” the IUCN definition identifies the threshold as the point in time when an alien species causes changes that cannot be reversed over two or three decades. These changes may occur before manifestation of actual harm.

In yet another context, the parties to the 1997 International Plant Protection Convention (IPPC) have formulated a further definition of a particular type of IAS, the “quarantine pest,” defined as a pest of potential economic importance that is already present, but not widely distributed and under official control.¹⁵⁸ Accordingly, states may implement measures against injurious species where those species already are present in their territory and causing economically measurable damage. This latter requirement means that damage to biodiversity from IAS needs to be quantified economically as well.

In practice, this requirement undoubtedly reflects the state practice of administrators viewing economic criteria as an objective and transparent means of justifying allocation of finite resources.¹⁵⁹ Indeed, in the context of IAS, administrators often defer implementing measures until a species has caused a level of harm sufficient to justify expenditure.¹⁶⁰ It is open to discussion, however, whether using economic criteria as a threshold for implementation of

156. Article 31(1) of the Vienna Convention on the Law of Treaties provides that a treaty shall be interpreted in good faith in accordance with the ordinary meaning of the terms of the treaty in context and with regard to the treaty's object and purpose. Vienna Convention on the Law of Treaties art. 31, May 23, 1969, 1155 U.N.T.S. 31. As of March 2009, the treaty had been ratified by 110 states. *Chapter XXIII Law of Treaties: Vienna Convention on the Law of Treaties*, UNITED NATIONS TREATY COLLECTION, Oct. 28, 2009, http://treaties.un.org/Pages/ViewDetailsIII.aspx?src=TREATY&mtdsg_no=XXIII~1&chapter=23&Temp=mtdsg3&lang=en. Although the guiding Principles are an international instrument rather than a treaty, the textual approach favored by the Vienna Convention on the Law of Treaties would not be out of place in interpreting instruments.

157. COMPACT OXFORD ENGLISH DICTIONARY, available at http://www.askoxford.com/concise_oed/threat?view=uk (last visited Oct. 3, 2009).

158. International Plant Protection Convention art. 2, Dec. 6, 1951, 150 U.N.T.S. 67.

159. See generally NICK HANLEY & CLIVE SPASH, COST-BENEFIT ANALYSIS AND THE ENVIRONMENT 269–70 (1993) (States rarely have unlimited resources and using economic criteria, such as cost-benefit analyses, is seen as a way of allocating resources in a balanced way).

160. FRESHWATER ECOLOGY ET. AL., A RISK ASSESSMENT OF THE IMPACTS OF PEST SPECIES IN THE RIVERINE ENVIRONMENT IN THE MURRAY-DARLING BASIN 20 (2002). The report notes that the “classification of a pest is often based on economic criteria when the damage caused by a pest species justifies the costs of a control program.” *Id.* at 2.

measures is an appropriate response to the protection of biodiversity from IAS.¹⁶¹ In particular, although it may be possible to develop formulae that ascribe mathematical and economic values to biodiversity,¹⁶² it is questionable whether this approach captures biodiversity values when they are not readily quantifiable in economic terms.¹⁶³ When this type of approach delays the implementation of measures until manifestation of damage, it may be too late to address and manage the IAS in a meaningful way. It may not, for example, be possible to eradicate the species, or the species already may have brought about irreversible consequences, such as loss of biodiversity.¹⁶⁴

In essence, the wide variety of terminology and criteria that regulators use to describe unwanted species has made it difficult for states to identify those alien species that threaten biodiversity. These considerations are particularly complex where the alien species also is considered useful.

