

### In this review:

- A. Recent articles – no abstract available
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## A. Recent articles – no abstract available

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Harwood, J. **Is there a role for ecologists in an ecosystem approach to the management of marine resources?** *Aquatic Conservation: Marine and Freshwater Ecosystems* 17(1): 1-4, 2007.

Donner, S.D. and Potere, D. **The inequity of the global threat to coral reefs.** *BioScience* 57(3): 214-215, 2007.

Duarte, C.M., Marba, N., and Holmer, M. **Rapid domestication of marine species.** *Science* 316(5823): 382-383, 2007.

Karl, H.A., Susskind, L.E., and Wallace, K.H. **A dialogue not a diatribe - Effective integration of science and policy through joint fact finding.** *Environment* 49(1): 20-34, 2007.

Lebar, M. D., Heimbegner, J. L., and Baker, B. J. **Cold-water marine natural products.** *Natural Product Reports* 24(4): 774-797, 2007.

Rodriguez, J.P., Taber, A. B., Daszak, P., Sukumar, R., Valladares-Padua, C., Padua, S., Aguirre, L.F., Medellin, R.A., Acosta, M., Aguirre, A.A., Bonacic, C., Bordino, P., Bruschini, J., Buchori, D., Gonzalez, S., Mathew, T., Mendez, M., Mugica, L., Pacheco, L.F., Dobson, A.P., and Pearl, M. **Globalization of conservation: a view from the south.** *Science* 317(5839): 755-756, 2007.

## B. Recent articles with abstracts

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Eigenbrode, S.D., O'Rourke, M., Wulfhorst, J.D., Althoff, D.M., Goldberg, C.S., Merrill, K., Morse, W., Nielsen-Pincus, M., Stephens, J., Winowiecki, L., and Bosque-Perez, N.A. **Employing philosophical dialogue in collaborative science.** *BioScience* 57(1): 55-64, 2007.

**Notes:** Integrated research across disciplines is required to address many of the pressing environmental problems facing human societies. Often the integration involves disparate disciplines, including those in the biological sciences, and demands collaboration from problem formulation through hypothesis development, data analysis, interpretation, and application. Such projects raise conceptual and methodological challenges that are new to many researchers in the biological sciences and to their collaborators in other disciplines. In this article, we develop the theme that many of these challenges are fundamentally philosophical, a dimension that has been largely overlooked in the extensive literature on cross-disciplinary research and education. We present a "toolbox for philosophical dialogue," consisting of a set of questions for self-examination that cross-disciplinary collaborators can use to identify and address their philosophical disparities and commonalities. We provide a brief user's manual for this toolbox and evidence for its effectiveness in promoting successful integration across disciplines.

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Johnston, P., Everard, M., Santillo, D., and Robert, K.H. **Reclaiming the definition of sustainability.** *Environmental Science and Pollution Research* 14(1): 60-66, 2007.

**Notes:** *Background and Scope.* Since its inception two decades ago, the concept of sustainable development has suffered from a proliferation of definitions, such that it has increasingly come to mean many things to many different people. This has limited its credibility, called into question its practical application and the significance of associated achievements and, overall, limited the progress in environmental and social developments which it was designed to underpin. *Goal.* This viewpoint article is intended to re-open the concept of sustainable development for discussion 20 years on from the Brundtland Report, in the context of the current state of the world, our growing understanding of ecosystems and their response to stressors and the parallel increase in recognition of inherent limitations to that understanding. *Approach.* Following a brief review of the diverse manner in which the concept has developed over time, we present the case for application of a series of simple conditions for sustainability, originally developed by The Natural Step in the early 90s, which nevertheless still provide a sound basis on which progress towards sustainable development could be monitored. The paper also highlights the unavoidable links between sustainability and ethics, including those in the sensitive fields of population and quality of life. *Discussion.* Overall we argue the need for the concept of sustainable development to be reclaimed from the plethora of economically-focused or somewhat vague and un-measurable definitions which have found increasing favour in recent years and which all too often accompany relatively minor progress against 'business as usual'. *Recommendations and Perspectives.* The vision encapsulated in the Brundtland Report was ground-breaking. If, however, true sustainability in human interactions with the biosphere is to be realised, a far stronger and more empirical interpretation of the original intent is urgently required. To be effective, such an interpretation must encompass and guide developments in political instruments and public policy as well as corporate decision-making, and must focus increasingly on addressing the root causes of major threats to sustainability rather than just their consequences.

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Newman, D.J. and Cragg, G.M. **Natural products as sources of new drugs over the last 25 years.** *Journal of Natural Products* 70(3): 461-477, 2007.

