Improving the Effectiveness of Environmental Regimes: "Consilience", Science and Common Sense

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The last five decades have witnessed the rise of systemic, chronic ecological degradation resulting from a myriad of human activities. Such environmental concerns have forced recognition of the inherent ecological inter-linkages among the Earth's habitats and man's ability to significantly impact the global ecosystem. Largely pursuant to the traditional legal domain of Law of the Sea (LOS) and the newly evolved legal domain of International Environmental Law (IEL), the international community has swiftly responded with a proliferation of global, regional and domestic environmental regimes targeting a myriad of ecological issues.

The international community is now emerging from a phase of environmental legal development that has allowed the proliferation of environmental regimes. However, upon reflection there has been minimal focus on assessing the ecological effectiveness of tools of the regime and their use, such instruments, policy and management tools, decision-making processes and actions related to the above such as implementation. Ecological effectiveness can be measured by the degree of improvement in the health of an ecosystem and the maintenance of its long-term sustainability; the latter being the ultimate goal of environmental regimes. Failure to meet the ultimate objective of improving and sustaining ecological integrity is not only ecologically ineffective, but also economically inefficient as resources are usurped with no ecological gain. To this end, seeking ecological effectiveness of all environmental instruments and related processes and actions is rational.

THE LAWS OF MAN AND THE LAWS OF NATURE

The United Nations Convention on the Law of the Sea (UNCLOS)[1], Part XII, is a constitution for environmental protection of not only the seas, but the planet's global ecosystem as, ecologically, the marine environment is inherently interconnected, directly or indirectly, with all terrestrial and freshwater habitats. The ecological interconnections between land and sea have resulted in overlapping legal domains for LOS and IEL as many instruments incorporate principles from each.[2] As environmental regimes have evolved, LOS and IEL each have a fundamental, but different purpose in environmental regime-building. LOS, primarily via UNCLOS, provides states with a legal and jurisdictional framework in which to operate as there is no international and legally-binding equivalent instrument in IEL. Conversely, in implementing the broad principles of UNCLOS, such as the duties to protect and preserve the marine environment and to co-operate on a global or regional basis,[3] states

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[1] *United Nations Convention on the Law of the Sea,* Montego Bay, 10 December 1982, UN Doc. A/Conf.62/122 (1982); 21 *I.L.M.* 1261 (1982) [hereinafter UNCLOS].

[2] A few instruments that draw on both LOS and IEL include: *Global Programme of Action for the Protection of the Marine Environment from Land-based Activities,* Washington, 5 December 1995, UNEP (OCA)/LBA/IG.2/7 (1995) [hereinafter GPA]; *Convention on Biological Diversity*, Rio de Janeiro, 5 June 1992, UN Doc. UNEP/Bio. Civ/Conf/L. 2; 31 *I.L.M.* 818 (1992); *Convention on Wetlands of International Importance Especially as Waterfowl Habitat*, Ramsar, 2 February 1971, 996 *U.N.T.S.* 245, 11 *I.L.M.* 963 (1972); and the *Convention for the Protection of the Marine Environment of the North-east Atlantic*, Paris, 22 September 1992, 32 *I.L.M.* 1069 (1993).

[3] UNCLOS, *supra* note 1, Articles 192 and 197, respectively.

and other actors draw on the substantive principles and functional actions within IEL framework.[4] Regional seas conventions are prime examples of the melding of IEL and LOS.

IEL has developed relatively swiftly over the previous four decades. Creativity, resourcefulness and diversity mark this journey as IEL has favoured, by necessity, a functional approach to addressing environmental issues and developed tools accordingly. Examples of the functional nature of IEL include its use of soft-law instruments; regional co-operative initiatives; green technology; education; integrated approaches; and strategies such as including stakeholders, empowering women, addressing poverty, promoting alternative actions and providing economic incentives.

IEL's diverse and functional approach diverged from the formalistic and diplomatic approach of international law generally and LOS specifically. Although many of the early IEL practitioners emanated from the LOS domain in the early decades, the necessity for functional approaches saw the gradual erosion within IEL of the LOS' diplomatic mindset of negotiated outcomes and consensual standards. Often reflecting the "lowest common denominator", such a mindset may be acceptable in international legal arena dictating state (and human) behaviour vis-à-vis each other, but it is inherently unsuitable in the international environmental arena where negotiated outcomes seldom provide the requisite level of environmental protection.

[4] A selection of principles which generally fall within the rubric of IEL includes sustainable development, the concept of precaution, integration (several types and levels), co-operation, intergenerational equity, integrated coastal management, best available technology and best environmental practice.

The shift in mindset away from the formalistic LOS mindset is consistent with the fundamental precept governing the effectiveness of IEL and environmental regimes – the laws of nature prevail over the laws of man. There is no negotiating with nature as ecological laws are grounded in immutable scientific principles. Thus, policies and actions must comply with the laws governing natural systems if interventions are to generate ecological improvement, or in other words, be ecologically effective.[5]

EVOLUTION OF INTERNATIONAL ENVIRONMENTAL LAW

The development of IEL can arguably be divided into three stages. The first stage was influenced by the LOS mindset of politicized outcomes and reflects a lack of critical understanding of environmental issues, particularly in a scientific and ecological context. Accumulating evidence of continuing and chronic degradation and ineffective policies and actions triggered the second stage, a transition phase in the 1990s. This evolved into the third stage in the early 2000s, which seems to largely focus on effective implementation. This, together with the evolving mindset that recognizes the supremacy of laws of nature, raises questions as to the ecological effectiveness of environmental regimes. Throughout the evolution of IEL, LOS remained relatively stable and provided a solid foundation in which to ground environmental regimes.

[5] This article uses the word "policy" broadly to include a variety of legal, policy and management initiatives, including global, regional and domestic soft- and hard-law instruments, such as conventions, laws, policies, action plans, management plans, guidelines, declarations, and memoranda of understanding. Likewise, "policy-making" comprises law, policy and decision-making processes and related processes and the term "policy-makers" encompasses the actors involved in the above processes.

Stage 1 of IEL: Creating an Arsenal of Tools

The first stage in the evolution of IEL commenced with the first macro environmental conference, the 1972 United Nations Conference on the Human Environment (Stockholm),[6] and ended with two macro conferences, 1992 UN Conference on the Environment and Development (UNCED) and the 1995 UN Conference on the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities (UNCGPA). This stage focussed largely on developing substantive tools, including legal and management concepts, principles and actions to promote ecological sustainability.[7] These have been entrenched in a prolific array of global, regional and domestic hard- and soft-law instruments.

While this era provided the international community with sufficient and largely philosophically sound tools with which to address environmental issues, weaknesses of stage 1 include the frequently ineffective application and implementation of these tools and instruments and the lack of development and incorporation of mechanisms to assess and review the effectiveness of policies, actions and related processes. Further, there was a general failure to recognize the need for and to infuse sound science into policy-making processes to foster ecological effectiveness in compliance with the laws of nature.

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[6] United Nations, *Report of the United Nations Conference on the Human Environment*, 5-16 June 1972, A/Conf.48/14/Rev.1 (1973).

[7] Some of the principles are noted above, *supra* note 4.

