Economic Growth and Biodiversity Loss in an Age of Tradable Permits

JON ROSALES

Department of Environmental Studies, St. Lawrence University, 23 Romoda Drive, Canton, NY 13617, U.S.A., email jrosales@stlawu.edu

Abstract: *Tradable permits are increasingly becoming part of environmental policy and conservation programs. The efficacy of tradable permit schemes in addressing the root cause of environmental decline—economic growth—will not be achieved unless the schemes cap economic activity based on ecological thresholds. Lessons can be learned from the largest tradable permit scheme to date, emissions trading now being implemented with the Kyoto Protocol. The Kyoto Protocol caps neither greenhouse gas emissions at a level that will achieve climate stability nor economic growth. If patterned after the Kyoto Protocol, cap-and-trade schemes for conservation will not ameliorate biodiversity loss either because they will not address economic growth. In response to these failures to cap economic growth, professional organizations concerned about biodiversity conservation should release position statements on economic growth and ecological thresholds. The statements can then be used by policy makers to infuse these positions into the local, national, and international environmental science-policy process when these schemes are being developed. Infusing language into the science-policy process that calls for capping economic activity based on ecological thresholds represents sound conservation science. Most importantly, position statements have a greater potential to ameliorate biodiversity loss if they are created and released than if this information remains within professional organizations because there is the potential for these ideas to be enacted into law and policy.*

Key Words: cap and trade, emissions trading, Kyoto Protocol, science-policy process

Crecimiento Económico y Pérdida de Biodiversidad en Tiempos de Permisos Comerciables

Resumen: *Cada vez más, los permisos comerciables son parte de la política ambiental y de los programas de conservación. La eficacia de los esquemas de permisos comerciables para atender la causa principal de la declinación ambiental—crecimiento económico—será baja a menos que los esquemas limiten la actividad económica con base en umbrales ecológicos. Se pueden aprender lecciones del mayor esquema de permisos comerciables a la fecha, la comercialización de emisiones implementada con el Protocolo de Kyoto. El Protocolo de Kyoto no limita a las emisiones de gases a un nivel que logre la estabilidad climática ni al crecimiento económico. Si se sigue el modelo del Protocolo de Kyoto, los esquemas de límite y comercio tampoco reducirán las pérdidas de biodiversidad porque no considerarán al crecimiento económico. En respuesta a estas fallas para limitar el crecimiento económico, las organizaciones profesionales preocupadas por la conservación de la biodiversidad deberían emitir declaraciones sobre su posición respecto a umbrales ecológicos y de crecimiento económico. Las declaraciones luego pueden ser usadas por políticos para infundir estas posiciones en el proceso ciencia ambiental-política a nivel local, nacional e internacional cuando estos esquemas estén siendo desarrollados. La infusión de lenguaje que demanda la limitación de actividades de crecimiento económico con base en umbrales ecológicos es ciencia de la conservación sólida. Más notablemente, las declaraciones de posición tienen un mayor potencial para reducir las pérdidas de biodiversidad si son creadas y publicadas que si esta información permanece dentro de las organizaciones profesionales porque existe el potencial para que estas ideas se constituyan en leyes y políticas.*

Palabras Clave: comercio de emisiones, límite y comercio, proceso ciencia-política, Protocolo de Kyoto

Paper submitted July 1, 2005; revised manuscript accepted October 20, 2005.

Conservation Biology Volume 20, No. 4, 1042–1050

DOI: 10.1111/j.1523-1739.2006.00374.x

Introduction

The main cause of environmental decline is economic growth. Efforts to stem biodiversity loss will ultimately fail unless the flow of natural resources through the economy, from extraction to waste, is capped and diminished. The economy depends on the biosphere for the natural resources necessary for the production of goods and services. The economy also discharges waste into the biosphere. Economic growth occurs when natural resources are depleted and waste builds up in the biosphere. This material relationship between the economy and the biosphere has been well established for over 30 years (Georgescu-Roegen 1971; Meadows et al. 1972; Daly 1977). The physical properties of the economy cannot escape the laws of thermodynamics as economic growth successively contributes to higher entropy. Ecological properties are also affected by economic growth as human and natural economies compete for resources. Czech (2000:5) points out that economic growth has reached a scale that it can be considered the limiting factor for conservation. And yet, he continues, there is a "paucity of discussion in natural resource journals [on economic growth]. . . as if the topic were taboo."