**Notes:** This review is an updated and expanded version of two prior reviews that were published in this journal in 1997 and 2003. In the case of all approved agents the time frame has been extended to include the 25½ years from 01/1981 to 06/2006 for all diseases worldwide and from 1950 (earliest so far identified) to 06/2006 for all approved antitumor drugs worldwide. We have continued to utilize our secondary subdivision of a "natural product mimic" or "NM" to join the original primary divisions. From the data presented, the utility of natural products as sources of novel structures, but not necessarily the final drug entity, is still alive and well. Thus, in the area of cancer, over the time frame from around the 1940s to date, of the 155 small molecules, 73% are other than "S" (synthetic), with 47% actually being either natural products or directly derived therefrom. In other areas, the influence of natural product structures is quite marked, with, as expected from prior information, the anti-infective area being dependent on natural products and their structures. Although combinatorial chemistry techniques have succeeded as methods of optimizing structures and have, in fact, been used in the optimization of many recently approved agents, we are able to identify only one *de novo* combinatorial compound approved as a drug in this 25 plus year time frame. We wish to draw the attention of readers to the rapidly evolving recognition that a significant number of natural product drugs/leads are actually produced by microbes and/or microbial interactions with the "host from whence it was isolated", and therefore we consider that this area of natural product research should be expanded significantly.

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Haller, S.F. and Gerrie, J. **The role of science in public policy: Higher reason, or reason for hire?** *Journal of Agricultural and Environmental Ethics* 20(2): 139-165, 2007.

**Notes:** The traditional vision of the role science should play in policy making is of a two stage process of scientists first finding out the facts, and then policy makers making a decision about what to do about them. We argue that this two stage process is a fiction and that a distinction must be drawn between pure science and science in the service of public policy. When science is transferred into the policy realm, its claims to truth get undermined because we must abandon the open-ended nature of scientific inquiry. When we move from the sphere of science to the sphere of policy, we pick an arbitrary point in the open-ended scientific process, and ask our experts to give us the answer. The choice of the endpoint, however, must always be arbitrary and determined by non-scientific factors. Thus, the two stages in the model of first finding the facts, and then making a decision about what to do, cannot be clearly separated. The second stage clearly affects the first. This conclusion will have implications about existing scientific policy institutions. For example, we advocate that the environmental assessment process be radically overhauled, or perhaps even let go. It will be our position that ultimately a better model for the

involvement of scientists in public policy debates is that of being participants in particular interest groups ("hired guns"), rather than as supposedly unbiased consultants to decision-makers.

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Sagoff, M. **On the compatibility of a conservation ethic with biological science.** *Conservation Biology* 21(2): 337-345, 2007.

**Notes:** If value entails or implies purpose, it follows that natural objects (e.g., endangered species) lack value and thus cannot be worth protecting except for a purpose they may serve -- either the end for which God created the world (according to natural theology) or some use to which human beings may put them (according to a consequentialist or utilitarian ethic). If value requires purpose, the refutation of natural theology after Darwin implies that humanity has no obligation to respect or preserve the natural world except insofar as it is economically efficient to do so. Drawing on the distinction between explanation and communication found in Calvinist theology, I argue that value does not entail purpose. The expressive, aesthetic, or communicative aspects of nature may be valuable or endow natural objects with value apart from any use or purpose these objects may serve. The crucial distinction between explanation and communication -- one scientific, the other aesthetic -- offers a rationale for an obligation to protect the natural world that may appeal to members of faith communities and to biologists and other scientists. This approach also helps resolve the "lurking inconsistency" some scholars see in the relationship between a deterministic biological science and a conservationist ethic.

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Beaumont, N.J., Austen, M.C., Atkins, J.P., Burdon, D., Degraer, S., Dentinho, T.P., Deros, S., Holm, P., Horton, T., van Ierland, E., Marboe, A.H., Starkey, D.J., Townsend, M., and Zarzycki, T. **Identification, definition and quantification of goods and services provided by marine biodiversity: Implications for the ecosystem approach.** *Marine Pollution Bulletin* 54(3): 253-265, 2007.

**Notes:** This paper identifies and defines ecosystem goods and services provided by marine biodiversity. Case studies have been used to provide an insight into the practical issues associated with the assessment of marine ecosystem goods and services at specific locations. The aim of this research was to validate the definitions of goods and services, and to identify knowledge gaps and likely difficulties of quantifying the goods and services. A validated theoretical framework for the assessment of goods and services is detailed, and examples of the goods and services at a variety of case study areas are documented. These results will enable future assessments of marine ecosystem goods and services. It is concluded that the utilisation of this goods and services approach has the capacity to play a fundamental role in the Ecosystem Approach, by enabling the pressures and demands of society, the economy and the environment to be integrated into environmental management.