Stage 2 of IEL: The Transition Stage of Questioning "Effectiveness"

Agenda 21 and the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities (GPA) are products on the cusp of the transition stage.[8] Recognizing the weaknesses of the first era, both of these instruments call for more and better science, encourage improved implementation and highlight the need for "effectiveness".[9] Departing from most legally-binding environmental instruments, both soft-law instruments provide guidance on *how* to improve the overall effectiveness of environmental policies and actions. Although they did not prove to be catalysts for the analyses and revision of policy-making processes, they arguably placed the issue of effectiveness of environmental regimes on the international radar.

Scientists, who have always been vocal,[10] but largely unheard by the international policy community, became more vocal in the 1990s about the ecologically unsound application and implementation of largely philosophically sound IEL tools. The scientific voice permeated

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[8] *Agenda 21*, 13 June 1992, UN Doc. A/Conf.151/4 (1992) and the GPA, *supra* note 2.

[9] See *Agenda 21*, *ibid*., Chapter 35, Science for Sustainable Development. The instrument refers to effectiveness over 140 times. The GPA, *ibid*., refers to the need for science and technical input throughout.

[10] For example: J. Cairns, Jr., "Aquatic Ecosystem Assimilative Capacity," *Fisheries* 2, No. 2 (1977): 5-7, 24; M. Waldichuk, "Control of Marine Pollution: An Essay Review," *Ocean Development and International Law* 4 (1977): 269; R. Carson, *Silent Spring* (New York and Boston: Houghton Mifflin Company, 1962, 1994); Editorial, "Why We Only Accept a Policy if We Know It Will Not Work," *Ecologist Quarterly* 1 (1978): 266; and A.R.D. Stebbing, "Assimilative Capacity," *Marine Pollution Bulletin* 12 (1981): 362.

the international community via reports,[11] articles[12] and books.[13] A direct approach to the heads of state at UNCED involved the Heidelberg Appeal to the Heads of States and

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[11] For example: GESAMP, "A Sea of Troubles," *GESAMP Reports and Studies* No. 70, 2000; GESAMP, "Protecting the Oceans from Land-based Activities: Land-based Sources and Activities Affecting the Quality and Uses of the Marine, Coastal and Associated Freshwater Environment," *GESAMP Reports and Studies No*. 71, 2001; GESAMP, "The State of the Marine Environment," *GESAMP Reports and Studies* No. 39, 1990; GESAMP, "Global Strategies for Marine Environmental Protection," *GESAMP Reports and Studies* No. 45, 1991; and GESAMP, *infra* note 64. For more information, see <http://www.gesamp.org>, 29 September 2007.

[12] For example: J. Cairns, "Healing the World's Ecological Wounds," *International Journal of Sustainable Development and World Ecology* 8 (2001): 185; J.S. Gray, "Statistics and the Precautionary Principle," *Marine Pollution Bulletin* 21 (1990): 174; L.D. Mee, "Scientific Methods and the Precautionary Principle," in D. Freestone and E. Hey, eds., *The Precautionary Principle in International Law: The Challenge of Implementation* (The Hague, London and Boston: Kluwer Law International, 1996); S.O. Funtowicz and J.R. Ravetz, *infra* note 88; R.G.V. Boelens, "From Policies to Science: Strategies for Marine Environmental Protection," *Marine Pollution Bulletin* 25 (1992): 14; Gray, *infra* note 51; C. Sheppard, "Not Politically Correct," *Marine Pollution Bulletin* 24 (1992): 524; J.C. Hall, W.T. Hall, and C.T. Simmons, "Water Quality Criteria for Copper: A Need for Revisions of the National Standard," *Water Environment and Technology* 9(6) (1997): 45; D. Ludwig, R. Hilborn, and C. Walters, "Uncertainty, Resource Exploitation, and Conservation: Lessons from History," *Science* 260 (1993): 17; T. Wakeford and M. Walters, eds., *Science for the Earth: Can Science Make the World a Better Place?* (Chichester, England: John Wiley & Sons, 1995); M.H. Depledge, "Ecotoxicology: A Science or Management Tool?," *Ambio* 22 (1993): 51; J.A. Hutchings, C. Walters and R.L. Haedrich, "Is Scientific Inquiry Incompatible with Government Information Control?," *Canadian Journal of Fisheries and Aquatic Sciences* 54 (1997): 1198; L. Jeftic, "The Role of Science in Marine Environmental Protection of Regional Seas and Their Coastal Areas: The Experience of the Mediterranean Action Plan," *Marine Pollution Bulletin* 25 (1992): 66; N. Myers, "Environmental Unknowns," *Science* 269 (1995): 358; T. Lovejoy, "Biodiversity: Dismissing Scientific Process," *Scientific American* 286(1) (2002): 67; and J. Rennie, "Misleading Math about the Earth," *Scientific American* 286(1) (2002): 59; Bewers, *infra* note 14; J.S. Gray and J.M. Bewers, *infra* note 58; and Gray, *infra* note 76.

[13] C. Sagan, *The Demon-Haunted World: Science as a Candle in the Dark* (New York: Random House, 1995); P.R. Ehrlich and A.H. Ehrlich, *Betrayal of Science and Reason: How Anti-environmental Rhetoric Threatens Our Future* (Washington, D.C.: Covelo, California: Island Press, 1996); Ray and Guzzo, *infra* note 14; Wilson, *infra* note 33; and Capra, *infra* note 54.

Governments.[14] Other actors involved in environmental regimes, primarily political and social scientists, concurred with the scientists.[15] While many discussed the need to foster sound policies and actions for improved ecological effectiveness, only a few acted.

Blatant acknowledgement of the need to improve ecological effectiveness came from the Global Environment Facility (GEF). In the mid-1990s, the GEF required new fund recipients under the International Waters focal area to draft a "Strategic Action Programme" (SAP). The qualifier, "strategic", differentiated the SAP from other action plans as the SAP was to be

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[14] See J.M. Bewers, "The Declining Influence of Science on Marine Environmental Policy," *Chemistry and Ecology* 10 (1995): 9-23 at p. 21 and Appendix 1, p. 23. Also see D.L. Ray and L.R. Guzzo, *Environmental Overkill: Whatever Happened to Common Sense?* (New York: HarperPerennial, 1993), pp. 6-7. Of the more than 400 signatures, over 250 included the world's leading scientists and 27 Nobel Laureates. Released on 1 June 1992, it noted, *inter alia*, that in two years of UNCED preparation, the involvement of scientific specialists was insignificant. It called for more scientific input and common sense in policy-making. The Heidelberg Appeal was neither acknowledged by the heads of state nor taken into account during the negotiations at UNCED. Ray and Guzzo, p. 7.