The relationship between economic growth and climate change is also firmly established. Extrapolating from current economic, technological, and social trends, the Intergovernmental Panel on Climate Change (IPCC) forecasts a gross world product of US$235–550 trillion by the year 2100, up from $21 trillion in 1990. They also forecast greenhouse gas emissions increases of 1450 gigatonnes of carbon (GtC) over the same period (IPCC 2000). Although many work toward delinking greenhouse gas emissions and economic growth (e.g., Goldemberg 1997; UNDSD 2005), these efforts can never fully detach the economy from its material base. Humans require physical sustenance for survival. Fueled by ever-expanding per capita consumption and human population, economic growth will remain the primary source of increased greenhouse gas emissions. Increased activity in the agricultural, transportation, industry, and electricity generation sectors, no matter how efficient, will continue to emit greenhouse gases.

In reaction to the critical repercussions of this relationship between economic growth and the biosphere, tradable permit schemes are increasingly being developed to address environmental decline (OECD 2002). One tradable permit format in particular—cap and trade—holds the potential to address this root cause of environmental degradation by restricting an economic activity at a level that is ecologically sustainable. I assess this potential by critically examining the reasoning behind one such cap-and-trade scheme—emissions trading of greenhouse gases—being implemented through the Kyoto Protocol. I discuss essential criticisms of this landmark cap-and-trade scheme and question its effectiveness in resolving environmental decline and addressing economic growth. To draw attention to this ultimate cause of environmental decline, I call for a response from professional conservation organizations in the form of position statements on economic growth. Such position statements could be used to infuse sound conservation science regarding the relationship between economic growth and biodiversity loss into local, national, and international policy development and will thereby guide the formation of future tradable permit schemes.

Tradable Permits

With the implementation of the Kyoto Protocol, a line of reasoning has been globalized: the most effective way to manage environmental problems is to commodify organisms or natural processes and use the market to find least-cost ways of achieving environmental objectives. The Kyoto Protocol ushers in the largest tradable permit scheme ever conceived. Its cap-and-trade scheme for greenhouse gases takes its line of reasoning from neoclassical economics that monetary incentives will direct social action away from some deleterious behavior toward mitigation, abatement, or conservation. Framing environmental problems in such a manner stems from a position that public goods such as biodiversity are "not supplied in sufficient quantities by individuals acting in their self-interest" (Ferraro & Kiss 2002). Supporters of this line of reasoning maintain that "[m]echanisms are needed by which resource owners are rewarded for their role as stewards in providing biodiversity and ecosystem services" (Jenkins et al. 2004). According to this perspective, conservation is an exercise in properly aligning incentives, and solutions to environmental problems proceed from a price mechanism that changes people's behavior.

Incentive-based approaches to conservation are not an entirely new line of reasoning. Over 70 years ago, Leopold (1991, originally published 1934) called for such an approach to conservation:

> Conservation will ultimately boil down to rewarding the private landowner who conserves the public interest. It asserts the new premise that if he fails to do so, his neighbors must ultimately pay the bill. It pleads that our jurists and economists anticipate the need for workable vehicles to carry that reward.

Since then, tradable permits have been used in fisheries, wetlands, and energy conservation efforts and for over 25 years to mitigate air pollution. But tradable permit schemes in their current forms are carrying the market logic to previously untrammeled areas. Schemes are now being conceived for every conceivable environmental process from ecosystem services such as salinity control to landscape beauty (Jenkins et al. 2004).

This line of reasoning has also entered the discourse of the Society for Conservation Biology (SCB). At the annual meeting in 2003, for example, several tradable permit approaches to conservation were proposed by presenters. A tradable permit scheme that would commodify tree snags for Indiana bat conservation was presented, as was a scheme aimed at guiding global timber trade toward sustainable harvest. Additionally, the cover story of the Spring 2003 issue of *Conservation in Practice*, entitled "Making Conservation Profitable," touted forerunners in conservation who, among other things, promote tradable permits as an emerging form of environmental management (Ellison & Daily 2003).

Arguments for tradable permits have also entered the pages of *Conservation Biology*. Over a decade ago Rasker et al. (1992) called for the privatization of wildlife, "to transfer property rights from the public to private interests for the purpose of facilitating market transactions." They gently cast such market-based solutions to conservation as "innovative," asking us to "remain open-minded" on this issue that makes many feel uneasy. More recent entries into this journal have also addressed economic arguments for conservation including tradable permits (Shogren et al. 1999; Hughey et al. 2003). In an exchange of letters, several authors suggest that tradable permits represent a fundamental shift in how people value biological organisms and advocate that their potential for conservation be maximized (Stier & Siebert 2002, 2003; Bonnie & Schwartzmann 2003). And Young (2005) briefly describes tradable forestry rights in Brazil as a financial mechanism that can be used in countries with poor capacity for conservation. We are in an age of tradable permits. As conservation and ecological organizations are asked to consider the line of reasoning associated with tradable permits, and as this reasoning takes hold of the operations of international environmental governance through the Kyoto Protocol, a critical discussion within these organizations about the significance of adopting these mechanisms is fitting.