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Kravchenko, S. **The Aarhus Convention and innovations in compliance with multilateral environmental agreements.** *Colorado Journal of International Environmental Law and Policy* 18(1): 1-50, 2007.

**Notes:** In one remarkable international convention, individual citizens and their organizations have acquired formal tools for pushing nations toward compliance with the international commitments they have made. The Aarhus Convention is the first multinational environmental treaty or convention that focuses exclusively on obligations of nations to their citizens and nongovernmental organizations (NGOs). At the First Meetings of the Parties in October 2002, the Parties adopted a truly innovative mechanism to assess how well the parties comply with the convention to help enforce these obligations. This Mechanism goes beyond the steps taken under other international conventions and suggests the need for a new look at compliance mechanisms.

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Young, O.R., Osherenko, G., Ogden, J., Crowder, L.B., Ogden, J., Wilson, J.A., Day, J.C., Douvère, F., Ehler, C.N., McLeod, K.L., Halperin, B.S., and Peach, R. **Solving the crisis in ocean governance: Place-based management of marine ecosystems.** *Environment* 49(4): 20-32, 2007.

**Notes:** There is growing awareness that the escalating crisis in marine ecosystems - from biodiversity losses and transformed food webs to marine pollution and warming waters - is in large part a failure of governance. Problems arise from

fragmentation in the governance systems used to manage specific human uses of marine resources, together with spatial and temporal mismatches between biophysical systems and the rights, rules, and decision making procedures created to manage human interactions with these systems. A practical way to solve this problem features place-based management - a strategy that calls for integrated management of the full suite of human activities occurring in spatially demarcated areas identified through a procedure that takes into account biophysical, socioeconomic, and jurisdictional considerations.

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Harte, J. **Human population as a dynamic factor in environmental degradation.** *Population and Environment* 28(4-5): 223-236, 2007.

**Notes:** The environmental consequences of increasing human population size are dynamic and nonlinear, not passive and linear. The role of feedbacks, thresholds, and synergies in the interaction of population size and the environment are reviewed here, with examples drawn from climate change, acid deposition, land use, soil degradation, and other global and regional environmental issues. The widely-assumed notion that environmental degradation grows in proportion to population size, assuming fixed per capita consumption and fixed modes of production, is shown to be overly optimistic. In particular, feedbacks, thresholds, and synergies generally amplify risk, causing degradation to grow disproportionately faster than growth in population size.

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Mossop, J. **Protecting marine biodiversity on the continental shelf beyond 200 nautical miles.** *Ocean Development and International Law* 38(3): 283-304, 2007.

**Notes:** States are expending significant effort to chart the extent of their continental shelves where these extend beyond 200 nautical miles. As more is understood about marine biodiversity on the outer continental shelf, states may wish to regulate the use of biodiversity for the purposes of conservation or for future exploitation. This article identifies potential threats to marine biodiversity on the continental shelf, explores whether conservation is a legitimate purpose for exercising coastal state rights over the outer continental shelf under the Law of the Sea Convention, and considers the various legal rules that coastal states may use to protect marine biodiversity. The article concludes that the continental shelf regime is undesirably vague in some instances but that coastal states have a legal basis for taking action to regulate activities that impact the marine biodiversity of the outer continental shelf.

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Murawski, S.A. **Ten myths concerning ecosystem approaches to marine resource management.** *Marine Policy* 31(6): 681-690, 2007.

**Notes:** Ecosystem approaches to marine resource management (EAM) offer comprehensive decision making based on rationalization of currently fragmented ocean policies and their implementation. However, despite the apparent utility in addressing these problems, EAM has also been criticized as being nonspecific, immature, invalid as a basis for decision making, and not fully supported by science. While it is commonly perceived that a paradigm shift in governance and science institutions awaits implementation to address these criticisms, in fact, ecosystem considerations *are* being incorporated more frequently, employing existing authorities as the basis for mitigation of sectoral impacts and for resource allocation. Management 'best practices' for EAM are emerging based on these experiences. Ten common criticisms of EAM, which I believe to be myths propagated primarily to maintain the *status quo* among sectoral interests, are discussed. Accelerated evolution of EAM will occur as science better articulates feedbacks, cumulative ecological effects and economic consequences framing policy choices, and more formal "rules of engagement" among sectors (e.g., fishing, coastal development, water quality, and energy) are negotiated. These operating procedures would be established under informal arrangements, in national law, and by international agreement. The management paradigm for marine resources *is* shifting and EAM will eventually be considered redundant with established practice.