[15] See, for example, L.K. Caldwell, *Between Two Worlds: Science, the Environmental Movement and Policy Choice* (Cambridge: Cambridge University Press, 1992); Lee, *infra* note 22; Orr, *infra* note 47; O.R. Young, ed., *Global Governance: Drawing Insights from the Environmental Experience* (Cambridge, Massachusetts and London, England: The MIT Press, 1997); R.M. M'Gonigle, T.L. Jamieson, M.K. McAllister, and R.M. Peterman, "Taking Uncertainty Seriously: From Permissive Regulation to Preventative Design in Environmental Decision-making," *Osgoode Hall Law Journal* 32 (1994): 99; N. Robinson, "Legal Systems, Decisionmaking, and the Science of Earth's Systems: Procedural Missing Links," *Ecology Law Quarterly* 27 (2000): 1075; G.E. Brown, "Environmental Science under Siege in the U.S. Congress," *Environment* 39(2) (1997): 12; Hempel, *infra* note 65; Faigman, *infra* note 43; D. Fisk, "Environmental Science and Environmental Law," *Journal of Environmental Law* 10 (1998): 3; P.R. Gross, N. Levitt and M.W. Lewis, eds., *The Flight from Science and Reason* (New York: New York Academy of Sciences, 1996); O.A. Houck, "Are Humans Part of the Ecosystem?," *Environmental Law* 28 (1998): 1; H. Margolis, *Dealing with Risk: Why the Public and the Experts Disagree on Environmental Issues* (Chicago and London: University of Chicago Press, 1996); and S. Rampton and J. Stauber, *Trust Us, We're Experts!: How Industry Manipulates Science and Gambles with Your Future* (New York: Jeremy P. Tarcher/Putnam and the Center for Media and Democracy, 2001).

grounded in a region-wide Transboundary Diagnostic Analysis (TDA).[16] The TDA, undertaken by scientists, was to assess and rank ecological degradation on a regional basis. Subsequently, demonstration sites would be established in accordance with the priority issues identified in the TDA and, operating over several years and involving many actors, relevant information collected, which in turn would ground the redrafted SAP.[17] Via this process, the SAP would comprise scientifically sound and realistic actions and measures that would result in ecological improvement.

In a GEF example, the UNEP/GEF South China Sea Project,[18] demonstration sites for each of the identified ecological issues involve scientists working with the community, policy-makers, law enforcement, politicians, community leaders, industry and other relevant actors to determine effective strategies to reverse trends of degradation. Scientists from each of the seven involved countries meet regularly to determine scientific criteria and other needs to effectively monitor, assess, and address the respective ecological issue. Legal and economic task forces work in conjunction with these groups. Every two years all actors meet to resolve problems and to determine strategies to improve effectiveness further. The draft SAP, which established the sound objectives and detailed relevant criteria and processes, will be finalized towards the end of the project. It will be grounded in sound science, incorporate relevant information from all sectors and disciplines garnered over the life of the project and establish review mechanisms to ensure the SAP remains current with scientific and other knowledge.

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[16] See the GEF website, <www.gefweb.org>, 29 September 2007.

[17] *Ibid.*

[18] UNEP/GEF Project to Reverse Environmental Degradation Trends in the South China Sea and Gulf of Thailand, <www.unepscs.org/>, 29 September 2007.

Several other regional seas have adopted SAPs, including the Mediterranean, Black, Red and Caspian seas.

Stage 3 of IEL: The Quest for "Effectiveness"

The first macro environmental conference of the new millennium, the 2002 World Summit on Sustainable Development (WSSD), focused global attention on the need for effective implementation.[19] The message of the WSSD departed, quite significantly, from earlier environmental conferences and meetings by highlighting *process* over substantive issues and principles. By doing so, arguably, the WSSD launched IEL into its third evolutionary stage by shifting the focus from "what to do" to "how to do it better".

The focus on improving overall and ecological effectiveness is evident in the frequent use of terms that act as qualifiers, such as "strategic", "effective", "knowledge-based (decision-making)",[20] "science-based (decision-making)",[21] and "adaptive (management)"[22] in instruments and documents. Employing such qualifiers for previously unqualified terms suggests dissatisfaction with previous instruments, actions and outcomes. They are an avenue to institutionalize pre-meditation, deliberation, calculation, planning, coordination and co-

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[19] See the *Plan of Implementation of the World Summit on Sustainable Development,* <www.un.org/esa/sustdev/documents/WSSD_POI_PD/English/WSSD_PlanImpl.pdf>, 29 September 2007.

[20] UNEP, *A Global Initiative to Strengthen Regional Seas Conventions and Action Plans and Enhance Co-operation*: *Regional Seas Strategic Directions for 2004-2007,* UNEP(DEC)/RS. 6 Annex I, 2004.

[21] Plan of Implementation, *supra* note 19, para. 109.

[22] See K.N. Lee, *Compass and Gyroscope: Integrating Science and Politics for the Environment* (Washington, D.C. and Covelco, California: Island Press, 1993).

operation to maximize effectiveness. It further encourages a shift in mindset to embrace sound policy-making and implementation and, by inference, the need to revise current processes to make them more effective.

"Strategic" and "strategy" gain prominence as the need for greater effectiveness is emphasised. The qualifier "strategic" peppers the 2002 Plan of Implementation of the World Summit on Sustainable Development (Plan of Implementation), appearing in phrases such as "strategic alliances", "strategic approaches", and "strategic plans".[23] Likewise, "strategic partnerships" replace mere partnerships. It has been adopted by both the Strategic Partnership for the Mediterranean Large Marine Ecosystem and the GEF Strategic Partnership on the Black Sea and Danube Basin.[24] The Secretariat for the GPA has formed a "strategic partnership" with the Regional Seas Programmes (RSP) to facilitate coordinated national action within a region in accordance with global directives.[25]

The RSP Members at the 6th Annual Global Meeting in 2004 endorsed a global initiative entitled, in part, Regional Seas Strategic Directions for 2004–2007 (Strategic Directions).[26] In agreeing that a primary role for RSPs should be as facilitators for the domestic and regional implementation of global instruments, Strategic Directions promotes sound processes, including knowledge-based policy-making, education, partnership synergies, co-ordinated implementation efforts, ecosystem-based integrated management, priority issue focus and

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[23] Plan of Implementation, *supra* note 19, paras. 113, 23(b) and 33(c), respectively.

[24] See respectively, <www.iwlearn.net/iw-projects/Fsp_112799470859> and <webapps01.un.org/dsd/partnerships/public/partnerships/941.html.>, 5 September 2007.

[25] For further information, see the GPA website, <www.gpa.unep.org>, 30 September 2007.

[26] UNEP, *A Global Initiative to Strengthen Regional Seas Conventions and Action Plans and Enhance Co-operation: Regional Seas Strategic Directions for 2004-2007*, UNEP(DEC)/RS. 6 Annex I, 2004.

innovative tools.[27] In May 2005, the Coordinating Body on the Seas of East Asia (COBSEA) held the "Brainstorming Meeting of the National Focal Points on New Strategic Directions of COBSEA".[28]

The terms, "effective", "effectiveness" and "effectively", while found in previous instruments, are used more frequently in the 2002 Plan of Implementation where they appear at least 81 times. References include: "effectively implement", "respond effectively", "deal effectively", "effective participation", "effective governance systems", "operationally effective", "effective measures", "effective science", "effective management frameworks", "effective policy responses", "effective participation", "effective UN system", "promote greater effectiveness of activities" and "enact and enforce clear and effective laws".[29] There is little doubt that the Plan of Implementation is a clarion call to improve effectiveness throughout policy-making processes and environmental regimes.