6. CAN ONE SIZE FIT ALL?

Clear definitions are fundamental to the operation of any regulatory regime.¹⁶⁵ They assist regulators in determining what to regulate, what type of measures to implement, and when to implement measures—in other words, definitions act as the triggers and parameters for laws. In the context of IAS, appropriate definitions also should assist in the early identification of IAS and thus help to prevent their entry. From an environmental perspective, states should adopt an appropriate definition of invasive alien species along the lines of definitions formulated by either the CBD Guiding Principles or the IUCN Guidelines. Yet, few states have adopted these definitions.¹⁶⁶

One state that has adopted a definition of invasive alien species similar to that found in the CBD Guiding Principles and the IUCN Guidelines, but somewhat

161. See generally John M. Gowdy, *The Value of Biodiversity: Markets, Society, and Ecosystems*, 37 *LAND ECON.* 25 (1997) (Economic criteria will be more suited to taking into account impacts on farmed plants or animals rather than native biodiversity, making the latter more difficult to quantify. In Australia, for example, these differences mean that losses attributable to IAS, in terms of lost production, eradication, and containment methods, have been quantified although environmental losses attributable to introduced rabbits, pigs, goats, cane toads, camels and many other species have not).

162. HANLEY & SPASH, *supra* note 159, at 261.

163. See Gowdy, *supra* note 161; HANLEY & SPASH, *supra* note 157, at 20–21.

164. GLOBAL INVASIVE SPECIES PROGRAMME, *GLOBAL STRATEGY ON INVASIVE ALIEN SPECIES* 6–8 (Jeffrey A. McNeely et al. eds., 2001).

165. See Rolf Lidskog et al., *Knowledge, Power and Control—Studying Environmental Regulation in Late Modernity*, 7 *J. OF ENVTL. POL'Y AND PLAN.* 89, 98–99 (2005) (The authors discuss an interest-based perspective to regulation that results from the struggles between divergent interests. Governments need to be sure of regulatory goals to balance these diverging interests).

166. The third national reports have been submitted by member states to the Conference of the Parties of the Convention on Biological Diversity. *National Reports and NBSAPs*, CONVENTION ON BIOLOGICAL DIVERSITY, Oct. 23, 2009, <http://www.biodiv.org/reports/list.aspx?type=nr-03> (last visited Sept. 19, 2009). The author has examined the 2006 reports and in answer to question 52, which canvasses the level of implementation of the CBD, approximately 41% of states have not used the CBD Guiding Principles at all.

ironically has not ratified the CBD, is the United States. Executive Order No. 13112 on Invasive Alien Species defines an invasive alien species as an alien species that is not native to an ecosystem and whose "introduction does, or is likely to cause economic or environmental harm or harm to human health."¹⁶⁷ The use of ecosystem parameters and the specific reference to environmental harm mirrors comparable terminology used by the CBD and IUCN. In the case of the United States, this overarching definition of an IAS underpins, at the policy level, the design and implementation of an integrated national invasive species regime.¹⁶⁸

In defining an IAS, the Executive Order describes an introduction as the "intentional or unintentional escape, release, dissemination, or placement of a species into an ecosystem as a result of human activity."¹⁶⁹ Consequently, the level of human interference tolerated by the U.S. conforms to the definition in the CBD Guiding Principles rather than the IUCN Guidelines. "Care by humans" thus is not incorporated within the concept of an IAS, leading to a somewhat narrower definition than that afforded by the IUCN Guidelines. Furthermore, the definition of an IAS is less likely to take into account continuing farming and agricultural practices.

Elsewhere, other states have been more hesitant in adopting a comprehensive and unified definition of IAS. In Australia, for example, there is no legislation at the federal level of government that contains a wide-ranging definition of invasive alien species. The primary legislation dealing with the protection of biodiversity, the Environment Protection and Biodiversity Conservation Act 1999 (Cth), only defines "native species."¹⁷⁰

In addition, although the deleterious impacts of invasive alien species may be listed as a threatening process in accordance with section 183 of that Act,¹⁷¹ the regime still lacks the cohesion that would be achieved by a unified policy approach linked by a common definition of IAS. This omission is reinforced by the fact that though the Environment Protection and Biodiversity Conservation Act 1999 (Cth) is supplemented by strategies and action plans, these do not provide full coverage of the IAS issue. For example, the Australian Pest Animal Strategy¹⁷² does not cover insects such as alien honeybees that become inva-

167. Exec. Order, *supra* note 94, at 1(a), (f).

168. See *WelcometoInvasiveSpecies.gov*, THE NATIONAL INVASIVE SPECIES COUNCIL, <http://www.invasivespecies.gov/> (last visited Oct. 28, 2009).