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Helm, R.C., Ford, R.G., and Carter, H.R. **The Oil Pollution Act of 1990 and natural resource damage assessment.** *Marine Ornithology* 34(2): 99-108, 2006 [PUBLISHED July 2007].

**Notes:** Before the March 1989 *Exxon Valdez* oil spill in Alaska, little attention was paid to the loss of seabirds from oil spills, and damage claims for injury to natural resources such as seabirds were rare. Since the *Exxon Valdez* spill and the subsequent passage of the *Oil Pollution Act of 1990* (OPA 90), the pursuit of damages for injury to natural resources has become an expected element of the overall cost of an oil spill. In the present paper, we discuss • how the enactment of OPA 90 appears to have affected the oil and marine transportation industries in the United States, especially along the west coast. • how, following the *Exxon Valdez* spill, natural resource damage (NRD) claims for injury to seabirds have become commonplace, but distinctly different when US west coast oil spills are compared with those on the US east and Gulf of Mexico (Gulf) coasts. • how beached birds have become central to estimating total seabird mortality caused by a spill. • our predictions concerning the future source of west coast vessel spills and the changing nature of NRD claims resolution nationwide.

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Liu, J.G., Dietz, T., Carpenter, S.R., Alberti, M., Folke, C., Moran, E., Pell, A.N., Deadman, P., Kratz, T., Lubchenco, J., Ostrom, E., Ouyang, Z., Provencher, W., Redman, C.L., Schneider, S. H., and Taylor, W.W. **Complexity of coupled human and natural systems.** *Science* 317(5844): 1513-1516, 2007.

**Notes:** Integrated studies of coupled human and natural systems reveal new and complex patterns and processes not evident when studied by social or natural scientists separately. Synthesis of six case studies from around the world shows that couplings between human and natural systems vary across space, time, and organizational units. They also exhibit nonlinear dynamics with thresholds, reciprocal feedback loops, time lags, resilience, heterogeneity, and surprises. Furthermore, past couplings have legacy effects on present conditions and future possibilities.

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Endresen, Ø., Sørgård, E., Behrens, H.L., Brett, P.O., and Isaksen, I.S.A. **A historical reconstruction of ships' fuel consumption and emissions.** *Journal of Geophysical Research* 112(12): art. D12301, 2007.

**Notes:** Shipping activity has increased considerably over the last century and currently represents a significant contribution to the global emissions of pollutants and greenhouse gases. Despite this, information about the historical development of fuel consumption and emissions is generally limited, with little data published pre-1950 and large deviations reported for estimates covering the last 3 decades. To better understand the historical development in ship emissions and the uncertainties associated with the estimates, we present fuel-based CO<sub>2</sub> and SO<sub>2</sub> emission inventories from 1925 up to 2002 and activity-based estimates from 1970 up to 2000. The global CO<sub>2</sub> emissions from ships in 1925 have been estimated to 229 Tg (CO<sub>2</sub>), growing to about 634 Tg (CO<sub>2</sub>) in 2002. The corresponding SO<sub>2</sub> emissions are about 2.5 Tg (SO<sub>2</sub>) and 8.5 Tg (SO<sub>2</sub>), respectively. Our activity-based estimates of fuel consumption from 1970 to 2000, covering all oceangoing civil ships above or equal to 100 gross tonnage (GT), are lower compared to previous activity-based studies. We have applied a more detailed model approach, which includes variation in the demand for sea transport, as well as operational and technological changes of the past. This study concludes that the main reason for the large deviations found in reported inventories is the applied number of days at sea. Moreover, our modeling indicates that the ship size and the degree of utilization of the fleet, combined with the shift to diesel engines, have been the major factors determining yearly fuel consumption. Interestingly, the model results from around 1973 suggest that the fleet growth is not necessarily followed by increased fuel consumption, as technical and operational characteristics have changed. Results from this study indicate that reported sales over the last 3 decades seems not to be significantly underreported as previous simplified activity-based studies have suggested. The results confirm our previously reported modeling estimates for year 2000. Previous activity-based studies have not considered ships less than 100 GT (e.g., today some 1.3 million fishing vessels), and we suggest that this fleet could account for an important part of the total fuel consumption (~10%).

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Dietz, T., Rosa, E.A., and York, R. **Driving the human ecological footprint.** *Frontiers in Ecology and Environment* 5(1): 13-18, 2007.