Additional confirmation of the entrance into stage 3 and the quest to improve ecological effectiveness is the 2002 seminal study entitled *Environmental Regime Effectiveness: Confronting Theory with Evidence.*[30] The authors concluded that although the 14 global and regional regimes studied "by and large make a positive difference, most fail to solve the problems they were designed to solve and often fail by a wide margin".[31] This is an

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[27] *Ibid.*

[28] UNEP, *Report of the Brainstorming Meeting of the National Focal Points on New Strategic Directions of COBSEA*, UNEP(DEC)EAS 1.NFP, 25 May 2005.

[29] For the references, search for "effective" in the electronic document, *supra* note 19.

[30] E.D. Miles, A. Underdal, S. Andresen, J. Wettestad, J.B. Skjærseth, and E.M. Carlin, eds., *Environmental Regime Effectiveness: Confronting Theory with Evidence* (Cambridge, Massachusetts and London: MIT Press, 2002).

[31] *Ibid.*, at p. 468.

indictment of the failure to focus on ecological effectiveness in the earlier stages of the evolution of IEL.

The third stage in the evolution of IEL marks the philosophical transition of environmental regimes from the era of "command and control" to an era of risk management, as dictated by the amalgam of environmental degradation issues and ecological complexities.[32] Risk management, by definition, is an ongoing, long-term process that requires examining, reviewing and revising to ensure that instruments, actions, measures and initiatives are effective and remain so. The focus is processes and their effectiveness in improving and maintaining ecological integrity.

This evolutionary stage of IEL embodies the quintessential trait of humans – the ability to reason. Common sense is infusing environmental regime development as actors strategise to ensure that efforts produce results, in this case ecological effectiveness.

TWO CONCEPTS TO PROMOTE EFFECTIVENESS

Two concepts, "consilience" and a "grand experiment" mindset, may prove useful for improving the ecological effectiveness of environmental regimes.

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[32] See generally, B. Fischhoff, S. Lichtenstein, P. Slovic, S.L. Derby, and R.L. Keeney, *Acceptable Risk* (Cambridge: University of Cambridge Press, 1981, 1993) and H. Kunreuther and P. Slovic, "Science, Values, and Risk," *The Annals of the American Academy of Political and Social Science* 545 (1996): 116.

“Consilience”: A Unifying Concept for Sound Policy-making

“Consilience” is defined as the “‘the jumping’ together of knowledge by the linking of facts and fact-based theory across disciplines to create a common groundwork of explanation”.[33] More simply, consilience fosters an intellectual and comprehensive understanding of environmental events and issues by integrating and unifying all relevant information.[34]

The term, consilience, is not new to the English language, having been introduced by William Whewell in his 1840 publication, *The Philosophy of the Inductive Sciences.*[35] It was recently revived in *Consilience: The Unity of Knowledge*, an illuminating text by an eminent scientist.[36] Consilience has noble roots in the Age of Enlightenment in the 17th and 18th centuries as the three great branches of learning, the arts, humanities, and sciences, were unified as knowledge from one branch was integrated with the other branches.[37] The Enlightenment was dominated by a handful of natural scientists and philosophers, namely Bacon, Descartes, Hobbes, Hume, Locke, Newton, Grotius, Galileo, Kant, and Leibniz.[38] Among the commonalities binding these men, “they believed in the unity of all knowledge

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[33] E.O. Wilson, *Consilience: The Unity of Knowledge* (New York: Alfred A. Knopf, Inc., 1998), p. 8.

[34] *Ibid*., pp. 8-13. Also see E.O. Wilson, “Consilience among the Great Branches of Learning,” in P. Galison, *et al.*, eds., *Science in Culture* (New Brunswick, N.J.: Transaction Publishers, 2001), pp. 131-150.

[35] Wilson, *supra* note 33, p. 8.

[36] *Ibid*.

[37] For an encapsulation of “consilience,” see E.O. Wilson, “Resuming the Enlightenment Quest,” *The Wilson Quarterly* 22 (1998): 16. Also see P.R. Gross, “The Icarian Impulse,” *The Wilson Quarterly* 22 (1998): 39. *Cf.* R. Rorty, “Against Unity,” *The Wilson Quarterly* 22 (1998): 28.

[38] Wilson, *supra* note 33, at p. 21.

and agreed on the power of science to reveal an orderly and understandable universe and thereby lay an enduring base for free and rational discourse".[39]

Consilience is particularly relevant at this juncture in environmental regime-building. Environmental policy-making is increasingly complex, involving systemic, chronic and amorphous issues, such as global climate change, biodiversity loss, habitat degradation, degradation from land-based activities and integrated coastal management (ICM). These issues involve, in addition to scientific complexity and a broad array of socio-economic concerns, fundamental and emotionally charged issues such as sovereignty, values, ethics, cultural and religious beliefs, human rights, and human welfare.

Complex environmental issues require consilience as the latter fosters a *broad knowledge base* for policy-making and a *critical understanding* of the fundamentals of the issue. Currently, policy-makers attempt to create a broad knowledge base by integrating knowledge and information from an array of sources and disciplines. However, it largely commences on an *ad hoc*, chaotic basis and lacks a master plan or comprehensive strategy for systematically considering and integrating *all* relevant information. Unfortunately, the information gathered is seldom screened to ensure it is sound and reliable and the best information available.

A critical understanding of environmental issues includes not only knowledge relating to the environmental issue, but an understanding of underlying issues, such as ecological principles; scientific challenges (e.g., reservations, uncertainties); hindrances to effectiveness (e.g., societal and cultural biases, media-driven perceptions, viable alternatives); and novel tactical

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[39] *Ibid.*

strategies for improving effectiveness (e.g., involving domestic implementing ministries in regional meetings to improve implementation). Possessing a critical understanding does not involve becoming an expert in every area, but involves a sufficient appreciation of the issues to make informed, sensible and sound decisions. For example, a large number of actors in environmental regimes suffer a lack of critical understanding of a critical understanding of science (which includes ecology) and consequently, they frequently make ecologically unsound decisions.

The premise underlying consilience is that a broad knowledge base and critical understanding empower actors to pose salient questions and reach sound decisions. It embodies systematic, strategic and coherent policy-making processes. To this end, the concept of consilience engenders *effectiveness* in environmental regimes.

The Grand Experiment: A New Mindset

Conceptually viewing environmental regime-building as a grand experiment is an appropriate mindset for fostering effectiveness. Scientific experimentation focuses on sound processes. Experiments are carefully designed, entailing informed thoughts and ideas and follow-up actions and assessing and reviewing those actions and making necessary adjustments, incorporating new information and building a knowledge base. Adopting an experimental mindset can establish environmental policy-making and regime building as an on-going process of learning and adaptation. Feedback and review mechanisms, designed to capture successful and unsuccessful strategies and assumptions, the emergence of unexpected phenomena, misstated values and other “missteps”, should trigger pre-mediated and rational policy responses to improve effectiveness of policies and actions.[40] Adaptive management, another name for this process, requires that actors be open-minded, flexible, objective, analytical, creative, sceptical (cautious), integrative and persevering (following up inconsistencies) in seeking ecological effectiveness—they must not merely seek expedient or politically popular resolutions.[41]

The mindset of a grand experiment is particularly relevant for complex issues as it fosters a methodological and rational framework to discover and then validate information and to generate sound policies for ecological sustainability. This mindset encourages actors to accept policy-making as a cyclic process of updating policies and actions in accordance with new information. Consistent with the third stage of IEL and consilience, this mindset focuses attention on processes and improving environmental regime effectiveness.