169. Exec. Order, *supra* note 94, at 1(a), (f).

170. Environment Protection and Biodiversity Conservation Act, 1999, § 528 (Austl.).

171. See Environment Protection and Biodiversity Conservation Act, 1999, § 183 (Austl.).

172. See *generally* NATURAL RESOURCE MANAGEMENT MINISTERIAL COUNCIL, AUSTRALIAN PEST ANIMAL STRATEGY—A NATIONAL STRATEGY FOR THE MANAGEMENT OF VERTEBRATE PEST ANIMALS IN AUSTRALIA (2007), available at <http://www.environment.gov.au/biodiversity/invasive/publications/pubs/pest-animal-strategy.pdf>. The Pest Animal strategy deals with vertebrate animals such as mammals, birds, reptiles, amphibians and fish of national significance but not insects. *Id.* at 6.

sive.¹⁷³ Similarly, the Australian Weeds Strategy does not apply to all weeds; rather, it applies to weeds designated “Weeds of National Significance.”¹⁷⁴

The now defunct Australian Environment Protection and Biodiversity Conservation Amendment (Invasive Species) Bill 2002 (Invasive Species Bill) would have defined an invasive alien as one that “directly or indirectly threatens, will threaten or is likely to threaten the survival, abundance or evolutionary development of a native species, ecological community, ecosystem or agricultural commodity.”¹⁷⁵ This definition would have come close to the definition of an IAS found in the CBD Guiding Principles and the IUCN Guidelines. However, the Invasive Species Bill never became law. It was rejected by Parliament and two years later became the subject of a senate inquiry.¹⁷⁶ The inquiry made twenty-seven recommendations, strengthening Australia’s response to IAS, yet stopped short of recommending the adoption of the bill. The inquiry concluded that the bill demonstrated a “commendable, if somewhat idealistic, approach [potentially leading to] risks and confusion.”¹⁷⁷

The difficulties associated with the passage of the Invasive Species Bill and its ultimate demise are indicative of how administrators and regulators are under pressure to appraise the invasive qualities of a species against the utility of the species to human endeavours. Such considerations do not bode well for regulatory regimes addressing biofuel production.

Many states are setting increasingly high targets for the production and use of biofuels. For example, the Australian federal government has determined that by 2010, Australia will be producing 350 million litres of biofuels per year.¹⁷⁸ In the United States, the Energy Independence and Security Act 2007¹⁷⁹ has set increased use targets ranging from nine billion gallons of renewable fuel in 2008

173. DAVID C. PATON, OVERVIEW OF THE IMPACTS OF FERAL AND MANAGED HONEYBEES IN AUSTRALIA 12–18 (1996), available at <http://www.environment.gov.au/biodiversity/invasive/publications/bees/index.html>.

174. Australian Government, *Weeds of National Significance*, WEEDS IN AUSTRALIA, Feb. 5, 2009, <http://www.weeds.gov.au/weeds/lists/wons.html>.

175. Environment Protection and Biodiversity Conservation Amendment (Invasive Species) Bill 2002, 2002, § 266AB(1)(a) (Austl.).

176. SENATE ENV’T, COMMUNICATIONS, INFO. TECH. AND THE ARTS REFERENCES COMM., AUSTRALIAN PARLIAMENT, TURNING BACK THE TIDE—THE INVASIVE SPECIES CHALLENGE: REPORT ON THE REGULATION, CONTROL AND MANAGEMENT OF INVASIVE SPECIES AND THE ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION AMENDMENT (INVASIVE SPECIES) BILL 2002 (2004), available at <http://www.environment.gov.au/biodiversity/invasive/publications/pubs/invasive-challenge.pdf> (The senate inquiry was initiated to report on Australia’s regulatory regime for managing invasive species, and particularly whether the Australian Parliament needed to adopt the Invasive Species Bill).