The Tradable Permit Line of Reasoning

Tradable permit schemes are often branded "as a cost-effective and flexible policy instrument for pollution control and natural resources management" (OECD 2002). Tradable permits are marketed as being more effective at getting the most conservation at the least cost, that is, achieving the environmental objectives set by the political process at lower costs than traditional command-and-control methods. In fact, rigid command-and-control methods are the alternative that businesses and many regulators are trying to avoid. Tradable permits are promoted as politically palatable because businesses are less likely to complain about environmental legislation when they can envision a way to comply if they do not meet their targets. In other words, it gives polluting and resource-depleting entities a mechanism through which they can continue their activities without being overburdened with regulation. Tradable permits can also create markets with tremendous profit potential. Under these lines of reasoning, tradable permit approaches to environmental conservation are increasingly put forward as strategies for environmental protection and management that satisfy everyone.

In their simplest form, three steps are involved in constructing tradable permit schemes: (1) set a cap, (2) allocate entitlements, and (3) allow trading. To set a cap, some level of mitigation, preservation, or human use of an environmental resource or amenity is negotiated within the policy process. Decision makers supposedly consider the economic, social, and ecological implications of the cap based on the amount of information at hand. Discrete units of mitigation or conservation, such as tons of carbon dioxide or hectares of forest, are derived. In allocation of entitlements, property rights to the units are assigned, that is, ownership of the units is determined. This normally requires converting an open-access commons into a publicly held commodity that is managed for private use. Entitlement, ownership, or payment is now required to use the commons. To allow trading, trade rules are developed to guide the market transactions of the new commodity. The units become a new commodity that can be bought, sold, or banked. Participants in the scheme that exceed their cap can buy units from other participants that have remained under their cap, hence they are called cap-and-trade systems.

Cap-and-Trade Scheme and the Kyoto Protocol

For the Kyoto Protocol, step 1 was developed through a process of political negotiation within the U.N. Framework Convention on Climate Change (UNFCCC). The UNFCCC parties agreed that "developed" countries, so-called Annex I countries because they appear in Annex I of the UNFCCC charter, would be required to cap their greenhouse gas emissions. If all Annex I parties ratify the protocol, the cumulative cap for these 39 countries would be 5.2% below 1990-level greenhouse gas emissions by the year 2010. The units of trade are carbon dioxide equivalents (CO_2e). Greenhouse gases and gas classes other than CO_2 included in the protocol (methane, nitrous oxide, sulfur hexafluoride, perfluorocarbons, and hydrofluorocarbons) are weighted against CO_2 based on their global warming potential to construct CO_2 equivalents. One unit equals one metric ton of CO_2e.

For step 2, parties to the UNFCCC decided that only countries that ratify the Kyoto Protocol are entitled to CO_2e units. Annex I countries can use the units against their greenhouse gas emission caps (with the exception of the United States, Australia, Croatia, and Monaco, who

have not ratified the Kyoto Protocol). Non-Annex I countries can generate CO_2e units through clean development projects to sell to Annex I countries. With the Kyoto Protocol's entry into force in early 2005, CO_2e certificates are a new commodity that can be bought, sold, or banked on the global marketplace. The U.N. authority legitimizes the new tender under the rules of the Kyoto Protocol and subsequent decisions.

For step 3 the parties to the UNFCCC developed trade rules for the Kyoto Protocol in 2001 called the Marrakech Accords. These highly detailed rules standardize accounting practices for each country and project to be applied toward Annex I caps. The Marrakech Accords established accounting procedures for greenhouse gas inventories, baseline calculations, and monitoring methodologies; included sinks as one of the possible mitigation strategies; and formalized most of the contentious issues related to the mechanisms of the protocol. The UNFCCC continues to meet and refine the trade rules.

These steps set up the Kyoto Protocol's three policy mechanisms. Two of the protocol's mechanisms are project based. Annex I parties can generate greenhouse gas reduction credits from offset projects that reduce emissions and sell the credits to other Annex I countries who can use them to comply with their cap. This mechanism is called joint implementation. Non-Annex I countries can engage in similar emission reduction projects and also sell the credits to Annex I countries. This mechanism is called the clean development mechanism. However, the most ambitious mechanism is emission trading. Emissions trading is a classic cap-and-trade policy mechanism. It allows Annex I countries to trade emission quotas. If a country emits less than its cap, it can sell those credits to other countries that can apply them toward their cap. The line of reasoning for all three mechanisms stems from neoclassical economics competitive advantage theory: greenhouse gas emissions reductions will take place where it is cheapest to do so, and through trade, all parties can take advantage of those cost differentials.

