Conservation Biology

Conservation Focus: *Priorities for Policy-Relevant Conservation Research: a View from SCB Regional Sections*

Priorities for Improving the Scientific Foundation of Conservation Policy in North America

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Abstract: *The Society for Conservation Biology (SCB) can enhance conservation of biodiversity in North America by increasing its engagement in public policy. Toward this end, the North America Section of SCB is establishing partnerships with other professional organizations in order to speak more powerfully to decision makers and taking other actions—such as increasing interaction with chapters—geared to engage members more substantively in science-policy issues. Additionally, the section is developing a North American Biodiversity Blueprint, which spans the continental United States and Canada and is informed by natural and social science. This blueprint is intended to clarify the policy challenges for protecting continental biodiversity, to foster bilateral collaboration to resolve common problems, and to suggest rational alternative policies and practices that are more likely than current practices to sustain North America's natural heritage. Conservation scientists and practitioners can play a key role by drawing policy makers' attention to ultimate, as well as proximate, causes of biodiversity decline and to the ecological and economic consequences of not addressing these threats.*

Keywords: biodiversity blueprint, conservation policy, North American conservation, science-policy issues

Prioridades para el Mejoramiento de la Ciencia de la Conservación

Resumen: *La Sociedad para la Biología de la Conservación (SBC) puede mejorar la conservación de la biodiversidad en Norte América mediante el incremento de su compromiso en las políticas públicas. En ese sentido, la sección Norte América de SBC está estableciendo sociedades con otras organizaciones profesionales a fin de hablar más potentemente con tomadores de decisiones entre otras acciones—como incrementar la interacción con capítulos—enfocadas a comprometer a los miembros en temas ciencia-política. Adicionalmente, la sección está desarrollando un Anteproyecto de Biodiversidad de Norte América, que abarca Estados Unidos y Canadá y está basado en ciencia natural y social. Este anteproyecto tiene la intención de clarificar los retos para la protección de la biodiversidad continental, fomentar la cooperación bilateral para resolver problemas comunes y para sugerir políticas y prácticas racionales alternativas para sustentar el patrimonio natural de Norte América. Los científicos y practicantes de la conservación pueden jugar un papel*

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clave atrayendo la atención de los políticos hacia las causas últimas, así como las proximales, de la declinación de la biodiversidad y hacia las consecuencias ecológicas y económicas de no atender estas amenazas.

Palabras Clave: anteproyecto de biodiversidad, conservación en Norte América, políticas de conservación, temas de ciencia y política

Introduction

The Society for Conservation Biology (SCB) is a global community of conservation professionals. The SCB's subgroups include regional sections, which address issues at continental or subcontinental levels; chapters, which address issues at finer geographic resolution; and working groups, which address thematic issues (e.g., freshwater). Conservation challenges span spatial, temporal, and disciplinary scales, and SCB's network of professionals is well positioned to inform policy with science and to engage with policy makers in a variety of ways. In 2007 SCB established a policy office with an emphasis on North America, further increasing the ability of SCB to inform debates about conservation policy in the United States (for additional details, see http://www.conbio.org/resources/policy; http://www.conbio.org/Sections/NAmerica/NAPolicy.CFM). The North American Section of SCB, in particular, can contribute much more to conservation policy across North America by building our capacity to inform decision making and by preparing a blueprint to guide the development of future policies affecting biodiversity. By so doing, we will solidify our role as one of the most dependable sources of information on conservation science and its application on the continent. Here we offer suggestions for how SCB's North America Section can achieve these objectives in the face of human population growth, globalizing economic development, and escalating climate change.

North America—What's at Stake

North America has a long history of conservation legislation and policy (Table 1), but its biodiversity is no less threatened than in other regions of the world. For example, hotspots of richness and endemism for several taxa occur in the United States, and temperate ecosystems here and worldwide generally have suffered greater conversion to anthropogenic land uses and are less well protected than other biomes (Noss et al. 1995; Stein et al. 2000; Hoekstra et al. 2005). There are many factors influencing biotic declines, not the least of which is failure to integrate conservation science and policy in a timely manner, but also inattention of policy makers and the public to the ultimate drivers of biodiversity loss, especially a large and growing human population coupled with high rates of consumption.

The SCB defines North America as Canada, Greenland, and the continental United States (Mexico chose to align with SCB's Austral and Neotropical America Section). Greenland, the world's largest island, is a self-governing territory of the Kingdom of Denmark. More than 80% of the island is covered by ice. Recent studies show accelerated melting of the Greenland ice sheet, which releases significant quantities of water and reduces surface albedo. This melting is likely to make a major contribution to the rise in global mean sea level, perhaps on the order of several meters, within the relatively near future (Dowdeswell 2006; Kerr 2006; Overpeck et al. 2006). Although we acknowledge the significance of Greenland to ecosystem integrity globally, in this paper we concentrate on continental North America. Policy activities of greatest relevance to Greenland, such as climate change and international treaties, generally are addressed by SCB at the global level rather than at the level of the North America Section.

