

Conserving Tropical Biodiversity amid Weak Institutions

CHRISTOPHER B. BARRETT, KATRINA BRANDON, CLARK GIBSON, AND HEIDI GJERTSEN

Tropical-biodiversity conservation has changed radically over the past generation. Until the early 1980s, conventional wisdom held that central governments should manage all conservation efforts in developing countries. Over the past 15 years or so, scholars, conservation practitioners, and policymakers have advocated an alternative approach based on bottom-up direction by local communities in response to real or perceived government malfeasance, misfeasance, or nonfeasance under the previous top-down model. Now that some of the pitfalls of community authority over conservation decisions have become apparent, the question is what, if any, best-bet strategies exist if the institutions of both government agencies and communities are ill equipped to handle the challenges of biodiversity conservation? (We follow Douglass North's [1990] definition of institutions as "the rules of the game in a society or, more formally, ... the humanly derived constraints that shape human interaction[p. 3].") Thus, we distinguish between organizations and institutions. For example, a bank is an organization, but within it are many formal and informal rules—institutions—that guide individuals' behavior.)

In this article, we address the broad question of where decisionmaking authority for tropical-biodiversity conservation should lie. In so doing, we advance four claims. First, the current fashion for community-based natural resource management overemphasizes the place of local communities in tropical-conservation efforts, much as the previous top-down model underemphasized communities' prospective role. Second, given the variability of economic and biophysical scales and institutional landscapes, the best management designs adapt to suit the biophysical and socioeconomic context and commonly involve distributing authority across multiple institutions rather than concentrating it in just one. Third, the greatest challenge to implementing such designs, indeed to achieving sustainable tropical-biodiversity conservation at all, is the weakness of existing institutions at all levels. Fourth, the necessary establishment or rehabilitation of institutions in tropical countries and of effective coordination among

them will therefore require greater commitments of financial and technical assistance at both the international and national levels.

The appeal of community-based natural resource management

Conventional wisdom holds that the fences-and-fines approach to protected-area management, which vests authority over natural resources in the hands of the central government, has not worked in low-income countries. Under this approach, the empowered government writes and enforces laws prohibiting or severely limiting human use of a resource. Historically, states have delegated little, if any, decisionmaking authority to local communities. Critics of this form of conservation management claim that governments in low-income countries have proved incapable of making or enforcing effective rules and have thereby failed to ensure biodiversity conservation in the tropics and subtropics while simultaneously contributing to the marginalization and poverty of rural communities excluded from parks (Ludwig et al. 1993, Brandon et al. 1998).

These criticisms helped to spawn new strategies intended to empower local communities with decisionmaking authority over certain natural resources. Known generally under the label *community-based natural resource management*, these approaches seek to structure programs that capture locally the potential social benefits of sustainable resource use, with the idea that when biodiversity is more valuable to locals, they will do more to conserve it (Western and Wright

Christopher B. Barrett (e-mail: cbb2@cornell.edu) is an associate professor and Heidi Gjertsen is a graduate student in the Department of Applied Economics and Management, Cornell University, Ithaca, NY 14853-7801. Katrina Brandon is a Fellow with Conservation International, Washington, DC 20036. Clark Gibson is an assistant professor in the Department of Political Science, Indiana University, Bloomington, IN 47405. © 2001 American Institute of Biological Sciences.

1994, Getz et al. 1999). Given the real possibility of win-win outcomes through an approach that gives more to the poor while trying to improve conservation indicators, community-based natural resource management understandably excites the interest and imagination of conservation groups and international development agencies worldwide.

The success of community-based schemes so far has generally not matched the fanfare. While supporters tout a few well-known programs (e.g., the CAMPFIRE program in Zimbabwe), studies rarely incorporate rigorous data on conservation or poverty indicators. Indeed, empirical researchers confront nongovernmental organizations and foreign aid missions that exhibit little interest in allowing thorough investigation of "their" community-based conservation projects. Moreover, careful comparative analyses of community-based programs are rare. In the absence of serious research by independent analysts validating the effects of community-based efforts on conservation outcomes, any claimed success should be greeted with skepticism.