Emissions Trading Reasoning

The narratives used in policy processes are important to know in order to understand why certain ideas are included or excluded. To understand fully why the cap-and-trade line of reasoning was accepted and enacted within the UNFCCC, it is important to know what key actors said about climate change, note the way they framed the problem, and consider the policy options they proposed. Framing political issues strategically allowed for certain ideas to gain acceptance, or political currency, and support within the UNFCCC. When enough support was garnered, these ideas made it into the text of Kyoto Protocol and subsequent decisions.

One way to understand what these key actors said is to note how they describe the protocol. The sentences, fragments of sentences, or groups of sentences they use comprise a quick summary (or story line, Hajer 1995; Anderson 2001) of how each views the issue. Such messages can be used to frame an issue according to particular interests and used as a vehicle for political change.

In over 40 interviews with key actors within the UNFCCC involved with emissions trading, the overarching message was that the policy "is a means to achieve our environmental goals at the least cost" (Rosales 2004). This is the primary message about emissions trading that gained acceptance and political currency within the UNFCCC. There are two important dimensions to this dominant message. One is the environmental goal, which is analogous to the cap in step 1, and the other is the least-cost categorization. Both of these dimensions need to be assessed critically in order to adequately assess other such tradable permit schemes as they emerge.

Critiques of Cap-and-Trade Approaches to Conservation

Establishing an Environmental Goal and Allocating Allowances

The environmental goal referred to in the dominant message about emissions trading is the cap. In the case of the Kyoto Protocol, the cap was set at 5.2% below 1990 levels for Annex I countries. However, now that the United States is not participating, the World Resources Institute estimates the actual emissions reductions at 0.6% below 1990 levels (K. Baumert, personal communication). Meanwhile, the IPCC estimates that 60–80% reductions by 2030 are needed to stabilize CO_2 concentrations in the atmosphere at 1990 levels (IPCC 1990).

Herein lies a major fault with cap-and-trade approaches. The caps are determined through negotiation within the policy process. Although consensus on ecological, social, economic, and political factors are supposedly considered within this debate, there is no guarantee that they or ecologically significant caps will be imposed. Furthermore, there is no guarantee that some medium ground will be achieved between the parties. It is more likely that powerful interests will control the discourse and terms of the decisions made. Within the UNFCCC, the main powerbrokers, the European Union, the United States, and Japan, negotiated the cap. The Group of 77, or lesser-developed countries, was not even invited to the final informal meeting when the Kyoto Protocol cap was decided upon (Mwandosya 1996). Although each negotiation process for cap-and-trade schemes will be different, caps will always be negotiated. The most vested interests—those with the most to gain or lose—do the most lobbying.

Therefore, these schemes cannot be relied upon to automatically include caps that are ecologically sound. As with the Kyoto Protocol, the caps in greenhouse gas emissions may not even come close within the time frame needed.

Entitlement of the new commodity in tradable permit schemes is also determined through negotiation. Decisions have to be made as to who gets what amount. Allocation could be made on a per capita basis, or it could be allotted to biggest users as in the case of Annex I "developed" countries under the Kyoto Protocol. Entitlement of allowances could also be allotted to "underdeveloped" nations as recompense for past ecological debt. Those who are not granted entitlement to the new commodity, as is the case with non-Annex I countries under the Kyoto Protocol's emissions trading scheme, may choose not to participate in the new market. All these important decisions are highly contentious and have to be made before a new tradable permit market can be created.

Creating a market where there are no previous structures of private property requires the state to determine who can participate, who owns what, and who should be paid. Creating a market where demand is created, as opposed to recognizing demand, runs counter to traditional conceptions of consumer sovereignty, a foundation of neoclassical economics. Such a market does not represent buyers and sellers meeting freely to determine the market price. "Such a 'market' may be foisted in existence, much like the regulatory regime it is intended to obviate" (Czech 2003*b*).

Even if entitlements to the new commodity are distributed to all parties' satisfaction and the fabricated market accepted, in many tradable permit cases it is not clear exactly what is being bought and sold. Increasingly vague commodities are being created to fit the necessities of a market system. Disparate unique physical properties are put through a creative accounting iteration to remove their diverse properties that stand as obstacles to economic commercialization (Sachs 1999). For example, the Katoomba Group recently launched their Ecosystem Marketplace seeking "to become a one-stop-shop of timely and transparent information on the emerging markets and payment schemes for ecosystem services" (Katoomba Group 2005). Their marketplace includes various greenhouse-gas-trading markets such as the EU trading scheme and the Chicago Climate Exchange; wetland mitigation and salinity trades; and offset, easement, and direct-payment markets for biodiversity. It is hard to imagine what some of the commodities look like on the shelves of the Ecosystem Marketplace. What, for example, does a salinity ecosystem services product look like? These new commodities are derived from changes in a ledger. The CO_2e products, for example, are derived from reductions from a baseline calculation; they are the calculated difference in greenhouse gas emissions that would otherwise be emitted. In other words, CO_2e products are the absence of something. It is confounding to imagine such a product, such as buying weight loss. To be confident that you are buying a legitimate commodity in these new markets, the accounting will have to be irrefutable.