Canada and the continental United States occupy about 4% of Earth's land surface (Table 2; see references therein). In terms of area, Canada and the United States are the second and third largest countries in the world, respectively (see http://www.aneki.com/largest.html). Their combined human population of 335 million represents approximately 5% of the world's population. Much of North America, especially mountain and desert regions and northern Canada, has a low density of human settlement. More than 80% of the continental population is located in cities (UNFPA 2007; Grimm et al. 2008).

Approximately 13% of the world's known species are native to continental North America (Table 2). These species are distributed across a wide variety of ecoregions, from arctic to tropical (Ricketts et al. 1999). Species richness and diversity of land cover are enhanced by the continent's extensive latitudinal and longitudinal gradients and high topographic heterogeneity. Major ecosystems include hot and cold deserts; prairies and other grasslands; temperate and subtropical rain forests; hardwood, coniferous, and boreal forests; and tundra. Temperate ecosystems—especially grasslands, savannas, and shrublands—are the most imperiled terrestrial ecosystems worldwide because the temperate zone has been most extensively settled and cultivated (Noss et al. 1995; Hoekstra et al. 2005). North America has widespread freshwater systems, including extensive subterranean aquifers and several million lakes and rivers. Many of these freshwater ecoregions are considered

Table 1. Subset of the laws and policies affecting biological diversity in Canada and the continental United States.

*Policy**	*Year*	*Region*
Fisheries Act	1868	Canada
United States Commission on Fish and Fisheries	1871	United States
Yellowstone National Park	1872	United States
Banff National Park	1885	Canada
Forest Reserve Act	1891	United States
Dominion Forest Reserves Act	1906	Canada
Boundary Waters Treaty, International Joint Commission	1909	North America
Migratory Birds Convention	1916	North America
Water Pollution Control Act	1948	United States
Clean Air Act	1963	United States
Wilderness Act	1964	United States
Wild and Scenic Rivers Act	1968	United States
National Environmental Policy Act	1969	United States
Canada Water Act	1970	Canada
Great Lakes Water Quality Agreement	1972	North America
Marine Mammal Protection Act	1972	United States
National Marine Sanctuaries Act	1972	United States
Canada Wildlife Act	1973	Canada
Endangered Species Act	1973	United States
Ratification of CITES	1974	United States
Ratification of CITES	1975	Canada
National Forest Management Act	1976	United States
Magnuson Fishery Conservation Act	1976	United States
27 UNESCO biosphere reserves	1976	United States
Clean Water Act	1977	United States
UNESCO Biosphere Reserve	1978	Canada
Ratification - Convention on Wetlands	1981	Canada
Coastal Fisheries Protection Act	1985	Canada
Ratification - Convention on Wetlands	1987	United States
Canada Forestry Act	1989	Canada
Air Quality Agreement	1991	North America
Wild Animal and Plant Trade Act	1992	Canada
Ratification - Convention on Biological Diversity	1992	Canada
CEC Agreement on Environmental Cooperation	1993	North America
Migratory Birds Convention Act	1994	Canada
Canada's Biodiversity Strategy	1995	Canada
Oceans Act	1996	Canada
Sustainable Fisheries Act	1996	United States
Canadian Environmental Protection Act	1999	Canada
Canada National Parks Act	2000	Canada
Species at Risk Act	2002	Canada
Canada National Marine Conservation Areas Act	2002	Canada
Ratification - Kyoto Protocol	2002	Canada
CEC Strategic Plan for the Conservation of Biodiversity	2003	North America
Alien Invasive Species Strategy for Canada	2004	Canada
National Strategy for Invasive Species Management	2004	United States

**Abbreviations: CITES, Convention on International Trade in Endangered Species; UNESCO; United Nations Educational, Scientific and Cultural Organization; CEC, North American Commission on Environmental Cooperation.*

biologically distinctive on a global scale (Abell et al. 2000). The five Great Lakes, which straddle the United States and Canada, hold 22% of the world's surface freshwater (Grady 2007). North America also has globally significant species richness and endemism. Some regions of the continent are centers of diversity for several taxonomic groups, especially aquatic invertebrates (Stein et al. 2000). North America also is rich in population-level diversity, in part because of continuing post-Pleistocene colonization dynamics at northern latitudes (e.g., Fraser & Bernatchez 2005). The continent is surrounded by three oceans, the Pacific, Atlantic, and Arctic, which represent semitropical to polar seas. The Grand Banks and Bering Sea are among the most productive fisheries in the world (Abell et al. 2000). Conservation of North America's biodiversity is thus not a parochial matter; rather, it is a globally consequential and meaningful goal for SCB as a global organization.