177. *Id.* at 207.

178. See SENATE STANDING COMM. ON RURAL AND REGIONAL AFFAIRS AND TRANSP., AUSTRALIAN PARLIAMENT, AUSTRALIA’S FUTURE OIL SUPPLY AND ALTERNATIVE TRANSPORT FUELS 120 (2007); see LOW & BOOTH, *supra* note 5, at 32.

179. See FRED SISSINE, CONGRESSIONAL RESEARCH SERVICE, ENERGY INDEPENDENCE AND SECURITY ACT OF 2001: A SUMMARY OF MAJOR PROVISIONS (2007), available at http://energy.senate.gov/public/_files/RL342941.pdf (summarizing the major provisions of the Act).

to thirty-six billion gallons by the year 2022¹⁸⁰—a figure that is more than double the current target. The European Union has followed a similar path. At present, the mix of biofuel to fossil fuel consumption within that regime is five point seven five percent,¹⁸¹ but this percentage is due to increase to ten percent by the year 2020.¹⁸² A comparable situation has emerged in developing countries, where some international regimes are actively encouraging these countries to produce biofuels.¹⁸³

The commitment by governments to biofuels is often underscored by the heavy subsidies that biofuels attract.¹⁸⁴ One report on this topic concluded:

Already the level of support enjoyed by the industry in OECD countries is of the order of US\$10 billion a year in excise tax exemptions and income tax credits, for a pair of fuels that account for less than 3% of overall liquid transport fuel demand. Bringing that share to 30%—a level frequently suggested by proponents— . . . would imply annual subsidies of \$100 billion a year or more, pushing them ever closer to the order of magnitude of support currently provided to the entire agricultural sector by OECD countries.¹⁸⁵

As the Conference of the Parties to the CBD has succinctly pointed out, “the current expansion of biofuels is driven largely by public policy and subsidies.”¹⁸⁶ Clearly, governments have invested much human and monetary capital in the development of the biofuel industry, and it is an investment unlikely to be easily relinquished. This appears to be the case, notwithstanding the public and institutional backlash at the amount of money expended on subsidies for biofuels.¹⁸⁷

180. Energy Independence and Security Act 2007, 42 U.S.C. § 7545 (o)(2)(B)(i)(I) (2000).

181. Directive 2003/30/EC of the European Parliament and of the Council of 8 May 2003 on the Promotion of the Use of Biofuels or Other Renewable Fuels for Transport, 2003 O.J. (L 123) 42.

182. Comm’n of the European Cmty’s, *Proposal for a Directive of the European Parliament and of the Council on the Promotion of the Use of Energy from Renewable Sources*, at 10, COM (2008) 19 final (Jan. 23, 2008).

183. United Nations Conference on Trade and Development, Twelfth Session, Accra, Ghana, Apr. 20–25, 2008, *Report of the Secretary-General of UNCTAD to UNCTAD XII, Globalization for Development: Opportunities and Challenges*, ¶ 182, U.N. Doc TD/413 (July 4, 2007).

184. Conference of the Parties to the Convention on Biological Diversity, *supra* note 5, ¶ 42.s

185. RONALD STEENBLIK, *THE GLOBAL SUBSIDIES INITIATIVE, INTERNATIONAL INSTITUTE FOR SUSTAINABLE DEVELOPMENT, SUBSIDIES: THE DISTORTED ECONOMICS OF BIOFUELS 4* (2007). The OECD is the Organisation for Economic Co-Operation and Development. It was established by the *Convention on the Organisation for Economic Co-Operation and Development*, dated December 14, 1960. *Members and Partners*, ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT, Sept. 2009, http://www.oecd.org/pages/0,3417,en_36734052_36761800_1_1_1_1,00.html. As of March 2009, the Convention had 30 parties. *About OECD*, ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT, http://www.oecd.org/pages/0,3417,en_36734052_36734103_1_1_1_1,00.html (last visited Oct. 28, 2009).