SCIENCE AND CONSILIENCE

Scientific knowledge is a "universal possession of humanity" and it "comprises what we know of the material world with reasonable certainty".[42] Science is necessary to inform actors of the biological, physical, and chemical implications of human activities; to establish ecological priorities; and to advise on the ecological and economic effectiveness of policy options. Scientific knowledge is at the core of environmental issues as the objective of environmental regimes is ecological sustainability. Measuring the ecological effectiveness of

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[40] See Lee, *supra* note 22, pp. 51-86 and GESAMP, *infra* note 64, pp. 10-12.

[41] Lee, *ibid*.

[42] Wilson, *supra* note 33, at p. 268.

policies and actions requires science. Without a sound scientific foundation, policies and actions are often ecologically ineffective and economically inefficient.

Science must inform policy, but not dictate, usurp, or hijack the policy-making process. Science can identify sound options and advise whether policy choices are sound, or how they can be adjusted to improve effectiveness. Scientists determine "what *is*" (factual findings) and society, through policy-making processes grounded with sound science, decides "what *ought* to be" given the interests and considerations of the various stakeholders.[43] The key is that options considered in the policy-making process must be scientifically sound. This is consilience in operation.

Declining Influence of Science

Paradoxically, science often fails to influence policy at a time when systemic degradation issues desperately require the input of sound science and at a time when scientists are well placed to provide useful and reliable advice.[44] This is unfortunate, but not surprising as,

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[43] D.L. Faigman, *Legal Alchemy: The Use and Misuse of Science in Law* (New York: W.H. Freeman and Company, 1999, 2000), p. 33 and P. Castro and M.E. Huber, *Marine Biology* (2nd ed., Dubuque, Iowa: Wm. C. Brown Publishers, 1997), pp. 14-16.

[44] See Bewers, *supra* note 14. Also see unpublished Ph.D. thesis of S.M. Lexmond, *From Chaos to Consilience: The Need for Science-based Policy to Prevent Marine Degradation from Land-based Activities*, <www.sml.kyl191.net/consilience.pdf>, 30 September 2007, Chapter 5. For examples of improved capacity, see generally P.M. Chapman, "Is Bioaccumulation Useful for Predicting Impacts," *Marine Pollution Bulletin* 34 (1997): 282; L.W. Aarssen, "On the Progress of Ecology," *Oikos* 80 (1997): 177; G. Kullenberg, "Capacity Building in Marine Research and Ocean Observations: A Perspective on Why and How," *Marine Policy* 22 (1998): 185; J.H. Stel, "Editorial – Marine

historically, science has been ignored, neglected and misused in many ways and at every stage of policy-making.[45]

The misuse of science has occurred despite good intentions. Its misuse is also attributable to malfeasance and the intentional manipulation of science for political or other purposes. Misuse includes: failing to consult scientists or to incorporate science; choosing unsound science over sound science; relying on outdated or biased science; relying on inappropriate experts in the targeted issue or those who represent a minority scientific view; ignoring the assimilative capacity of the natural environment; interpreting and applying philosophically sound legal principles, such as the concepts of precaution, best available technology and best environmental practice, in scientifically unsound ways; adopting unsound principles like zero discharge; and being fixated with inappropriate technology.[46]

Scientific Illiteracy

Scientific illiteracy underlies much of the misuse of science. Policy-makers may be considered "functionally science-illiterate" where their level of critical understanding of science is below the level that is required to make effective decisions about environmental

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Capacity Building in a Changing Global Setting," *Marine Policy* 22 (1998): 175; E. Okemwa, "The Intergovernmental Oceanographic Commission of UNESCO and Regional Capacity Building," *Marine Policy* 22 (1998): 197; and R. Bailey, ed., *Earth Report 2000: Revisiting the True State of the Planet* (New York: McGraw-Hill, Inc., 2000).

[45] Lexmond, *ibid.*, Chapters 2 and 4.

[46] See *ibid*., Chapter 4. Also, many publications noted in footnotes 10-13 and 15, herein, detail misuses.

issues and discern sound policy options.[47] Unfortunately, most non-scientific actors have emerged science-illiterate from schools and tertiary educational institutions as few institutions require that students have even minimal scientific exposure.[48]

The implications of scientific illiteracy can be severe.[49] The most blatant is poor policy choices that result in continuing ecological degradation. Many actors fail to understand fundamentals, such as the extent to which rational policy choices are bound, or should be bound, to science.[50] The science-illiterate make poor choices about sound science, suitable experts, policy options and implementation, as noted above. They make fundamental mistakes such as asking the wrong questions or funding inappropriate research.[51] Scientific illiteracy impairs communication, confounds progress and co-operation, generates tension and results in poor choices.[52] Economic inefficiency often ensues as valuable time and resources are used inappropriately; for example, to address low ecological priorities, while high priority issues persist.

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[47] See D.W. Orr, *Ecological Literacy: Education and the Transition to a Postmodern World* (New York: State University of New York Press, 1992); C.P. Snow, *Two Cultures and the Scientific Revolution* (New York: Cambridge University Press, 1959); and G. Hardin, *Filters Against Folly: How to Survive Despite Economists, Ecologists and the Merely Eloquent* (New York: Penguin, 1987). For a more detailed discussion see Lexmond, *ibid.,* Chapter 2.

[48] Orr, *ibid*., pp. *x-xii*.

[49] These examples in this section are discussed in more detail in Lexmond, *supra* note 44, Chapter 4.

[50] See P.E. Allin, "Some Social Aspects of Modern Science: A Point of View," *International Journal of Environment Studies* 3 (1972): 49 at p. 50 and Chapman, *supra* note 44, p. 227. Also see L.M. Warren, "The Precautionary Principle: Use with Caution," in K. Milton, ed., *Environmentalism: The View from Anthropology* (London and New York: Routledge, 1993), pp. 97-111; Brown, *supra* note 15; Bewers, *supra* note 14; Wilson, *supra* note 33; and F.B. Golley, *A History of the Ecosystem Concept in Ecology: More than the Sum of the Parts* (New Haven and London: Yale University Press, 1993).

[51] J.P. Holdren, "Energy: Asking the Wrong Questions," *Scientific American* 286(1) (2002): 63 and J.S. Gray, "Whose Research Is It Anyway?," *New Scientist* 149(2023) (1996): 48, respectively.

[52] See generally, Lexmond, *supra* note 44, Chapters 2 and 4.

Failing to understand the scientific process can result in choosing unqualified or biased experts or unsound science. Misunderstanding scientific terminology, such as the scientific distinction between contamination and pollution and between toxic chemicals and toxic doses, leads to confusion or misunderstandings.[53] Disregarding scientific qualifications can result in false expectations and other outcomes that result in ecological ineffectiveness, unfair loss of scientific credibility and increased tension between the science and policy domains.