Although careful students of community-based approaches do acknowledge that performance varies widely and depends on satisfying certain ecological and institutional conditions, discussions about community-based conservation often sidestep the deeper issues on which successful conservation efforts depend. In particular, implementation of community-based schemes too often proceeds from untested biological and socioeconomic assumptions, some of which are likely to be false in many, if not most, situations (Wells and Brandon 1992, Barrett and Arcese 1995, Brandon 2000). In particular, assumptions regarding ecological and social scales and community-level institutions are rarely explored deeply. (The subsequent sections of this article discuss these issues in turn.) If scholars, policymakers, and conservation practitioners continue to ignore these assumptions, an excessive focus on community-based conservation projects may lead to squandered opportunities for conservation and development and inflamed rather than alleviated tensions between poor tropical communities and conservationists.

Social and ecological scales

The core challenge of tropical conservation lies in reconciling private and social incentives, or what economists term the problem of *externalities*. (An externality arises when a person's decision imposes costs or confers benefits on someone other than the decisionmaker. A classic example is a consumption choice that involves disposal of wastes at no charge to the consumer but that produces pollution that affects others.) As Garrett Hardin (1968) pointed out, self-interested individuals making decisions in isolation from one another may have no incentive to take account of the common good of environmental conservation, leading to rational overexploitation of a natural resource for private gain. Hardin recommended either individualized or state control over land and other natural resources as the best means to internalize resource use externalities and thereby conserve the commons. (The term *commons* refers to a resource over which there do not exist

individual private property rights. As a consequence, multiple persons have legitimate, overlapping claims, giving rise to externalities [Hardin 1968, Ostrom 1990].) In general, there is no single best means to resolve externality problems; the best approach depends heavily on the context.

Much work on common-property management regimes focuses on resources for which solving the externality problem can greatly increase the welfare of a well-defined user group. Hardin's pastoralists could individually gain from collectively resisting their temptation to put more sheep on a common pasture, thereby degrading it. Rangeland grazing, maintenance of common irrigation infrastructure, and forest management are familiar examples of relatively circumscribed resources considered valuable by a local, identifiable population of users (Ostrom 1990, Bromley 1992). A voluminous analytical and empirical literature demonstrates that halting natural resource degradation in such settings probably requires that a strong role be played by communities (Baland and Platteau 1996). Thus, when the aim is the maintenance of ecosystem services valued primarily, if not exclusively, by local residents, communities can often be the foundation for effective conservation management (although tough institutional questions remain).

Demands for *in situ* biodiversity conservation typically involve externalities that are both ecologically and socially broader than those of familiar commons problems. The necessary ecological scale typically far exceeds the space that any single community can ably manage. Migratory species exacerbate this problem. To take extreme cases that highlight the more general point, no single community could possibly manage whale or wildebeest conservation successfully.

The social side of conservation externalities is equally problematic. Economists have devoted considerable energy over the past 2 decades to measuring the apparently substantial *nomuse* values associated with aesthetic or spiritual appreciation or with the desire to bequeath a robust environment to future generations or to retain the option to use the resource at some unspecified future date. Distant and better-off populations may highly value the conservation of carbon sinks in tropical rainforests, ecosystems with high rates of endemism that might contain genetic material important to medicine or agriculture, or charismatic megafauna that hold intrinsic appeal. The challenge is factoring outsiders' valuation of natural resources into local use decisions. The international Convention on Biological Diversity attempted to solve this problem by granting to host nations sovereign rights over the natural resources contained within their borders. But clear delineation of property rights only resolves externality problems when there are no transaction costs. The substantial transaction costs involved in bringing together, for example, a California conservationist and forest dwellers in the Central African Republic have proved a significant obstacle to the commercialization of conservation, as manifested in the relatively meager sums involved in ecotourism, bioprospecting, or marketing of nontimber forest products (Barrett and Lybbert 2000). The property rights clarification by the Con-

vention on Biological Diversity helps ensure an equitable sharing of what revenues can be generated from commercial exploitation of biodiversity, but only a trivial portion of the external valuation of biodiversity can be captured in this manner (Simpson 1999).