Table 2. Some variables relevant to biological diversity in North America.[a]

Variable	*World statistic*	*Source[b]*	*Year*	*Canada*	*USA*	*North America*	*Outside North America*
Area							
total (million km^2)	510	1	2008	10	9.6	19.6	490.4
land (million km^2)	130.1	1	2008	9.1	9.2	18.3	112
protected (%)	3.1	1,2	2005	9	25	16.8	2.6
Human population							
total (million individuals)	6,600	3,4	2007	33	302	335	6,265
growth rate (%)	1.24	1	00–05	1.01	1.03	1.02	–
net migration rate[c]	0	1	00–05	6.6	4.4	4.7	0.3
migrant population (% of total population)	3.00	5	2005	18.9	12.9	13.5	–
urban population (% of total population)	50	6	2007	80	81	81	–
Consumption							
agricultural area (% of land area)	38.1	7	2005	7.4	45.3	26.4	40.1
water consumption (m^3/individual/year)	800	8,9	2005	1420	1730	1700	–
ecological footprint (global ha/person)	2.2	10	2003	7.6	9.6	9.4	–
carbon emissions from energy use (%)	100	8	2005	2	21	23	77
Biodiversity (known)							
native species (millions)	1.8	11,12,13	2008	0.07	0.1	0.13[d]	1.57
ESA/SARA listed species (%)[e]	–	14,15	2008	0.5	0.9	0.8[f]	–
species at risk of extinction/extirpation (%)[g]	–	16	2008	3.2	11.6	10.0	–
species at risk of extinction (%)[g]	≤39	16,17	2008	1.4	10.6	8.3	–
threatened vertebrates (%)[b,i]	22.8[j]	16,17	2008	17.0	28.6	30.1	–
threatened vascular plants (%)[b,i]	70.3[j]	16,17	2008	20.2	28.6	31.9	–
extinct native species (%)[k]	0.05	16,17	2008	0.01	0.1	0.1	–
exotic invasive species (%)	0.05	18	2008	0.3	0.2	0.2	–

[a] *Includes Canada and the continental United States. Data are approximate and are at the level of 'species' (not at the population level).*
[b] *Source key: 1, UNSD 2008; 2, IUCN WCPA 2007; 3, USCB 2007; 4, StatCan 2007; 5 UNFPA 2006; 6, UNFPA 2007; 7, FAO 2005; 8, OECD 2008; 9, Holdren 2008; 10, GFN 2006; 11, Eisner et al 1995; 12, CESCC 2006; 13, Groom 2006; 14, USFWS 2008; 15, SARA 2008; 16, NatureServe 2008; 17, IUCN 2007; 18, ISSG 2008.*
[c] *Net migration rate, immigration-emigration/1000 people/year.*
[d] *Estimate using NatureServe proportions for overlap.*
[e] *Abbreviations: ESA, Endangered Species Act (USA); SARA, Species at Risk Act (Canada).*
[f] *Species listed in both Canada and the United States (12%) are not counted twice.*
[g] *NatureServe data for globally critically imperiled (G1), imperiled (G2), and vulnerable (G3) native species.*
[b] *NatureServe data for nationally or globally critically imperiled (G1, N1), imperiled (G2, N2), and vulnerable (G3, N3) native species.*
[i] *International Union for Conservation of Nature data for critically endangered, endangered, or vulnerable.*
[j] *Expressed as a proportion of number of species evaluated.*
[k] *Presumed extinct (GX, NatureServe) or extinct (EX, International Union for Conservation of Nature).*

North American Conservation Policy—Successes and Challenges

North American biodiversity policies have been successful mainly in slowing the loss of continental biodiversity; however, they have failed to stop the loss or lessen our impact on global biodiversity. The ultimate threat to biodiversity is resource consumption fueled by growth of human populations and economies. The rate of population growth in the United States, particularly from immigration, is high compared with most other developed nations (Harden 2006). The annual growth rate (1.02% per year [2000–2005 data] compared with 1.24% globally; Table 2) will increase the North American population by 50% by 2045, compared with a global increase of 50% by 2038 (UNSD 2005). Inevitably associated with this growth is the conversion of natural landscapes to agricultural, urban, and other uses that are often at odds with biodiversity conservation. Indeed, the rate of land consumption for development—primarily urban sprawl—in the United States is twice the rate of population growth (Flint 2006).

Changes in policy related to human population growth and consumption potentially can reduce losses of biodiversity, yet the governments of the United States and Canada largely have failed to address the root causes of biodiversity loss. Nevertheless, North American governments have at times been global leaders in land conservation. They created the world's first national parks, Yellowstone (1872, United States) and Banff (1885,

Canada), drafted extensive legislation to maintain wild areas (e.g., U.S. Wilderness Act of 1964, Canadian Wildlife Act of 1985); and passed laws to protect biodiversity at the species level (U.S. Endangered Species Act of 1973, Canadian Species at Risk Act 2003). Indeed, the U.S. Endangered Species Act is generally considered one of the strongest environmental laws in the world; hence, it has received much resistance over its implementation (Stokstad 2005). Dozens of legislative acts to conserve biodiversity and many strategies, plans, international conventions, and bilateral agreements have been enacted, ratified, or adopted at national levels in Canada and the United States (Table 1). Additional statutes and programs exist at the level of states, provinces, territories, and cities. In the United States, private land conservation has been encouraged by the state and federal governments through financial incentives and partnerships with nongovernmental organizations.