**Notes:** This comparative analysis shows that population size and affluence are the principal drivers of anthropogenic environmental stressors, while other widely postulated drivers (eg urbanization, economic structure, age distribution) have little effect. Similarly, increased education and life expectancy do not increase environmental stressors, suggesting that some aspects of human well-being can be improved with minimal environmental impact. Projecting to 2015, we suggest that increases in

population and affluence will likely expand human impact on the environment by over one-third. Countering these driving forces would require increases in the efficiency of resource use of about 2% per year.

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Lovett, G.M., Burns, D.A., Driscoll, C.T., Jenkins, J.C., Mitchell, M.J., Rustad, L., Shanley, J.B., Likens, G.E., and Hauber, R. **Who needs environmental monitoring?** *Frontiers in Ecology and Environment* 5(5): 253-260, 2007.

**Notes:** Environmental monitoring is often criticized as being unscientific, too expensive, and wasteful. While some monitoring studies do suffer from these problems, there are also many highly successful long-term monitoring programs that have provided important scientific advances and crucial information for environmental policy. Here, we discuss the characteristics of effective monitoring programs, and contend that monitoring should be considered a fundamental component of environmental science and policy. We urge scientists who develop monitoring programs to plan in advance to ensure high data quality, accessibility, and cost-effectiveness, and we urge government agencies and other funding institutions to make greater commitments to increasing the amount and long-term stability of funding for environmental monitoring programs.

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Barthelmie, R. **Wind energy: status and trends.** *Geography Compass* 1(3): 275-301, 2007.

**Notes:** Installed wind energy capacity has been increasing rapidly worldwide over the last 5 years and now exceeds 70 GW. Wind energy contributes up to 18.5% of electricity consumption in Denmark and about 3% in Europe. Wind energy is economically competitive at good wind sites, can be rapidly deployed compared to conventional sources and contributes to the goal of meeting increasing electricity demand while reducing emissions of greenhouse gases. This article discusses current wind energy technology and how it is being deployed, particularly in Europe. There are many factors involved in both the cost and the price of wind energy that are explained in brief. The status of wind energy in Europe, around the world and offshore are listed. Finally, some selected research areas such as wind speed profiles, climatic variations and wind turbine wakes are outlined, together with barriers to wind energy development.

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Meletis, Z.A. and Campbell, L.M. **Call it consumption! Re-conceptualizing ecotourism as consumption and consumptive.** *Geography Compass* 1(4): 850-870, 2007.

**Notes:** Labeling ecotourism as 'non-consumptive' and contrasting it with direct uses of wildlife through activities such as hunting is common practice among organizations and academics primarily concerned with conservation. We interrogate this binary opposition by questioning the assumptions underlying it, namely that 'the direct consumption of wildlife' (i) does not occur in ecotourism; (ii) is incompatible with ecotourism; (iii) is the primary concern; and (iv) is inferior to ecotourism as both a conservation and development strategy. Based on a review of the relevant theoretical and case-study based literature, as well as our own research, we argue that categorizing ecotourism as 'non-consumptive' is not only inaccurate, but also has consequences for both environments and people. We suggest ways in which ecotourism can be re-conceptualized in order to better achieve its goals of conserving both nature and culture, and of contributing to both conservation and development.

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Klak, T. **Sustainable ecotourism development in Central America and the Caribbean: Review of debates and conceptual reformulation.** *Geography Compass* 1(5): 1037-1057, 2007.

**Notes:** Tourism is one of the world's largest economic sectors. Ecotourism is its fastest growing component (United Nations World Tourism Organization 2007), and a promising strategy for sustainable development. Rural Central America and the Caribbean are in need of sustainable development and contain promising ecotourism sites. Despite their empirical importance and potential, tourism and ecotourism as research topics present several difficulties. This article surveys recent tourism and ecotourism scholarship and pays special attention to other recent literature reviews that contribute to that scholarship. It offers a three dimensional view of sustainable ecotourism development based on ecological integrity, economic viability, and social justice. Our common conception of ecotourism needs to broaden. It is typically presented as one of many distinct alternatives to mass tourism such as cultural, historical, and agro-tourism. It is more fruitful to view alternative tourisms as synergistic

components of a sustainable tourism ensemble. The article explores consequences of neglecting any of the three sustainability dimensions. It concludes by summarizing the article's contributions to the practice and analysis of sustainable ecotourism development.

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Fisher, B. and Christopher, T. **Poverty and biodiversity: Measuring the overlap of human poverty and the biodiversity hotspots.** *Ecological Economics* 62(1): 93-101, 2007.