Official and nonprofit financial transfers do not begin to close the gap between total external, nonuse valuation, and commercial conservation-related flows of funds. For example, protected-area management costs almost 3% of the gross domestic product in Kenya, where 44% of the population of 26 million people fall below the national poverty line, with a per-capita annual income of only \$160 among those 11.5 million persons (Norton-Griffiths and Southey 1995, Kenya Ministry of Planning and National Development 1998). It is both unrealistic and unjust to expect continued highly regressive financing of conservation efforts that have global benefit, and with respected organizations such as the International Union for the Conservation of Nature suggesting that a minimum of 10% to 12% of each country's landmass be devoted to conservation, the expansion of community-based designs to the minimum necessary ecological scale runs headlong into formidable institutional challenges as to how to internalize the significant and dispersed externalities associated with the social scale of tropical-biodiversity conservation.

The institutional landscape

The institutional landscape should be approached as carefully as the ecological if biodiversity conservation is to be successful. It makes no more sense to valorize the community as the best defender of conservation in all cases than it does to claim that national governments are always in the best position to protect nature. Discussion about which institutions are appropriate to govern biodiversity conservation must move beyond the false dichotomy of community versus central government. Instead, scholars and policymakers must focus first on how institutions work at multiple levels and explore which configurations appear best for different types of biodiversity conservation.

Currently, however, the community-based approach is so popular as to be nearly unassailable, despite the fact that proponents of community-based management often fail to define or examine the communities they champion (Brechin et al. n.d.). Advocates tend to naively assume that communities encompass homogeneous groups of people with common goals and effective, evolutionarily stable mechanisms to achieve them (Brosious et al. 1998, Agrawal and Gibson 1999, Belsky 1999). However, anthropologists have long documented communities divided by gender, generation, and economics. Local communities contain individuals harboring different aspirations, leadership rivalries, and varying degrees and kinds of resource exploitation and overexploitation (Gusfield 1978, Redford 1992, Redford and Mansour 1998, Leach et al. 1999). Creating community-level institutions to conserve biodiversity can prove very difficult where economic, social, or technological conditions are highly

variable (Ostrom 1990, Bromley 1992, Baland and Platteau 1999). To take but one example from the Peruvian Amazon, consumptive use of species is highly concentrated among just a few households or clans who stand to lose disproportionately from serious conservation measures, while the benefits of conservation are spread broadly, setting up a collective-action problem in which the minority with significant interests prevails over the majority, who gain little per capita from forcing change (Olson 1965, Takasaki et al. 2001). Inventing social harmony where there is none will not only fail to ensure the success of community-based approaches, it may blind reformers to the need for understanding the array of institutions at the local level.

The capacity of communities to self-govern their natural resources also cannot be assumed. Comparative work on the conditions under which communities can successfully manage their natural resources is infrequent, and biased case selection is the norm, in part because social scientists generally investigate institutions that persist rather than those that have failed and disappeared. Current research in this vein teaches us that communities both succeed and fail in conservation tasks. Some communities have strong institutions that have dealt well with change. Most are probably too weak to resist the temptation to overuse their resources or to overcome outsiders seeking to exploit or control the resources.

Governments in many parts of the tropics also have poor conservation records. The politics of natural resources generally emphasize exploitation and redistribution, sometimes including the cooptation of purportedly community-based efforts (Bates 1981, Hill 1991, Gibson and Marks 1995, Dauvergne 1997, Gibson 1999). Governments can be quite effective in some sectors—raising an army, for instance, or funding urban development—but most central authorities lack clear incentives to protect biodiversity. Such conservation is costly, has a limited domestic constituency, and carries with it the *opportunity cost* of distributing a country's natural wealth to political allies. (The economic concept of *opportunity cost* refers to the value of the best option foregone. In the present context, there is often considerable political value in granting key supporters access to natural resources for their use and exploitation.) Even in the rare case when political incentives are somewhat aligned with a desire to conserve biodiversity, corrupt and inefficient bureaucracies can undermine conservation on the ground.