This extensive web of legislation, built over a 140-year period, is an impressive legacy, yet biodiversity continues to decline (CEC 2002). For the United States, where the conservation status of species is better documented than in Canada, approximately one-third of native species are considered critically imperiled, imperiled, or vulnerable globally (Stein et al. 2000). Preliminary monitoring in Canada has shown that only 70% of species within its borders can be considered "secure" (Environment Canada 2006). The leading proximate threats to biodiversity in North America, as elsewhere, are losses and declines in quality of species' habitats (Groom 2006), and these threats are exacerbated by climate change, pollution, overharvesting, and invasions of non-native species, among other factors (Venter et al. 2006). The proportion of North American species that are non-native invasives is greater than the known global proportion (Table 2), and such species are a leading threat to native biodiversity in many regions (Lodge et al. 2006).

Largely due to its high rate of resource consumption, North America contributes disproportionately to biodiversity loss on a global scale. We are, on average, wealthier than other continents. The share of global gross domestic product (GDP) adjusted for purchasing power parity for the United States is 22.61% and for Canada is 2.06% (total: 24.57%) (World Bank 2005). Because energy use tends to increase with wealth (Chow et al. 2003), our energy consumption dramatically outpaces other population groups on a per capita basis (Fig. 1). A useful index of consumption is the ecological footprint—the global biological capacity (capacity of a given area to generate an ongoing supply of renewable resources and to absorb its spillover wastes) directed towards supporting each person each year (Fig. 2; Wackernagel & Rees 1996; GFN 2006; GreenFacts http://www.greenfacts.org/glossary/abc/biocapacity.htm).
The North American footprint currently exceeds 9 global ha/person, four times the world average (Table 2).

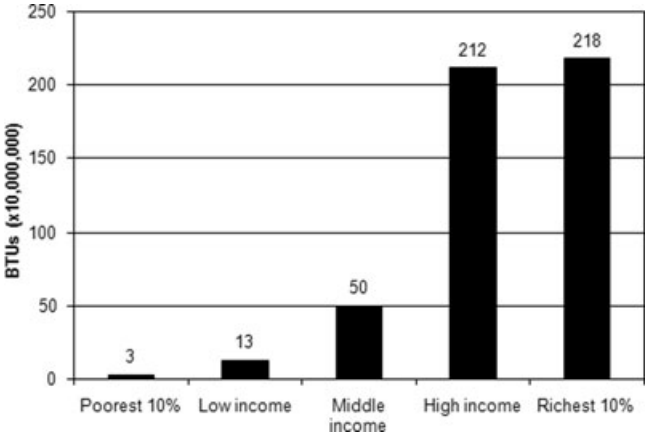

Figure 1. Aggregate per capita energy consumption of countries by income level (Chow et al. 2003). The United States and Canada are among the richest 10% of countries.

The North American use of biological capacity is at the expense of natural landscapes and native species globally because we import so much food and energy. The United States exceeded its biological capacity by 1970 and Canada is rapidly approaching its own capacity (Fig. 2). The continuing increase in the North American footprint is possible only through the importation of food and energy from other continents. Still, policies in North America fail to address the ultimate stressors to biodiversity—population size and consumption. Moreover, the North American economic model (if such a model truly exists) does not incorporate the benefits of natural capital and the costs of its loss (Hawken 1993). Rather, the economic model and related measures such as GDP treat biodiversity and ecosystem functions largely as externalities.

North America's disproportionate contribution to climate change also affects global biodiversity. Whereas North America accounts for roughly 5% of the world's population, it produces roughly 23% of the world's greenhouse gas emissions (Baumert & Pershing 2004). The carbon footprint of our economic activity has been decreasing in the United States by about 14% per decade and in Canada by about 8%; however, growth in our per capita income and our ability to consume has been growing at about 22% per decade, vastly outstripping efficiency gains (Baumert & Pershing 2004).