Improving Scientific Literacy

Scientific literacy for non-scientists involves a critical understanding of two aspects of science. The first is the processes of science and how scientists operate (scientific method), such as limitations and challenges, scientific reservations, peer review, scientific uncertainties and the incremental process of accumulating scientific knowledge. The second involves ecological literacy, or eco-literacy. In addition to appreciating the complexity of the ecosystem, eco-literacy entails an understanding of the rudiments of ecology, including the five basic principles of ecological organization (inter-dependence; cyclic flow of nutrients, resources, and energy; partnerships; ecosystem dynamism and flexibility; and biological diversity).[54] The aim of scientific literacy is not to create scientific experts of non-scientist,

[53] For example, in science, pollution must result in deleterious changes to the environment, whereas contamination is the presence of substances which do not register deleterious changes, as perhaps the concentration is sufficiently low. Thus, contamination can become pollution when deleterious changes are discernible. In law, pollution is most often defined as the introduction of substances that result or may result in deleterious changes. From a science perspective, this comprises both contamination and pollution. Consequently, scientists and lawyers discussing "pollution" are talking about two different concepts.

[54] F. Capra, *The Web of Life: A New Scientific Understanding of Living Systems* (New York: Anchor Books, Doubleday, 1996), pp. 298-304. Also see GESAMP, "Protecting the Oceans from Land-based Activities: Land-based Sources and

but to generate sophisticated and informed *users* of science who can ask relevant questions and avoid the pitfalls that have led to unsound policy.[55]

The current low levels of scientific literacy can be addressed with scientific education at all levels of society, targeting school children for long-term literacy and offering immediate educational opportunities to key actors, media and the general public.[56] Educating the general public helps to change perceptions and behaviour and provides awareness and knowledge to positively influence policy and promote skills for living within the laws of nature.[57]

Actors who are influential in policy-making should become science-literate through dedicated scientific and eco-literacy programmes. Policy-makers, bureaucrats, lawyers, and other government and state actors involved in environmental regimes should be encouraged, if not

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Activities Affecting the Quality and Uses of the Marine, Coastal and Associated Freshwater Environment," *GESAMP Reports and Studies* No. 71, 2001 and E.P. Odum, *Ecology and Our Endangered Life-support System* (2nd ed., Sunderland, Massachusetts: Sinauer Associates, Inc., 1993).

[55] See generally, Faigman, *supra* note 43. His premise is that actors should have a sufficient understanding of science to be informed users or consumers of science.

[56] See generally S. Tomkins, "Science for the Earth Starts at School," in Wakeford and Walters, eds., *supra* note 12, pp. 257-276; Orr, *supra* note 47; W.A. Thomas, "A Report from the Workshop on Cross Education of Lawyers and Scientists," *Jurimetrics Journal* 19 (1978): 92; W.A. Thomas, "A Report from the Workshop on Cross Education of Lawyers and Scientists," 19 *Jurimetrics Journal* 92 (1978); H. Schneider, "Concepts and Issues," in OECD, *Environmental Education: An Approach to Sustainable Development*, Prepared under the OECD Development Centre's Research Programme on Coping with Environmental Threats in Developing Countries (Paris: OECD, 1992), pp. 25-33; and O.S. Dijksterhuis, "Environmental Education: A Tool for Coastal Management? A Study of the Caribbean Region," *Coastal Management* 24 (1996): 339.

[57] E.W. Weidner, "Educational Aspects of Environmental Issues," *International Journal of Environmental Studies* 2(1) (1972): 301-308, at p. 308. For a discussion on the need for behavioural fixes in addition to technological fixes, see R.W. Kates, "Success, Strain, and Surprise," *Issues in Science and Technology* 2 (1985-1986): 46.

required, to take a scientific literacy exam, or enrol in a government-sponsored scientific literacy course with accreditation or incentives given to those who upgrade their skills. It is essential that the actors in decision-making positions be able to cut through emotionally charged issues and be empowered to make wise choices utilizing the best available science.[58]

A motivational tool is a twelve-step self-help programme entitled, "Becoming a Sophisticated Consumer of Science".[59] Programme participants commence with an admission of scientific illiteracy, acknowledge the need for scientific literacy to fulfil professional obligations, commit to seeking sound scientific advice, and agree that, by following the steps, they will become sophisticated consumers of science.[60] The programme may sound somewhat pedantic, but it holds promise as a tool to encourage decision-makers to improve their levels of scientific understanding as part of the process of improving regime effectiveness. While other factors, such as socio-economic issues, must guide environmental decisions, the premise is that the options must be grounded in sound science to ensure wise decisions and that the actions chosen will positively impact the ecosystem in accordance with the objectives and sound use of financial and other resources.

A key group of actors deserving special and immediate scientific education is the media, who, in turn, can become educators of the general public.[61] There is a move towards

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[58] See J.S. Gray and J.M. Bewers, "Towards a Scientific Definition of the Precautionary Principle," *Marine Pollution Bulletin* 32 (1996): 768, at p. 771.

[59] Faigman, *supra* note 43, p. 198.

[60] *Ibid*.

[61] See L.S. Susskind, *Environmental Diplomacy: Negotiating More Effective Global Agreements* (New York: Oxford: Oxford University Press), 1994, p. 136 and Ray and Guzzo, *supra* note 14, pp. 171-187. See H.A. Cohl, *Are We Scaring*

responsible and balanced reporting, particularly as bodies such as the Union of Concerned Scientists, based in the United States, speak out against inaccurate or misleading science reporting on environmental issues.[62] The contrarian reports and open debates in the media must continue, and they should be encouraged. However, clarity and honesty on behalf of reporters is necessary to, for example, distinguish minority scientific opinions from those of the mainstream scientific body or to confirm whether a cited expert has expertise in the relevant area. The media needs to fully inform the public to assist the latter in making rational choices.

Scientific literacy can be addressed on a global (perhaps within the United Nations) or regional level via a multi-disciplinary task force mandated to conceptualize, design, and implement novel ways of making science less daunting and more interesting for non-scientific actors while creating materials to support scientific literacy. Such a task force requires participation by numerous disciplines, including social scientists and psychologists who understand factors influencing mindsets and perceptions and consequently policy choices, as well as cultural and religious biases, information processing styles and fear and risk perception.[63]

Ourselves to Death?: How Pessimism, Paranoia, and a Misguided Media are Leading Us Toward Disaster (New York: St. Martin's Griffin Press, 1997).

[62] The Union of Concerned Scientists started in the 1960s in response to concerns about the social uses of scientific discovery. Its members encourage the sound use of sound science, particularly in publicly debated environmental concerns such as global climate change. See the Union of Concerned Scientists, <www.ucsusa.org>, 29 September 2007.

[63] For example, see D. Goleman, *Emotional Intelligence* (New York: Bantam Books, 1995); S. Pinker, *How the Mind Works* (New York: W.W. Norton, 1997); and Wilson, *supra* note 33.

Institutionalizing a Role for Science

Scientists have long recognised that science requires a defined role in environmental regime development. The Group of Experts on Scientific Aspects of Marine Environmental Protection (GESAMP), a body established to advise specific United Nations-related bodies, published in 1996 "The Contributions of Science to Integrated Coastal Management".[64] They foresaw a two-pronged role for science. The first role entails scientists offering scientific advice. They can offer the best available scientific knowledge and advice to tailor policies and actions and provide a sound scientific framework in which to discuss socio-economic and political concerns. This will involve sound scientific knowledge about the natural world, assessment of scientific impacts of human activities and assessment of various options for ecological effectiveness (to ensure resources are not wasted pursuing actions that are ecologically ineffective). Where scientific uncertainty is high, scientists can advise on feasible options and suggest feedback mechanisms to regularly assess the effectiveness of the policies and actions. In the second role, scientists are educators, improving scientific literacy and communication and building confidence in science. Scientists can educate, direct, guide, advise, challenge, and support actors in an effort to foster sound policy and to discourage or eliminate misperceptions, myths, prejudices, abuse, neglect, misunderstanding, and confusion.