Community-based methods work best when there are strong (formal or informal) local systems of social control to enforce access restrictions, while government-run systems fare well in the hands of a competent bureaucracy. In much of the tropics, however, weakness of both systems is the norm. Traditional management systems are often overwhelmed, eroded, or nonexistent at the community level. Commercial natural resource markets are commonly incomplete and inefficient, and many countries are generally fiscally and politically fragile. Thus, there is no uniformly preferable locus of conservation authority in tropical settings.

While work regarding the effects of institutions on conservation outcomes is ongoing, some general agreement does exist on at least four core ideas. Successful conservation institutions, at whatever scale, must possess (1) the authority, ability, and willingness to restrict access and use; (2) the wherewithal to offer incentives to use resources sustainably (which in some cases may mean no use at all); (3) the technical capacity to monitor ecological and social conditions; and (4) the managerial flexibility to alter the array of incentives and the rules of access so as to cope with changes in the condition of the resource or its users (Kremen et al. 1994, Ostrom et al. 1999). Conservation programs administered by the central governments of many tropical countries commonly have difficulty meeting all of these conditions. Community-based conservation schemes, on the other hand, too often emphasize only incentives while ignoring the other three conditions.

Although designers of conservation programs focus mostly on incentives, this does not mean the incentive structures they offer are well designed (Brandon and Wells 1992, Barrett and Arcese 1995). (For an important exception, see the series of papers by Marshall Murphree regarding the structure of incentives under CAMPFIRE, published by the Center for Applied Social Sciences, University of Zimbabwe.) For example, most community-based conservation program designs assume that poor households have fixed income targets and do not pursue additional opportunities beyond those targets. Therefore, if projects can help households meet this need without consumptive recourse to natural resources, conservation goals will be advanced. The more common outcome, however, is that increased household income, combined with little enforcement and few explicit links between the positive incentives and the conservation project, simply fosters more rapid resource extraction (Agrawal et al. 1998, Barrett and Arcese 1998). The static nature of community-based thinking also renders many projects victim to unanticipated shocks because they do not have the ability to adjust use restrictions or the mix of incentives appropriately (Barrett and Arcese 1998, Larsen et al. 1998, Margoulis and Salafsky 1998). Conservation schemes based primarily on positive inducements also require benefit flows large enough to spread throughout the community. While some conservation projects enjoy massive amounts of external aid or high returns from safari hunting, which may satisfy revenue needs (e.g., Zambia's ADMADE or Zimbabwe's CAMPFIRE program), few countries can rely on such financial resources. In the absence of significant external support, conservation efforts must use existing and prospective institutional arrangements.

Prospects for progress

Since neither governments nor communities are uniformly reliable foundations for tropical-biodiversity conservation, what prospects are there for progress? The key to answering that question lies in recognizing that biodiversity conservation entails a range of activities—e.g., fundraising and administration, promoting widespread environmental awareness,

technical monitoring of ecological and social systems, coordinating dialogue among stakeholders, and enforcing rules within particular habitats—and that organizations' relative aptitudes, or *comparative advantage* in economic terms, differ across tasks. A community might have very effective local rules for monitoring use of a forest and enforcing rules against hunting there, yet have no capacity to create broader awareness of the value of the endemic species, to raise funds from distant nonusers who value those species' existence, or to monitor the species' population dynamics. Meanwhile, the central government, a local university, a union of regional resource user associations, or an international charity might have complementary skills and weaknesses.

Comparative advantage in conservation tasks is likely to be predictable if based on contextual details, especially those of ecological and social scales and the institutional landscape discussed above. For example, Ostrom (1990) has identified a set of design principles for effective common-pool resource management by communities that reflect these criteria, and similar common characteristics of effective government-managed parks have emerged (Brandon et al. 1998). There is nonetheless a pressing need for theoretical and empirical scholarship to identify robust predictors of institutional comparative advantage in performing conservation tasks and to determine the implications for conservation design: when should authority be vested in central governments, when should it wholly devolve to local communities, and when should there be some form of coordinated or nested management combining the skills of multiple actors?

In the meantime, some relevant principles are available from related economic theories of public finance. These theories explore arrangements for providing and paying for goods and services that any of several distinct organizations could in theory provide (Musgrave 1959, Oates 1991, Ferejohn and Weingast 1997).