Policies that specifically address the consequences of human population growth and consumption could significantly reduce losses of biodiversity in North America and globally. Powerful economic arguments, however, such as the creation of short-term jobs through construction of (often unnecessary) housing, strip malls, and energy-inefficient automobiles, drive policies that foster declines in environmental quality for humans and other species. For the North American Section of SCB to become an

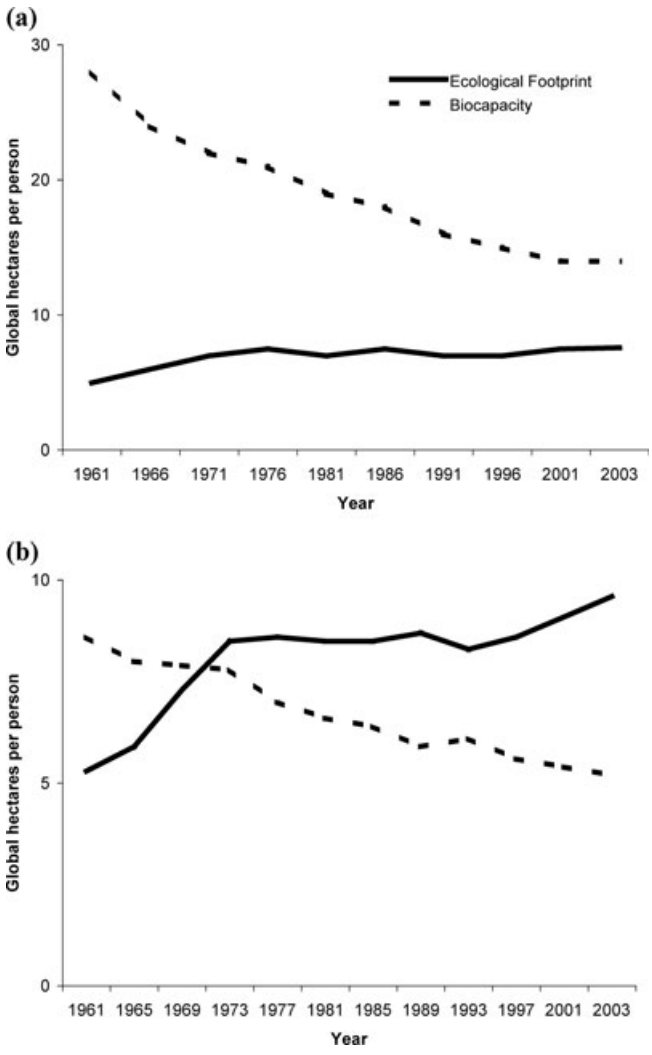

Figure 2. Ecological footprints and biocapacities (global hectares per person) in (a) Canada and (b) the United States (GFN 2006).

influential participant in the arena of conservation and development policy, we must develop a truly interdisciplinary science of conservation, one that incorporates economics and other social sciences in addition to the natural sciences.

Key Opportunities for Integrating Conservation Science into Policy

The North America Section of SCB can enhance conservation of the continent's biodiversity by promoting integration of conservation science into policy decisions that affect the use and management of land and water resources, regulation and management of non-native invasive species, and strategies for conservation and land use in anticipation of climate change. Some of these threats are urgent, a compelling example being sea-level rise. Although coastal counties comprise 17% of the land area of the United States, over 53% of the country's population is concentrated in those counties (Crossett et al. 2004). Many of these people live in low-lying areas, such as southern Louisiana and Florida, which will be inundated by rising seas, perhaps within a century (Kerr 2006). Yet, there are no plans or policies for relocating coastal residents, protecting ecological corridors to allow the landward migration of species, or protecting inland areas of high conservation value that are likely to be invaded by people emigrating from flooded coastal zones. Conservation professionals should be at the forefront of efforts to develop such plans.

North American conservation policy has not stopped the loss of biodiversity in part because it does not place sufficient economic value on biodiversity. An example is the way the U.S. Fish & Wildlife Service evaluates critical habitat for endangered species. The agency uses a narrowly focused method that accounts only for the economic costs of protecting habitat, which tends to limit how much habitat is protected, without also weighing economic benefits that will result from carbon sequestration, clean water, and recreation associated with protected areas (Duane et al. 2008). Economic models that incorporate biodiversity's value have been developed and are being refined (e.g., Pearce 2001), as are estimates of that value (Balmford et al. 2002; Losey & Vaughan 2006). To be effective, however, this information (even if still an estimation) must be applied by government and the private sector. Two main factors that limit application of this information are lack of coordination among agencies, levels of government, and countries and limited use of science in decision making among agencies and policy makers. The North America Section of SCB is well positioned to tackle both these challenges through development of a continental-scale biodiversity blueprint and continued efforts to improve the use of science in decision making related to conservation. We are heartened that, in the United States, the new President Barack Obama has pledged to restore scientific integrity and accountability to government decision making and policy.

North American Biodiversity Blueprint

Canada and the United States share species, ecosystems, and abiotic and biotic drivers of environmental change and evolution; they also have broadly similar cultures. The political boundaries between Canada and the United States are not ecologically based. Ecoregions and species' ranges commonly cross this international boundary, and many species now restricted to the United States may move into Canada in response to climate change. A continental vision for conservation of biodiversity is needed to recognize these biological realities and the increasingly dynamic nature of species distributions.