GESAMP, in their publication, has detailed a role for science through five consecutive stages of an iterative, feedback-enhanced policy-making process for integrated coastal

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[64] GESAMP, "The Contributions of Science to Integrated Coastal Management," *GESAMP Reports and Studies* No. 61, 1996.

management.[65] GESAMP's five stages [66] are equally relevant to all environmental policy-making processes and they entail a two-fold role for science at each stage as follows:

Stage 1: Issue Identification and Assessment

In this initial stage, scientists should collect sufficient information to guide a multi-disciplinary team in subsequent stages of policy-making. Social and natural scientists and other relevant actors take the first step towards consilience, as economic, social (e.g., values and interests), and ecological information establishes a basis for goal- and priority-setting. This entails compiling, integrating, and prioritizing information to identify and assess ecological and social issues, and developmental, institutional, cultural, and other relevant contexts in which a policy must operate.[67]

Natural scientists must assume scientific and educational roles in roughly equal measure in this stage. They must identify and communicate the scientific priorities (e.g., ecological and research), trends, linkages, gaps in scientific knowledge and scientific uncertainty and the implications of their findings.[68] Their role as educators is fundamental to the initial stage, as

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[65] *Ibid.*, pp. 5-12 and 20-21. Also see L.C. Hempel, *Environmental Governance: The Global Challenge* (Washington D.C. and Covelo, California: Island Press, 1996), pp. 134-147. Further see Susskind, *supra* note 61, pp. 76-78, which identifies five roles for science, namely trend spotters, theory-builders, theory-testers, communicators, and policy analysts.

[66] See GESAMP, *ibid.*, pp. 5-12. Further, see Hempel, *ibid.*, for a very insightful discussion of each stage of the policy-making process, complete with pitfalls, constraints, and needs.

[67] GESAMP, *ibid.*, p. 5.

[68] *Ibid.*, p. 7.

it is here that misperceptions, prejudices, biases, and other types of misunderstanding foment.[69]

Stage 2: Planning and Programme Preparation

This organizational stage utilizes information from the assessment stage as a basis for consultation and planning a detailed operational strategy. Programme objectives, environmental quality objectives, and competing values must be concisely articulated.[70] The economic, ecological, and social costs of various options must be analysed and debated. The participation of diverse disciplines and the acknowledgment of the validity of diverse interests are fundamental at this stage.

The scientific role in this stage includes research, monitoring, identifying characteristics or conditions of concern, elaborating on natural and anthropocentric influences, and collecting and providing to other actors the necessary scientific information.[71] Co-operation among scientists and other actors to formulate specific questions for scientific investigation greatly enhances the probability of success.[72] Scientists can highlight alternative strategies and the ecological effectiveness of various options. By educating actors about the ecological priorities, scientists can work with other actors to tailor policy options that will provide sufficient environmental protection without undue economic or social costs.

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[69] *Ibid*., p. 21.

[70] *Ibid*., p. 7.

[71] *Ibid*., pp. 7-9.

[72] *Ibid*., p. 9.

Scientists should emphasize the need for scientific feedback mechanisms to indicate whether the stated environmental quality objectives are being met and to assess the level of environmental protection secured via the chosen options. Adaptive management strategies to revise policies accordingly should be determined by the relevant actors.

Stage 3: Adoption and Funding

This is a crucial stage as policy choices must be marketed to politicians (most often ministers, heads of agencies, or even the head of government), funding agencies, and the public.[73] A well-organized, explicit, scientifically sound, accurate proposal with a detailed and substantiated budget for each stage will attract interest and encourage constructive dialogue and debate. Regardless of how soundly science was applied at the initial stages, this stage presents the greatest risk of neglect or failure to incorporate sound science as this stage, more than any other, is one of negotiation, bargaining, and accommodation of interests across a broad array of actors.[74]

The primary role for scientists in this stage is to educate, identify, explain, and if necessary, defend the policies as scientifically sound and economically efficient.[75] As issues are debated, scientists need to clarify and advise on ecological repercussions of a range of actions, or inaction, ensuring that the scientific/ecological issues are understood and not overlooked in negotiations and that the ecological pros and cons of various policy options are understood.

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[73] *Ibid.*

[74] *Ibid.*

[75] *Ibid.*, p. 10. As nature's interpreters, scientists are the only actors competent to explain and clarify scientific aspects and ecological implications of management options.

Scientists must ensure that the best available scientific expertise is utilized and identify unsound proposals.[76] Negotiation and accommodation are legitimate and necessary, as society must set priorities, but the options must be grounded in sound science to maximize ecological effectiveness and wise use of scarce financial and other resources.

Stage 4: Implementation

Effective implementation is best attained through a pre-meditated implementation strategy. Facets of such a strategy may include controls, regulations, incentives, monitoring programmes, feedback mechanisms, enforcement mechanisms and institutional arrangements.[77] Issues to be addressed both before and during implementation include conflict resolution, inter-agency co-ordination, infrastructure development, public education, personnel training, and contemplation of new problems.[78]

The scientific role entails continuous assessment of policy performance, revision and adaptation of techniques, experimental designs, monitoring programmes, and related scientific endeavours.[79] Mechanisms are required to enhance communication between scientists and other actors and to incorporate scientific feedback into policy-making and implementation efforts.

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[76] See J.S. Gray, "Integrating Precautionary Scientific Methods into Decision-making," in D. Freestone and E. Hey, eds., *The Precautionary Principle in International Law: The Challenge of Implementation* (The Hague, London and Boston: Kluwer Law International, 1996), p. 146.

[77] GESAMP, *supra* note 64, p. 10.

[78] *Ibid*., p. 10.

[79] *Ibid.*

The scientist's role as educator and advisor is essential in this stage. As policies become operational, the involvement of additional actors increases the risk of poor utilization of scientific information, perpetuation of misperceptions and poor use of scarce resources.

Stage 5: Review/Evaluation and Adjustment/Adaptation

The evaluation of policy performance is the only way to measure the effectiveness of policies and actions. Paradoxically, this stage is the most frequently omitted or poorly addressed in environmental policy-making.[80] Pre-determined feedback mechanisms, assessments and periodic reviews are crucial to identifying new information, inefficiencies, ineffectiveness, over-effectiveness (which wastes scarce resources) and successes.

The review process should trigger a pre-determined revision process for adapting policies and actions to reflect the findings of the assessments and reviews. Embracing the cyclical nature of policy-making processes, the revision process should trigger a return to stage 1 (assessment), re-initiating the five-stage process to ensure policy revisions are regular, rational and sound.

These five stages proposed by GESAMP are consistent with consilience of science with other information and the "grand experiment" mindset embracing adaptive management.[81] Adopting the five-stage policy-making process will foster strategic and effective regime development. This is consistent with the current stage in the evolution of IEL.