First, where relative aptitudes are reasonably similar, the absolutely (as opposed to relatively) most effective provider should be given full conservation authority because the costs of coordination between organizations will almost surely exceed the modest potential gains from specialization by skill. The rarity with which one finds reasonable uniformity of relative abilities lays the foundation for the second principle: The strengths of distinct organizations should be combined through either vertical coordination within nested hierarchies—e.g., many communities performing certain tasks in exchange for resources from a few regional governments operating within the bounds of policies established by the central government—or horizontal coordination within a level in a hierarchy, such as through federations or unions of neighboring communities around a protected area or of national governments bordering an ocean commons (Navarro 1989, Baviskar 1990, Bebbington 1996, Inamdar et al. 1999, Ostrom et al. 1999, Wilkinson 1999). This is essentially just the economic law of comparative advantage, which states that division of labor according to relative ability improves outcomes.

Third, horizontal coordination can easily give way to competition among organizations, which must be monitored carefully. Sometimes competition can be healthy, fostering productive experimentation and broad dissemination of lessons learned. At other times competition among organizations can lead to winner-take-all contests and inequitable outcomes that undermine popular support for the core objective. The former case favors relatively greater devolution of authority to smaller-scale units. Conversely, relatively greater centralization of authority prevails when competition proves counterproductive.

Fourth, when coordination is extremely costly, it can nonetheless be preferable to concentrate authority in a single entity in spite of its relative ineptitude at particular necessary tasks. One must be careful not to confuse the gross benefits of coordination with the net benefits, meaning gross benefits less coordination costs, which can be extremely high in tropical settings characterized by political instability, poor infrastructure, and diverse cultures.

There are already experiments under way with linked or nested institutional arrangements for conservation, for example, comanagement of reef ecosystems by coastal communities and national bureaucracies, and unions of forest user groups. Such initiatives need to be monitored carefully and studied in a systematic, comparative manner so that generalizable lessons for conservation management design can be applied elsewhere.

In addition to the absence of a well-articulated theory or convincing empirical evidence specific to institutional-cum-organizational conservation design questions, the other major obstacle is the relative dearth of effective institutions in the low-income tropics. Weak communities, governments, and markets are perhaps the defining characteristics of these nations. The conservation community not only needs to invest in scholarship to sort out design questions methodically, it also needs to invest in building and linking effective conservation institutions and organizations embodying the behavioral rules that constitute institutions. Inept, corrupt, or dysfunctional institutions are not easily reformed, so we do not mean to suggest that this is a simple task, just that it is necessary. So too it is imperative to help foster sociopolitical stability and traditions of open dialogue in which competing interests can be addressed openly and worked through to find the common ground among distinct interest groups (Uphoff 1992, Margoulis and Salafsky 1998, Barrett and Grizzle 1999). Otherwise, coordination may prove too difficult to establish and maintain, with the consequence that concentration of complete conservation authority in a single ineffective agent may be the best of a bad lot of options.

Since the benefits of tropical-biodiversity conservation typically extend far beyond the communities of local resource users or the boundaries of their nations, a significant share of the costs of developing and maintaining the institutional capacity to internalize biodiversity externalities necessarily must fall on wealthy foreign individuals, organizations, and nations. Tropical-biodiversity conservation cannot be

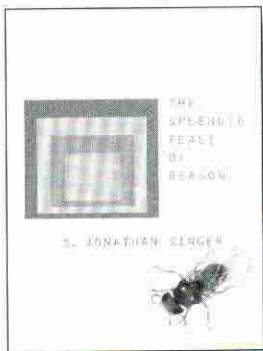
achieved on the cheap. The global beneficiaries of biodiversity must not abdicate complete authority and responsibility to either tropical states or indigenous communities but rather must work to improve the capacity of nested institutions to induce and enforce tropical conservation.