The North America Section of SCB seeks to create a collaborative team of North American researchers and practitioners in the natural and social sciences with the goal of producing a North American Biodiversity Blueprint. This blueprint will aim to (1) summarize existing policies, which are often unnecessarily complex and disconnected; (2) outline fewer but more scientifically sound policies that are easier to implement; (3) address species and their ecosystems at continental as well as national levels; (4) outline the impact of growing demographic pressures and our ecological footprint; and (5) highlight the potential role of aboriginal communities in the development of conservation and land-use policy. Above all, the blueprint must bring policy makers' attention to the importance of incorporating the value of biodiversity into North America's economic model (albeit this remains an area where further scientific demonstration of the linkage between biodiversity and economic health is needed). Although the North American Biodiversity Blueprint is still in the conceptual stage of development, we intend the blueprint to develop into a practical road map for conserving North American biodiversity in a rapidly changing environment.

As scientists, our responsibility is primarily not to develop, but to inform policy (Wood & Gross 2008), albeit the debate about the role of conservation biologists as policy advocates is far from settled. In any case, the North America Section of SCB needs powerful collaborators from many disciplines if it is to inform continental conservation policy. A potential continental collaborator is the Commission for Environmental Cooperation (CEC; http://www.cec.org/home/index.cfm?varlan [in English]). This trinational (Canada, Mexico, United States) organization, created through the North American Free Trade Agreement (NAFTA), is responsible for addressing environmental concerns arising from continental economic practices, and has a conservation mandate to promote North American biodiversity. The CEC has a 12-member Biodiversity Conservation Working Group, with four members from each of the three countries. Despite various shortcomings of NAFTA, the North America Section of SCB would do well to offer assistance to CEC in developing a biodiversity conservation strategy. In addition, the North America Section of SCB should continue to monitor development of the International Mechanism of Scientific Expertise on Biodiversity and determine how we might collaborate (see http://www.imoseb.net/welcome).

Better Use of Science

One of SCB's five major policy goals is to reinforce the use and protection of science in governmental decision making and environmental assessment processes. In recent years, there has been a high degree of political interference in science by elected and appointed politicians and administrators at multiple levels of government in the United States (Union of Concerned Scientists; http://www.ucsusa.org/scientific_integrity/) and in Canada (Hutchings et al. 1997; Mooers et al 2007). One of us (D.A.D.) testified at a hearing of the U.S. House Natural Resources Committee in May 2007 on the widespread political interference in endangered species decisions by administrative officials. Although administrative decisions regarding the Northern Spotted Owl (*Strix occidentalis caurina*) were of major concern, testimony from numerous witnesses suggested that scientific advice was overruled in as many as 80 decisions regarding endangered species. Protections for whistleblowers (those within agencies who report misconduct) also were curtailed. For issues that relate directly to conservation of biodiversity, the North America Section has an obligation to publicize, through our publications, meetings, and other activities, instances of interference with science and to hold government officials and their collaborators in such interference accountable. Actions considered by the section include encouragement and formal recognition of individuals who have been subject to or who have directly observed political interference with science. We will also continue our work with other professional organizations and societies, such as the American Fisheries Society, The Wildlife Society, the American Ornithologists' Union, and the Union of Concerned Scientists, to pursue legislative or oversight strategies and remedies to promote use of and reduce interference with science by elected officials and agency leaders. These remedies may include new regulations or separate legislation as well as amendments to existing statutes (e.g., Federal Advisory Committee Act, Whistleblower Protection Act, Endangered Species Act, and Marine Mammal Protection Act). Since its founding the North America Section has a commendable history of fruitful collaborations with other professional societies, especially regarding the U.S. Endangered Species Act. We anticipate that interference with science by federal officials in the United States will decline sharply as a result of President Obama's expressed commitment to put science back in its rightful place in decision making. The SCB issued in December 2008 a set of recommendations to be considered by the Obama administration and Congress to strengthen the scientific foundation of biodiversity conservation (Society for Conservation Biology 2008).

Summary

The SCB was established by North American scientists a quarter of a century ago to advance the science and practice of conserving Earth's biodiversity. Nevertheless, achieving this mission continues to be elusive in all countries, including Canada and the United States. North

America has an extensive network of conservation policy at all levels of government, which is slowing—but rarely stopping or reversing—declines in biodiversity. The North America Section has considerable potential for increasing the ability of science to inform policy and management locally, nationally, and globally through a range of activities. These activities include development of a North American Biodiversity Blueprint, which will be the topic of a conference of the North America Section, along with U.S. and Canadian chapters, in fall of 2009.