186. Conference of the Parties to the Convention on Biological Diversity, *supra* note 5, ¶ 42.

187. *See, e.g., EU Biodiesel Producers Launch Trade Complaint*, INTERNATIONAL CENTRE FOR TRADE AND SUSTAINABLE DEVELOPMENT, May 2, 2008, <http://ictsd.net/i/news/biores/11202/> (an article by the International Centre for Trade and Sustainable Development reporting a complaint made by the European Biodiesel Board

The situation is all the more worrying because commentators have noted that very few studies have been undertaken on the environmental impact of biofuel plants.¹⁸⁸ Yet, analogous evaluations have been progressively developed for other species, such as biological control agents and genetically modified plants.¹⁸⁹

Ultimately, the issue turns on whether states developing one definition for all types of IAS is an achievable goal and, more importantly, whether one definition is workable. In reality, although a lack of appropriate definitions can undermine the foundations of effective regulation, definitions should not be seen as a panacea. Even with comprehensive definitions, government policy will still influence how the underlying legislation is interpreted and implemented.

The United States Executive Order No. 13112 on Invasive Alien Species has not, for example, stopped the United States from enthusiastically pursuing a biofuel strategy. Consequently, resolving the definitional dilemma of IAS not only requires that states formulate appropriate definitions but also requires that states provide support and a strong commitment to the design and implementation of effective measures to deal with invasive alien species. Though appropriate definitions will not necessarily cure the problem of IAS, they are a necessary step towards comprehensive regulation.

7. CONCLUSION

In promoting the cultivation and use of biofuels, states are motivated by the worthwhile desire to resolve problems associated with fuel shortages and climate change. However, although these motives are commendable, states appear to be adopting the use of biofuels without adequately evaluating biofuel species for their potential to become invasive alien species. In taking this path, states have laid the foundation for a problem that may not manifest for many years, but when it does, it may be too late to address it in a meaningful way.

The biofuel issue is an example of a wider challenge facing states—the regulation of alien species useful to humans. The fact that a species may be regarded as a resource by one product sector or regime, yet considered harmful by another, means that states often balance or compromise competing claims. In doing so, however, states also should consider that useful alien species might also pose a threat to biodiversity.

States are not assisted by the current definitional quandary, where different regimes have developed different definitions and descriptions of what constitutes

(EBB) to the European Commission against subsidized biodiesel exports); Editorial, *The Biofuels Backlash*, WALL ST. J., May 2, 2008, at A18, available at http://online.wsj.com/article/SB121011613215972205.html?mod=opinion_main_review_and_outlooks.

188. JOSEPH M. DiTOMASO ET AL., BIOFUEL FEEDSTOCKS: THE RISK OF FUTURE INVASIONS 4–6 (2007); LOW & BOOTH, *supra* note 5, at 11; Puppán, *supra* note 38, at 106–12.

189. INTERNATIONAL PROTECTION OF THE ENVIRONMENT: CONSERVATION IN SUSTAINABLE DEVELOPMENT 1 (Wolfgang E. Burhenne & Nicholas A. Robinson, eds., 1995).

an IAS. Although environmental instruments such as the CBD Guiding Principles and the IUCN Guidelines contain definitions of invasive alien species that are wide enough to include useful species, states have not predominantly embraced this approach.

The reasons for this hesitancy lie in the fact that humans depend on alien species for a variety of purposes. Therefore, formulating a singular definition presents many challenges. Nevertheless, if states are to avoid repeating mistakes where useful but invasive species are introduced without adequate evaluation, IAS regimes need to be based on comprehensive definitions that clearly articulate the object and parameters of regulation. The foundations of this necessarily start with a common understanding and definition of what constitutes an invasive alien species.