Yet, as conservation biologists know, the accounting of environmental amenities, processes, and organisms is largely unknown. Estimates of the total number of species living on the planet range from 4 to 100 million species (Miller 2004). Furthermore, within species it is exceedingly difficult to determine population size, and population size has to be qualified with population dynamics and community ecology. For climate change, an accurate accounting of the global carbon budget has not been completed (Woods Hole Research Center 2004), and the Kyoto Protocol does not even include the role of soils for carbon sequestration in all its policy mechanisms. Notwithstanding, these environmental values will have to be calculated continuously for market transactions to occur. In the case of climate change, Lohman (2001) explains that to properly determine the entitlements and value of the CO_2e units, complete knowledge is needed of all global carbon flows and a complete consensus must be reached on who is responsible for changes to those flows. He concludes that,

> Bad or unverifiable carbon credits are likely to jam the trading system. Cheating will be both encouraged and uncontrollable. Ultimately, the market is unlikely to survive. Far from being checked, climate change will be subsidized and exacerbated (p. 9).

Along with incentives to conserve, the marketplace includes other incentives such as fraud and profiteering that have to be recognized as being part of any tradable permit package.

An additional concern with allocating allowances is access to the new market. The emissions trading market, for example, largely comprises technocratic experts who possess the required knowledge and capital to take advantage of this new commodity. Calculating CO_2e credits requires technical expertise and is very expensive. Established global trade organizations such as Det Norske Veritas are becoming U.N.-certified carbon brokers, buying and selling CO_2e credits on the global market. These brokers, who already control international finance and commodity exchange, have been handed a windfall with the emerging $US30–100 billion carbon market (Conservation Finance Alliance 2005). This makes CO_2e yet another commodity for the conspicuous consumption of privileged classes. Emissions trading further concentrates power in this managerial class of experts and carbon entrepreneurs, benefiting those who are already the beneficiaries of globalization—economists, engineers, scientists, and industrialists. Underprivileged peoples and most individual consumers are not likely to participate in this market. Emissions trading further amplifies inequality trends by limiting access to this new market to

nation-states. Indigenous nations, for example, do not qualify as official actors within the United Nations because they are not nation-states. They can observe the proceedings but are not full participants in the UNFCCC. Thus constructed, emissions trading is a mechanism designed for the use of existing structures of power, expertise, and privilege.

Because tradable permit schemes make commodities out of natural processes and organisms that will be bought and sold by differing social actors, there is the propensity to accumulate ownership by those most able to participate in the new market. The trade function of tradable permit schemes innately sets up a system of unequal accumulation.

The Least-Cost Categorization

Most of the key actors involved with emissions trading under the Kyoto Protocol focused on its least-cost dimension. According to the proponents of emissions trading that were interviewed, cost efficiency is the *raison d'être* of emissions trading. This second dimension of their message also has some serious implications for the Kyoto Protocol's overall effectiveness to ameliorate climate change.

The least-cost line of reasoning is not only evident in climate-change policy, it is also an extension of fundamental tenets of modernity preached by neoclassical economists. In neoclassical economics, the obsession with cost efficiency is coupled with the myth of limitless production and consumption. Herein lies the problem. In a recent talk at the World Bank entitled "Sustainable Development: Definitions, Principles, Policies," Herman Daly noted that being frugal may make a person want to be more cost efficient, but being cost efficient does not make a person want to be more frugal; being cost efficient "makes frugality less necessary" (30 April 2002). In this regard, focusing on cost efficiency alone can distract us from diminishing consumption and giving us a false impression that we can continuously expand profligate consumption.

I do not argue that cost efficiency is misguided. Obviously, financial resources should not be wasted. What one does with the enhanced cost efficiency is another matter. By accepting tradable permit schemes on their least-cost grounds alone, meaningful activities and agreements that might actually address the main problem of economic growth are ignored. Care must be taken in accepting cap-and-trade approaches to conservation solely on their least-cost criteria. Cap-and-trade schemes with weak caps could enable the continuation of environmentally deleterious behavior especially when state regulations are dismantled to allow for the new program. In effect, such ill-designed programs could make it cheaper to pollute or deplete natural resources.