**Notes:** In an effort to prioritize conservation efforts, scientists have developed the concept of biodiversity hotspots. Since most hotspots occur in countries where poverty is widespread, the success of conservation efforts depends upon the recognition that poverty can be a significant constraint on conservation, and at the same time conservation is an important component to the alleviation of long-term poverty. In this paper we present five key socioeconomic poverty indicators (access to water, undernourishment, potential population pressure, number living below poverty line and debt service) and integrate them with an ecologically based hotspots analysis in order to illustrate magnitude of the overlap between biological conservation and poverty. The analysis here suggests that the overlap between severe, multifaceted poverty and key areas of global biodiversity is great and needs to be acknowledged. Understanding the magnitude of overlap and interactions among poverty, conservation and macroeconomic processes is crucial for identifying illusive, yet possible, win-win solutions.

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Bohringer, C. and Jochem, P.E.P. **Measuring the immeasurable - A survey of sustainability indices.** *Ecological Economics* 63(1): 1-8, 2007.

**Notes:** Sustainability indices for countries provide a one-dimensional metric to valuate country specific information on the three dimensions of sustainable development: economic, environmental, and social conditions. At the policy level, they suggest an unambiguous yardstick against which a country's development can be measured and even a cross-country comparison can be performed. This article reviews the explanatory power of various sustainability indices applied in policy practice. We show that these indices fail to fulfill fundamental scientific requirements making them rather useless if not misleading with respect to policy advice.

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Rammel, C., Stagl, S., and Wilfing, H. **Managing complex adaptive systems - A co-evolutionary perspective on natural resource management.** *Ecological Economics* 63(1): 9-21, 2007.

**Notes:** The overexploitation of natural resources and the increasing number of social conflicts following from their unsustainable use point to a wide gap between the objectives of sustainability and current resource management practices. One of the reasons for the difficulties to close this gap is that for evolving complex systems like natural and socioeconomic systems, sustainability cannot be a static objective. Instead sustainable development is an open evolutionary process of improving the management of social-ecological systems, through better understanding and knowledge. Therefore, natural resource management systems need to be able to deal with different temporal, spatial and social scales, nested hierarchies, irreducible uncertainty, multidimensional interactions and emergent properties. The co-evolutionary perspective outlined in this paper serves as heuristic device to map the interactions settled in the networks between the resource base, social institutions and the behaviour of individual actors. For this purpose we draw on ideas from complex adaptive systems theory, evolutionary theory and evolutionary economics. Finally, we outline a research agenda for a co-evolutionary approach for natural resource management systems.

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Costanza, R. and Farley, J. **Ecological economics of coastal disasters: Introduction to the special issue.** *Ecological Economics* 63(2-3): 249-253, 2007.

**Notes:** Coastal disasters are increasing in frequency and magnitude-measured in terms of human lives lost, destroyed infrastructure, ecological damage and disrupted social networks. Hurricane Katrina and the Indian ocean tsunami illustrate the severe and widespread impacts of such disasters on human well-being. The proximate cause of most of these disasters is "forces of nature". However, human decisions, driven largely by economic forces, do much to aggravate these natural disasters

- for example, coastal mangroves and wetlands protect coastal communities from wave surges and winds, but are rapidly being converted for the production of market goods, and anthropogenic climate change driven by the energy use of our economy may exacerbate coastal disasters in several ways. The goal of economics should be to improve the sustainable well-being of humans. Our well-being is generated in part by the production of market goods and services, but also by the goods and services provided by nature, by social networks and norms, by knowledge and health - in short: built, natural, social and human capital, respectively. In seeking to increase human well-being solely, by maximizing the monetary value of market goods (built capital), our current economic system may be doing more to undermine our sustainable well-being than to improve it, a point made clear by the growing negative impacts of coastal disasters. An economic system should allocate available resources in a way that equitably and efficiently provides for the sustainable well-being of people by protecting and investing in all four types of capital. This is what ecological economics seeks to do. This article introduces ten papers that apply the four capital framework to the analysis of coastal disasters, seeking to understand their impacts and how to mitigate them, how to predict and plan for them, and how to use this information to redesign coastal areas in a more sustainable and desirable way.

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Martinez, M.L., Intralawan, A., Vazquez, G., Perez-Maqueo, O., Sutton, P., and Landgrave, R. **The coasts of our world: Ecological, economic and social importance.** *Ecological Economics* 63(2-3): 254-272, 2007.