The mission of conserving biodiversity, which is central to SCB, requires much greater engagement of the natural and social sciences within governmental decision making. In addition to consolidating and enforcing existing policies, we encourage policy makers and the North American public to recognize and address the ultimate drivers of biodiversity loss—population growth, damaging forms of economic growth, and excessive consumption—however controversial these issues may be. New policies, such as tax incentives and disincentives, may be needed to deal with these ultimate threats to biodiversity and to human well-being. Ignoring these threats will not make them disappear.

A key challenge for the North America Section is determining how best to divide scarce resources between addressing the ultimate drivers of biodiversity loss versus the proximate threats. Another perennial challenge is reconciling the tension between advocacy and credibility, which has been a source of divisiveness and distraction within SCB (Noss 2007). Regardless of these difficulties, SCB would do well to continue leveraging scientific information into policies that transform human behavior into a sustainable relationship with nature.

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Literature Cited

Abell, R. A., et al. 2000. Freshwater ecoregions of North America: a conservation assessment. Island Press, Washington, D.C.

Balmford, A., et al. 2002. Economic reasons for conserving wild nature. Science **297:**950–953.

Baumert, K., and J. Pershing. 2004. Climate data: insights and observations. Pew Center on Global Climate Change, Arlington, Virginia.

CEC (North American Commission for Environmental Cooperation). 2002. The North American mosaic: a state of the environment report. CEC, Montreal.

CESCC (Canadian Endangered Species Conservation Council). 2006. Wild species 2005: the general status of species in Canada. Environment Canada, Ottawa.

Chow, J., R. J. Kopp and P. R. Portney 2003. Energy resources and global development. Science **302:**1528–1531.

Crossett, K., T. Culliton, P. Wiely, and T. Goodspeed. 2004. Population trends along the coastal United States: 1980–2008. Coastal trends report series. National Oceanic and Atmospheric Administration, Silver Spring, Maryland.

Dowdeswell, J. A. 2006. The Greenland ice sheet and global sea-level rise. Science **311:**963–964.

Duane, T. P., et al. 2008. Economics of critical habitat designation and species recovery: consensus statement of a workshop sponsored by the Pacific Rivers Council, Environmental Studies Program at San Francisco State University, Ecotrust, and the National Center for Conservation Science and Policy. Pacific Rivers Council, Portland, Oregon. Available from http://www.pacrivers.org/Economics-Critical-Habitat.pdf (accessed November 2008).

Eisner, T., J. Lubchenco, E. O. Wilson, D. S. Wilcove, and M. J. Bean. 1995. Building a scientifically sound policy for protecting endangered species. Science **269:**1231–1232.

Environment Canada. 2006. Wild species 2005: the general status of species in Canada. Environment Canada (National General Status Working Group), Ottawa. Available from http://www.wildspecies.ca/wildspecies2005/ (accessed November 2008).

FAO (Food and Agriculture Organization). 2005. ResourceSTAT: land use database. FAO, Rome. Available from http://faostat.fao.org/ (accessed June 2008).

Flint, A. 2006. This land: the battle over sprawl and the future of America. Johns Hopkins University Press, Baltimore, Maryland.

Fraser, D. J., and L. Bernatchez. 2005. Allopatric origins of sympatric brook charr populations: colonization history and admixture. Molecular Ecology **14:**1497–1509.

GFN (Global Footprint Network). 2006. Ecological footprint and biocapacity. GFN, Oakland, California. Available from http://www.footprintnetwork.org/ (accessed June 2008).

Grady, W. 2007. The Great Lakes: the natural history of a changing region. Greystone Books, Vancouver.

Grimm, N. B., S. H. Faeth, N. E. Golubiewski, C. L. Redman, J. Wu, X. Bai, and J. M. Briggs. 2008. Global change and the ecology of cities. Science **319:**756–760.

Groom, M. J. 2006. Threats to biodiversity. Pages 63–109 in M. J. Groom, G. K. Meffe, and R. C. Carroll, editors. Principles of conservation biology. 3rd edition. Sinauer Associates, Sunderland, Massachusetts.

Harden, B. 2006. America's population set to top 300 million-immigration fuels much of growth. Washington Post, 12 October:A01.

Hawken, P. 1993. The ecology of commerce: a declaration of sustainability. Harper Collins, New York.

Hoekstra, J. M., T. M. Boucher, T. H. Ricketts, and C. Roberts. 2005. Confronting a biome crisis: global disparities of habitat loss and protection. Ecology Letters **8:**23–29.

Holdren, J. P. 2008. Presidential address: science and technology for sustainable well-being. Science **319:**424–434.

Hutchings, J. A., C. Walters, and R. L. Haedrich. 1997. Is scientific inquiry incompatible with government information control? Canadian Journal of Fisheries and Aquatic Sciences **54:**1198–1210.

ISSG (Invasive Species Specialist Group). 2008. Global invasive species database. Available from http://www.issg.org/database (accessed June 2008).