Professional organizations of conservationists and ecologists can disassociate themselves from these poorly conceived programs by promoting and supporting environmental policy that is based on sound conservation science. Members know "economic growth is the primary challenge to biodiversity conservation and ultimately to human economic sustainability" (Czech 2003*a*). They also know that consuming resources at any rate beyond the regenerative capacity of the planet, no matter how cost efficient that consumption, will not stem biodiversity loss. Therefore, such organizations must use their unique understanding of the impacts of economic growth on biodiversity and construct policy pronouncements based on members' shared values. Unless the cap is severe enough to constrain human activity within ecological thresholds, tradable permit schemes by themselves will not address the ultimate behavior that is the source of global climate change and biodiversity loss. Professional organizations can offer a voice that can steer policy discourses on tradable permits away from cost efficiency alone toward a focus on the cap.

Institutional Response

The emissions trading case is instructive for professional organizations that are working to abate ecological decline. As tradable permit schemes are negotiated, these organizations can contribute to the science-policy process in a way that reflects a particular organization's knowledge and interests. The organization can purposefully steer policy discourses by making recommendations that will affect social and environmental change. Conservation biologists should not approach the subject as if it were devoid of purpose (Daly 1999). Conservation biologists can add their observation of biological limits to growth to the environmental discourse. Conservation and ecological organizations can be the watchdogs of "the bounds of organic nature" (Sachs 1999) and the voice of a biologically constrained world. This can be their purpose in the science-policy process. To achieve this, organizations will have to become much more politically savvy (SCB 2005).

As tradable permit schemes to conservation are constructed, professional organizations can use their expertise to take a position on step 1 of these schemes, that is, on setting the cap. At a minimum, they should ensure that the cap is ecologically valid. Organizations can add their expertise about sustainable yields, ecological thresholds, viable population sizes, and best practices. Members of such organizations are well qualified to take positions on these issues and can interject recommendations into the science-policy process. This could be done on an ongoing basis as new cap-and-trade schemes are developed.

However, more fundamentally, professional organizations can also take a position on the ultimate cap, a cap

on economic growth. Although fiscal and monetary policy targeted at spurring economic growth may seem outside the realm of conservation biology, the impact of that legislation on biodiversity is well known. For this reason, the North American Section of SCB and the Wildlife Society have already issued position statements on economic growth. Such statements can be used to infuse new messages and new lines of reasoning into the policy process. Like having an influential article to cite, position statements can be used to justify arguments when policy is being negotiated. Policy makers often use talking points, developed by societies such as SCB, as they develop text for legislation, treaties, programs, or initiatives. Professional organizations could further infuse these talking points into policy text directly by lobbying in national and international arenas such as at the Convention on Biological Diversity and the UNFCCC. Because most conservation and ecology member organizations can provide "the highest quality scientific counsel, analysis, and recommendations" (SCB 2005), their recommendations will be of high repute and taken seriously.

Professional organizations concerned about conservation and ecology should develop strategic policy initiatives on economic growth because economic growth affects biodiversity on a global level. There is a need for scientific input to resolve the problem, namely, to determine ecologically significant limits. Position statements on economic growth could guide future statements on other issues as they arise. Organizations should collaborate on these efforts. The American Fisheries Society and Ecological Society of America are both considering position statements on economic growth. Most importantly, working on the main cause of biodiversity loss is the most promising way to have a catalytic effect on reducing the loss of biodiversity.

Addressing the economic growth problem will be exceedingly difficult. Society at large will not readily accept or pursue a nongrowing economy. The doctrine of growth-as-progress is rarely questioned (Rosales 2004). Lives and livelihoods are at stake. Powerful interests are entrenched and will not want to change. It may also be hard for members of organizations to decide on this issue and distill a single position. The position statements will have to be negotiated, but a good starting point are the following statements from policy adopted by the Wildlife Society and the North American chapter of SCB:

- "Economic growth is an increase in production and consumption of goods and services" (SCBNAS 2004; TWS 2004).
- The production and consumption of goods and services requires physical inputs from the natural environment that return to the environment as less useful waste.
- There are limits to economic growth. It is increasingly evident that economic growth continues at the expense of natural systems particularly now that we have overshot the carrying capacity of the planet (Meadows et al. 2004).
- Economic growth is the aggregate of unequal per capita production and consumption rates around the world. Not everyone contributes to economic growth equally and should not be held equally responsible. Underdeveloped nations should retain the right to develop while overdeveloped nations bear the responsibility to cut back consumption. Additionally, it should be recognized that economic growth often displaces otherwise sustainable livelihoods.
- "There is a fundamental conflict between economic growth and biodiversity conservation" (SCBNAS 2004). Economic growth is the primary driver of the main reason for biodiversity loss—habitat destruction. Economic growth also contributes to the other main causes of biodiversity loss, the introduction of exotic species through legal and illegal global commerce, and legal and illegal hunting and poaching. And, economic growth increasingly pollutes ecosystems, affecting their ability to sustain life.
- Humans can organize themselves to stay within the carrying capacity of the planet. Capping human activity below the carrying capacity of the planet is consistent with precepts of sustainability.
- "Technological progress has had many positive and negative ecological and economic effects and may not be depended upon to reconcile the conflict between economic growth and biodiversity conservation" (SCBNAS 2004).
- Conservation biology research should increasingly focus on determining the appropriate caps and thresholds to economic activity and contribute their findings to policy makers in a format that can be used for decision making.