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[80] *Ibid*. This stage is either omitted or superficially addressed in ICM, *ibid*. Likewise, multilateral environmental agreements and domestic policy often lack effective review mechanisms.

[81] *Ibid*. and Lee, *supra* note 22, pp. 51-86. Lee discusses in detail the strategy of "adaptive management".

Encouraging Consilience

Encouraging consilience, by definition, should improve the ecological effectiveness of environmental regimes. Consilience infers strategic planning utilising all relevant information and, in particular, science. Existing, but under-utilized options for encouraging consilience, include epistemic communities, post-normal science and the use of facilitators. Creative and lateral thinking can produce novel options, for example, in the form of instruments, tools, principles and actions. Various options are discussed below.

An environmental epistemic community is a network of individuals with expertise or competence in various domains or sectors, who, sharing a common outlook (e.g., ecological improvement), come together to influence policy-making processes.[82] Epistemic communities are most successful where they offer science-based, consensual knowledge on priority issues and sound measures.[83] Epistemic communities have successfully influenced policy in the Mediterranean RSP,[84] the 1987 Montreal Ozone Protocol,[85] the management regime for the

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[82] P.M. Haas, "Do Regimes Matter?: Epistemic Communities and Mediterranean Pollution Control," *International Organizations* 43 (1989): 377; P.M. Haas, ed., *Knowledge, Power, and International Policy Coordination, International Organizations* (Special Issue) 46 (1992); P.M. Haas, "Introduction: Epistemic Communities and International Policy Coordination," *International Organizations* (Special Issue) 46 (1992): 1; H. Breitmeier, "International Organizations and the Creation of Environmental Regimes," in Young, *supra* note 15, pp. 90-92; O.S. Stokke, "Regimes as Governance Systems," in Young, *supra* note 15, pp. 57-58; M. Valiante, P. Muldoon, and L. Botts, "Ecosystem Governance: Lessons from the Great Lakes," in Young, *supra* note 15, pp. 197-225; and Hempel, *supra* note 65, pp. 124-128.

[83] See generally, Haas, 1989, *ibid*.

[84] Haas, 1989 and 1992, *supra* note 82.

[85] Haas, 1989, *ibid.*, p. 402.

Great Lakes boundary waters between Canada and the United States,[86] and the Parliamentarians of the Arctic Region.[87]

"Post-normal science" is a rational methodology that draws on an extended peer community, traditionally comprises only scientists, to provide "extended facts" in situations where scientific uncertainty is high, the issues are complex, the ecological or health stakes are high, values are in dispute and policy decisions are urgent.[88]. The extended facts may include observations and experiences of relevant actors (e.g., birders, fishers, scuba divers, indigenous community, cottage industries, etc.).[89] Utilizing extended facts gathered from outside the traditional scientific community to confirm the accuracy and validity of scientific predictions, assumptions, and models and drawing on actors that have relevant information provides a rational, iterative and dynamic process to manage the various types of scientific uncertainty inherent in contemporary environmental issues.[90]

The use of facilitators at negotiations and meetings encourages consilience and overall effectiveness.[91] Facilitators are "specialized generalists" who have a critical understanding of

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[86] Valiante, et al., *supra* note 82, pp. 218 and 224-225.

[87] See Minister of Public Works and Government Services Canada, *Report of the Second Conference of Parliamentarians of the Arctic Region, Yellowknife, Northwest Territories, Canada, 13-14 March 1996* (Ottawa: Minister of Public Works and Government Services Canada, 1996).

[88] S.O. Funtowicz and J.R. Ravetz, "A New Scientific Methodology for Global Environmental Issues," in R. Costanza, ed., *Ecological Economics: The Science and Management of Sustainability* (New York: Columbia University Press, 1991), p. 139 and S.O. Funtowicz and J.R. Ravetz, "Uncertainty, Complexity and Post-normal Science," *Environmental Toxicology and Chemistry* 13 (1994): 1881.

[89] *Ibid*.

[90] Funtowitz and Ravetz, 1994, *ibid*., pp. 1883-1885 and Funtowitz and Ravetz, 1991, *ibid.*, pp. 148-150.

[91] See T. Justice and D.W. Jamieson, *The Facilitator's Handbook* (New York: American Management Association, 1999).

the most relevant disciplines and cross-disciplinary appreciation of the types of issues that derail co-operation and agreement. Their role in policy-making processes and regime-building are to facilitate communication, co-operation and problem-solving by rephrasing and explaining positions in terms understood by the actors. Facilitators act as both interpreters and psychologists to fathom misunderstandings and misperceptions, foster understanding and acceptance among actors and ensure meaningful inclusion of all relevant actors.

Creative and lateral thinking can produce unlimited novel options for encouraging consilience and improving ecological effectiveness. To this end, an international think tank mandated with rethinking current approaches and devising novel options and strategies would be welcome. An example of a novel diplomatic strategy could involve an international (or regional) declaration that shifts the focuses from *what to do* to *how to do it*.[92] Its primary theme should be strategies to improve regime effectiveness. Provisions can include improving science-literacy, infusing sound science into policy-making processes, promoting consilience, enumerating the lessons learned from the Regime Effectiveness Study,[93] and strategies such as adaptive management, epistemic communities, post-normal science and procedural improvements (such as including domestic policy implementers in regional policy-setting meetings and endorsement of policies by heads of state to increase credibility). This instrument could synthesize efforts in the current *ad hoc* quest for greater regime effectiveness and place environmental regime development on a strategic path forward.

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[92] See Lexmond, *supra* note 44, Chapter 5.

[93] Miles, et al., *supra* note 30.

CONCLUSION

The international environmental arena has evolved into a sophisticated array of environmental regimes comprising principles of IEL and LOS, instruments and related entities and actions. Likewise, the perception of environmental issues and the related mindset are evolving as actions ineffective at resolving environmental issues highlight the need for the laws of man to heed the laws of nature. The era of command and control is past and resolving environmental issues is increasingly accepted as an exercise in risk management—a grand experiment in policy-making.

This current stage of IEL is increasingly recognising that environmental regimes must be effective and dynamic—cycles of incremental knowledge-building and policy adaptation consistent with the long-term objective of ecological sustainability. There is growing emphasis on shifting to strategic means to improve ecological effectiveness and ensure that environmental actions become learning opportunities via feedback and review mechanisms.

The international environmental community is shifting in positive directions. It is hoped that the next step will be to acknowledge that the only avenue to ecological effectiveness is to embrace sound science and infuse it into policy-making processes to encourage the systematic collection and rational use of reliable information and highlight the most ecologically effective and economically efficient options available. Commensurate with this is the need to empower environmental actors to make, via improved levels of scientific literacy, effective choices. While other aspects of environmental regimes require attention, science and scientific literacy for non-actors are critical components as nature is governed by the immutable laws of science. The growing emphasis on strategy and effectiveness is leading the actors toward science, holding promise for ecologically effective environmental regimes embodying consilience and common sense.

Actors positioned to advance effective regime development should possess attributes that mirror those of the late Douglas M. Johnston, an individual who was the embodiment of consilience. These attributes include a diverse knowledge base, multi-disciplinary perspective, science-literate, creative and open-minded, in addition to being a good communicator (in particular, a good listener), problem solver, lateral thinker, visionary, and grounded in common sense.