IUCN (International Union for Conservation of Nature). 2007. 2007 IUCN Red List of threatened species. IUCN, Gland, Switzerland. Available from http://www.iucnredlist.org (accessed June 2008).

IUCN WCPA (World Commission on Protected Areas). 2007. Growth in nationally protected areas. UN Environment Program, World Conservation Monitoring Center, Cambridge, United Kingdom.

Kerr, R. A. 2006. A worrying trend of less ice, higher seas. Science **311:**1698–1701.

Lodge, D. M., et al. 2006. ESA report: biological invasions: recommendations for U.S. policy and management. Ecological Applications **16:**2035–2054.

Losey, J. E., and M. Vaughan. 2006. The economic value of ecological services provided by insects. BioScience **56:**311–323.

Mooers, A. Ø., L. R. Prugh, M. Festa-Bianchet, and J. A. Hutchings. 2007. Biases in legal listing under Canadian endangered species legislation. Conservation Biology **21:**572–575.

NatureServe. 2008. NatureServe explorer: an online encyclopedia of life. Version 7.0. Available from http://www.natureserve.org/explorer/ (accessed June 2008).

Noss, R. F. 2007. Values are a good thing in conservation biology. Conservation Biology **21:**18–20.

Noss, R. F., E. T. LaRoe, and J. M. Scott. 1995. Endangered ecosystems of the United States: a preliminary assessment of loss and degradation. Biological report 28. National Biological Service, Washington, D.C.

OECD (Organisation for Economic Co-operation and Development Statistics). 2008. Country statistical profiles. OECD, Paris. Available from http://stats.oecd.org/ (accessed June 2008).

Overpeck, J. T., B. L. Otto-Bliesner, G. H. Miller, D. R. Muhs, R. B. Alley, and J. T. Kiehl. 2006. Paleoclimatic evidence for future ice-sheet instability and rapid sea-level rise. Science **311:**1747–1750.

Pearce, D. 2001. Valuing biological diversity: issues and overview. Pages 27–44 in Organisation for Economic Co-operation and Development (OECD), editor. Valuation of biodiversity benefits: selected studies. OECD, Paris.

Ricketts, T. H., et al., editors. 1999. Terrestrial ecoregions of North America: a conservation assessment. Island Press, Washington, D.C.

SARA (Species at Risk Act) Public Registry. 2008. A-Z species index. SARA Public Registry Office, Gatineau, Quebec. Available from http://www.sararegistry.gc.ca/sar/index/default_e.cfm (accessed June 2008).

Society for Conservation Biology (SCB). 2008. Recommendations for actions by the Obama Administration and the Congress to advance the scientific foundation for conserving biological diversity. Report. Society for Conservation Biology, Washington, D.C.

StatCan (Statistics Canada). 2007. Canadian population estimate: 1 July 2007. StatCan, Ottawa. Available from http://www.statcan.ca/ (accessed May 2008).

Stein, B. A., L. S. Kutner, and J. S. Adams, editors. 2000. Precious heritage: the status of biodiversity in the United States. Oxford University Press, New York.

Stokstad, E. 2005. What's wrong with the Endangered Species Act? Science **309:**2150–2152.

UNFPA (United Nations Population Division). 2006. World migrant stock: the 2005 revision database. UNFPA, New York. Available from http://esa.un.org/migration/ (accessed June 2008).

UNFPA (United Nations Population Fund). 2007. State of the world 2007: unleashing the potential for urban growth. UNFPA, New York. Available from http://www.unfpa.org/swp/ (accessed June 2008).

UNSD (United Nations Statistics Division). 2008. UNdata: a data access system to UN databases. UNSD, New York. Available from http://data.un.org/ (accessed June 2008).

USCB (United States Census Bureau). 2007. United States population estimate: 1 July 2007; World population estimate: 1 July 2007. USCB, Washington, D.C. Available from http://www.census.gov/ (accessed June 2008).

USFWS (United States Fish and Wildlife Service). 2008. Threatened and endangered species system (TESS). USFWS, Washignton, D.C. Available from http://ecos.fws.gov/tess_public/ (accessed June 2008).

Venter, O., N. N. Brodeur, L Nemiroff, B. Belland, I. J. Dolinsek, and J. W. A. Grant. 2006. Threats to endangered species in Canada. BioScience **56:**903–910.

Wackernagel, M., and W. E. Rees. 1996. Our ecological footprint: reducing human impact on the Earth. New Society Publishers, Gabriola Island, British Columbia.

Wood, C. C., and M. R. Gross. 2008. The elemental conservation unit: communicating risk without dictating targets for protection. Conservation Biology **22:**36–47.

World Bank. 2005. International comparison program. World Bank, Washington, D.C. Available from http://web.worldbank.org/WBSITE / EXTERNAL / DATASTATISTICS / ICPEXT / 0, menuPK: 1973757~pagePK:62002243~piPK:62002387~theSitePK:270065, 00.html (accessed November 2008).