Messages that reflect an organization's position can then be drawn by policy makers from the position statements and passed between them to gain political support. Such messages can succinctly reduce the complexity of an issue for policy makers, can help policy makers generate political support, and can ultimately be a source of social change. A few examples of the messages that could be derived from the recommendations above include economic growth is fueled by finite natural capital economic growth; increasingly occurs at the expense of plants, animals, and ecosystems and its benefits and costs are shared unequally; any tradable permit scheme is only as good as its cap; and conservation biologists know the biological limits to growth.

Conclusion

Professional conservation and ecology organizations can use the expertise of their members to construct a better

world. The one we have is not preordained. They can also use the abilities of their members to suggest other modes of social organization that, as preeminent science-studies scholar Donna Haraway (1994) recommends, "will make us swerve from the established disorder of finished, deadly worlds." The limits to economic growth have been known for a long time. The literature is now over 30 years old. Yet most of the discussion has remained in academic circles and has now been superceded by a sustainable-development framework for addressing the human and nature relationship. More conservationists need to convey the facts of growth limits to the general public and policy makers. Traditional efforts in working on improving conservation management, engaging in education campaigns, and conducting scientific inquiry should continue. But as tradable permit schemes come on line, they can, by design, set limits on human activity and economic growth. It is vital that the caps be ecologically sound. If policy makers are not informed and convinced of these thresholds, these schemes may actually contribute to increased biodiversity loss by augmenting economic activity. If this happens, economic growth will be checked in due course as natural capital stocks become more entropic. In other words, if climate change and biodiversity loss continue unabated, economic growth will be checked and disrupted as the physical base of the economy is impaired—a condition everyone wants to avoid.

Ecologically oriented professional organizations should also take care in embracing tradable permit schemes that do not equitably distribute entitlements and exclude underprivileged peoples. These organizations could inform policy debates with their expertise about biological limits and establish a reputation of being mindful of the social implications of biodiversity conservation.

Acknowledgments

I am very grateful to the anonymous reviewers for their careful analysis and to B. Czech for his willingness to advise and his insightful experience with this topic. I am also grateful to the editors, G. Meffe and D. Ehrenfeld, for their exceptional guidance, high professional standards, and openness to this subject. All the reviewers' comments were extremely helpful. I also thank M. Larson and E. Main for their excellent editing support.

Literature Cited

Anderson, J. L. 2001. Stone-age minds at work on 21st century science: how cognitive psychology can inform conservation biology. Conservation Biology in Practice **2:**20–27.

Bonnie, R., and S. Schwartzman. 2003. Tropical reforestation and deforestation and the Kyoto Protocol. Conservation Biology **17:**4.

Conservation Finance Alliance. 2005. Conservation finance guide. Conservation Finance Alliance, Washington, D.C. Available from http://guide.conservationfinance.org/chapter/index.cfm?Page=2 (accessed June 2005).

Czech, B. 2000. Economic growth as the limiting factor for wildlife conservation. Wildlife Society Bulletin **28:**4–15.

Czech, B. 2003*a*. Technological progress and biodiversity conservation: a dollar spent, a dollar burned. Conservation Biology **17:**1344–1357.

Czech, B. 2003*b*. Roll over, Adam Smith: the "new economy of nature" overlooks the origins of money. BioScience **53:**180–181.

Daly, H. E. 1977. Steady-state economics. W. H. Freeman and Company, San Francisco.

Daly, H. E. 1999. Editorial: the lurking inconsistency. Conservation Biology **13:**693–694.

Ellison, K., and G. C. Daily. 2003. Making conservation profitable. Conservation in Practice **4:**13–19.

Ferraro, P. J., and A. Kiss. 2002. Direct payments to conserve biodiversity. Science **298:**1718–1719.

Georgescu-Roegen, N. 1971. The entropy law and the economic process. Harvard University Press, Cambridge, Massachusetts.

Goldemberg, J. 1997. Leapfrogging strategies for developing countries. Pages 333–347 in Y. Kaya and K. Yokobori editors. Environment, energy, and economy: strategies for sustainability. U.N. University Press, Tokyo. Also available from http://www.unu.edu/unupress/unupbooks/uu17ee/uu17ee0m.htm#17.%20leapfrogging%20strategies%20for%20developing%20countries (accessed June 2005).