**Notes:** We integrated the emerging information of the ecological, economic and social importance of the coasts at a global scale. We defined coastal regions to range from the continental shelf (to a depth of 200 m), the intertidal areas and adjacent land within 100 km of the coastline. We used the 1 km resolution Global Land Cover Characteristics Database and calculated the area covered by 11 different land cover classes (natural and human-altered ecosystems) within the 100 km limit [Burke, L., Kura, Y., Kasem, K., Revenga, C., Spalding, M., McAllister, D., 2001. Coastal Ecosystems. Washington DC World Resource Institute. 93 pp.]. Cover of aquatic ecosystems was calculated based on several world databases. Our results show that the coasts of the world comprise a wide variety of geomorphological characteristics of which mountainous coasts with a narrow shelf are the most abundant. Sandy shores are found on 16% of the coastal countries. The coasts are located in every weather regime and the number of biomes is equally variable. Within the 100 km limit, 72% still is covered by natural ecosystems and 28% have been altered by human activities (urban and croplands). Open shrubs and evergreen broadleaf forests are the most abundant terrestrial ecosystems. Canada has the largest area of natural and relatively well preserved terrestrial ecosystems. Indonesia and China have the largest percentages of cropland area near the shore, and Japan and the US have the largest coastal urban areas. Indonesia, Australia, Brazil, Bahamas and New Caledonia have the largest areas of aquatic ecosystems. The calculated economic value of goods and services provided by coastal ecosystems showed that altogether, coastal ecosystems contribute 77% of global ecosystem-services value calculated by Costanza *et al.* [Costanza, R., d'Arge, R., de Groot, R., Farber, S., Grasso, M., Hannon, B., Naeem, S., Limburg, K., Paruelo, J., O'Neill, R.V., Raskin, R., Sutton, P., van den Belt, M., 1997. The value of the world's ecosystem services and natural capital. *Nature* 387, 253-260]. According to 2003 data, 2.385 million people live within the coastal limit, which represents 41% of world global population. More than 50% of the coastal countries have from 80 to 100% of their total population within 100 km of the coastline. Twenty-one of the 33 world's megacities are found on the coast. Multivariate analyses grouped coastal countries according to their ecologic, economic and social characteristics. Three gradients explained 55% of the variance: degree of conservation, ecosystem service product and demographic trends. Given the current scenario and the climate change prediction, the coastal environments will be confronting serious environmental issues that should be worked in advance, in order to achieve a sustainable development of the most valued locations of the world. Several recommendations are made.

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Perez-Maqueo, O., Intralawan, A., and Martinez, M.L. **Coastal disasters from the perspective of ecological economics.** *Ecological Economics* 63(2-3): 273-284, 2007.

**Notes:** Natural hazards are recurrent events that frequently result in high death tolls and large economic losses. Because of their large impact, they have concerned the international community for a long time. In spite of the efforts, the impact of natural hazards has increased. Oftentimes, the role of natural ecosystems and the ecosystem services they provide to human societies are not considered in risk reduction programs. How relevant are ecosystems? What are the consequences of the depletion of natural ecosystems and the loss of ecosystem services provided by them? Would the alternative vision of ecological economics, in which development and economy are seen as the Whole - the ecosystem - (Daly, H.E. And Farley, J., 2004. *Ecological Economics: principles and applications*. Island Press, Washington, DC., 454 pp.), be helpful in reducing disaster risk? In this paper we are set to test whether a holistic approach from the perspective of ecological economics is

helpful to clarify and reduce the impact of natural hazards. We focused on hurricanes because they are the most frequently reported events of all natural disasters (Hewitt, K., 1997. *Regions of Risk*. Longman, Edinburgh Gate, 389 pp.). We analyze the relationship between the components of Human, Built, Social and Natural capitals with the damage caused by hurricanes in terms of mortality rate. We then generate a conceptual model to help envision the complexity of the system. A stepwise (back and forth steps) linear regression analysis revealed that mortality rate was significantly and positively affected by hurricane frequency ( $P < 0.01$ ) while area covered by semi-altered ecosystems (a mosaic of natural and human-altered ecosystems) ( $P < 0.01$ ) and GDP ( $P < 0.05$ ) negatively affected mortality rate ( $R^2 = 0.81$ ). The proportion of natural/altered ecosystems yielding the best protection results needs to be determined yet. Natural capital alone does not decrease number of deaths. Rather, its complex interactions with the other capitals and the many feedback loops that are involved need to be considered to achieve effective disaster risk reduction. No single capital is enough to reduce the impact and intensity of natural hazard. A balance between Human, Built, Social and Natural capitals and an increasing awareness of the consequences of different development decisions, will help human societies to *live with* rather than *cope with* coastal hazards.