Hajer, M. A. 1995. The politics of environmental discourse: ecological modernization and the policy process. Oxford University Press, Oxford, United Kingdom.

Haraway, D. J. 1994. A game of cat's cradle: science studies, feminist theory, cultural studies. Configurations **1:**59–71.

Hughey, K. F. D., R. Cullen, and E. Moran. 2003. Integrating economics into priority setting and evaluation in conservation management. Conservation Biology **17:**93–103.

IPCC (Intergovernmental Panel on Climate Change). 2000. Emissions scenarios: summary for policymakers. IPCC, Geneva, Switzerland. Available from http://www.ipcc.ch/pub/sres-e.pdf (accessed June 2005).

IPCC (Intergovernmental Panel on Climate Change). 1990. First assessment report: scientific assessment of climate change—report of working group I. Cambridge University Press, Cambridge, United Kingdom.

Jenkins, M., S. J. Scherr, and M. Inbar. 2004. Markets for biodiversity services: potential roles and challenges. Environment **July/August:**32–42.

Katoomba Group. 2005. About ecosystem marketplace. Katoomba Group, Washington, D.C. Available from http://ecosystemmarketplace.net/index.php (accessed June 2005).

Leopold, A. 1991. Conservation economics. Pages 193–202 in S. L. Flader and J. B. Callicott, editors. The river of the mother of God and other essays by Aldo Leopold. University of Wisconsin Press, Madison.

Lohmann, L. 2001. Democracy or carbocracy? Intellectual corruption and the future of the climate debate. Briefing 24. The Corner House, Dorset, United Kingdom.

Meadows, D., D. L. Meadows, J. Randers, and W. W. Behrens III. 1972. The limits to growth: a report for the Club of Rome's project on the predicament of mankind. Universe Books, New York.

Meadows, D., J. Randers, and D. L. Meadows. 2004. The limits to growth: a thirty year update. Chelsea Green, White River Junction, Vermont.

Miller, G. T. 2004. Living in the environment: principles, connections, and solutions. Brooks/Cole, Pacific Grove, California.

Mwandosya, M. J. 1996. Survival emissions: a perspective from the South on global climate change negotiations. DUP Limited and The Centre for Energy, Environment, Science and Technology, Dar es Salaam, Tanzania.

OECD (Organisation for Economic Co-operation and Development).

2002. Implementing domestic tradable permits: recent developments and future challenges. OECD, Paris.

Rasker, R., M. V. Martin, and R. L. Johnson. 1992. Economics: theory versus practice in wildlife management. Conservation Biology **6:**338–349.

Rosales, J. 2004. The idea of social progress and emissions trading. Pages 135–163 in V. Grover, editor. Climate change: perspectives five years after Kyoto. Science Publishers, Enfield, New Hampshire.

Sachs, W. 1999. Planet dialectics: explorations in environment and development. Witwaterstrand University Press, Johannesburg.

SCB (Society for Conservation Biology). 2005. Enhancing the impact of conservation science: the Society for Conservation Biology's Strategic Plan 2006–2010 (9 September 2005). SCB, Arlington, Virginia. Available from http://www.conbio.org/SCB/Information/StrategicPlan/2006/(accessed October 2005).

SCBNAS (Society of Conservation Biology, North America Section). 2004. The steady state economy as a sustainable alternative to economic growth. SCB, Arlington, Virginia. Available from http://www.conbio.org/SCB/Activities/Sections/NAmerica/NASSCBPositionOnEconomicGrowth.cfm (accessed June 2005).

Shogren, J. F., et al. 1999. Why economics matters for endangered species protection. Conservation Biology **13:**1257–1261.

Stier, S. C., and S. F. Siebert. 2002. The Kyoto Protocol: an opportunity for biodiversity restoration forestry. Conservation Biology **16:**575.

Stier, S. C., and S. F. Siebert. 2003. Tropical reforestation and deforestation and the Kyoto Protocol. Conservation Biology **17:5**.

TWS (The Wildlife Society). 2004. Wildlife policy statement—economic growth. TWS, Bethesda, Maryland. Available from http://www.wildlife.org/policy/index.cfm?tname=policystatements&statement=ps35 (accessed June 2005).

UNDSD (U.N. Division of Sustainable Development). 2005. Energy use per unit of GDP. UNDSD, New York. Available from http://www.un.org/esa/sustdev/index.html (accessed June 2005).

Woods Hole Research Center. 2004. The missing carbon sink. Wood Hole Research Center, Wood Hole, Massachusetts. Available from http://www.whrc.org/carbon/missingc.htm (accessed August 2005).

Young, C. E. F. 2005. Financial mechanisms for conservation in Brazil. Conservation Biology **19:**756–761.