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Bagstad, K.J., Stapleton, K., and D'Agostino, J.R. **Taxes, subsidies, and insurance as drivers of United States coastal development.** *Ecological Economics* 63(2-3): 285-298, 2007.

**Notes:** Ever-increasing coastal populations in the United States and worldwide are putting growing quantities of people and property at risk due to coastal disasters. At the same time, poorly-planned development policies and practices erode the natural capital of coastal regions, eliminating existing landscape protection from intense wind and waves. Government tax, subsidy, and insurance policies can encourage or discourage particular forms of development. In the U.S., there is no consistent set of incentives or disincentives for coastal development, and many programs have ambiguous or contradictory goals. Federal programs are highly fragmented, being administered by a variety of government agencies. State and local governments can also implement policies to improve coastal disaster protection, but often fail to do so. In other cases state and local policies designed for local economic growth work against the goals of federal policy, increasing flood damage risk while relying on federal aid once disaster does strike. These programs frequently lead to perverse subsidies, where economically inefficient policies degrade natural capital and foster economic inequality. In this study, we evaluate the existing tax, subsidy, and insurance structures that led to coastal development patterns on the U.S. Gulf Coast over the last sixty years, and propose alternative policies that could create a more sustainable, just, economically efficient, and storm-adaptive region.

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Gaddis, E.B., Miles, B., Morse, S., and Lewis, D. **Full-cost accounting of coastal disasters in the United States: Implications for planning and preparedness.** *Ecological Economics* 63(2-3): 307-318, 2007.

**Notes:** As coastal disasters become more frequent and costly, a full assessment of costs becomes more important. This paper aims to identify costs of coastal disasters to human, social, built and natural capital and their associated services at the local site of a disaster and in the regions and nations that respond for relief and recovery. The spatial and temporal magnitude and scale of costs is captured differently in typical cost accounting and a more comprehensive approach, full-cost accounting. The difference between these approaches will be demonstrated using Hurricane Katrina (2005) as a case study, though we do not attempt to perform a full-cost accounting of this actual event. We examine how disaster planning and preparedness becomes more cost effective when the full cost of disasters is calculated. A full-cost accounting of coastal disasters sets the stage for rigorous comparisons of strategies for post-disaster development. The rudimentary analysis of this paper indicates that continued population development as well as the maintenance of current settlements in particular regions along the coasts may not be in the national interest. In this way, full-cost accounting could help reduce vulnerability to future disasters.

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Duxbury, J. and Dickinson, S. **Principles for sustainable governance of the coastal zone: In the context of coastal disasters.** *Ecological Economics* 63(2-3): 319-330, 2007.

**Notes:** As increasing numbers of the global population gravitate toward the coasts, pressure mounts on ecosystems and the infrastructure at coastal locations. In the coastal zone many problems have arisen, including coastal population growth and degradation of natural capital, from the neglect of the four capitals that enhance sustainability: natural, built, social and human. New strategies need to be devised that will allow coastal communities to continue to live in these regions without further degrading natural capital. The Brundtland Report, which was further advanced at United Nations meetings in Stockholm

(1972) and Rio de Janeiro (1992), initiated the idea of sustainability. Following these meetings and the adoption of Agenda 21, concern about growing pressures on the oceans lead to an Independent World Commission on the Oceans (IWCO) workshop where a number of Principles for Sustainable Governance of the Oceans (Costanza, R., Andrade, F., *et al.*, 1998) were developed. In the light of recent coastal disasters such as the Indonesian Tsunami (2004) and Hurricanes Katrina and Rita (2005), this paper examines the current problems inherent in the coastal zone and attempts to develop new principles for sustainability using the IWCO derived principles as a springboard.

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Boyd, J. and Banzhaf, S. **What are ecosystem services? The need for standardized environmental accounting units.** *Ecological Economics* 63(2-3): 616-626, 2007.

**Notes:** This paper advocates consistently defined units of account to measure the contributions of nature to human welfare. We argue that such units have to date not been defined by environmental accounting advocates and that the term "ecosystem services" is too ad hoc to be of practical use in welfare accounting. We propose a definition, rooted in economic principles, of final ecosystem service units. A goal of these units is comparability with the definition of conventional goods and services found in GDP and the other national accounts. We illustrate our definition of ecological units of account with concrete examples. We also argue that these same units of account provide an architecture for environmental performance measurement by governments, conservancies, and environmental markets.

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