References cited

- Agrawal A, Gibson CC. 1999. Enchantment and disenchantment: The role of community in natural resource conservation. *World Development* 27: 629–649.
- Agrawal A, Britt-Kapoor C, Kanel K. 1998. *Decentralization in Nepal: A Comparative Analysis*. San Francisco: Institute for Contemporary Studies.
- Baland JM, Platteau JP. 1996. *Halting Degradation of Natural Resources: Is There a Role for Rural Communities?* Oxford (UK): Clarendon Press.
- . 1999. The ambiguous impact of inequality on local resource management. *World Development* 27: 773–788.
- Barrett CB, Arcese P. 1995. Are ICDPs sustainable? On the conservation of large mammals in sub-Saharan Africa. *World Development* 23: 1073–1085.
- . 1998. Wildlife harvest in integrated conservation and development projects: Linking harvest to household demand, agricultural production and environmental shocks in the Serengeti. *Land Economics* 74: 449–465.
- Barrett CB, Grizzle RE. 1999. A holistic approach to sustainability based on pluralistic stewardship. *Environmental Ethics* 21: 23–42.
- Barrett CB, Lybbert TJ. 2000. Is bioprospecting a viable strategy for conserving tropical ecosystems? *Ecological Economics* 34: 293–300.
- Bates R. 1981. *Markets and States in Tropical Africa*. Berkeley: University of California Press.
- Baviskar BS. 1990. Dairy cooperatives and rural development in Gujarat. Pages 256–273 in Doornbos M, Nair KN, eds. *Resources, Institutions, and Strategies: Operation Flood and Indian Dairying*. New Delhi: Sage.
- Bebbington A. 1996. Movements, modernizations, and markets: Indigenous organizations and agrarian strategies in Ecuador. Pages 86–109 in Peet R, Watts M, eds. *Liberation Ecologies: Environment, Development, Social Movements*. London: Routledge.
- Belsky JM. 1999. Misrepresenting communities: The politics of community-based rural ecotourism in Gales Point Manatee, Belize. *Rural Sociology* 64: 641–666.
- Brandon K. 2000. Moving beyond integrated conservation and development projects (ICDPs) to achieve biodiversity conservation. Pages 417–432 in Lee DR, Barrett CB, eds. *Tradeoffs or Synergies? Agricultural Intensification, Economic Development and the Environment in Developing Countries*. Wallingford (UK): CAB International.
- Brandon K, Wells M. 1992. Planning for people and parks: Design dilemmas. *World Development* 20: 557–570.
- Brandon K, Redford K, Sanderson S, eds. 1998. *Parks in Peril: People, Politics, and Protected Areas*. Washington (DC): Island Press.
- Brechin SR, Fortwangler C, Wilshusen P, West PC. n.d. Reinventing a square wheel: The backlash to people-sensitive conservation and the future of international biodiversity conservation management. *Society and Natural Resources*. Forthcoming.
- Bromley D, ed. 1992. *Making the Commons Work*. San Francisco: Institute for Contemporary Studies.
- Brosius JB, Tsing AL, Zerner C. 1998. Representing communities: Histories and politics of community-based natural resource management. *Society and Natural Resources* 11: 157–169.
- Dauvergne P. 1997. *Shadows in the Forest*. Cambridge (MA): MIT Press.
- Ferejohn J, Weingast BR. 1997. *The New Federalism: Can the States Be Trusted?* Stanford (CA): Hoover Institution Press.
- Getz WM, Fortmann L, Cumming D, du Toit J, Hilty J, Martin R, Murphree M, Owen-Smith N, Starfield AM, Westphal MI. 1999. Conservation—Sustaining natural and human capital: Villagers and scientists. *Science* 283: 1855–1856.
- Gibson CC. 1999. *Politicians and Poachers*. Cambridge (UK): Cambridge University Press.

- Gibson CC, Marks SA. 1995. Transforming rural hunters into conservationists: An assessment of community-based wildlife management programs in Africa. *World Development* 23: 941–957.
- Gusfield JR. 1978. *Community: A Critical Response*. New York: Harper and Row.
- Hardin G. 1968. The tragedy of the commons. *Science* 162: 1243–1248.
- Hill KA. 1991. Zimbabwe's wildlife conservation regime: Rural farmers and the state. *Human Ecology* 19: 1–19.
- Inamdar A, de Jode H, Lindsay K, Cobb S. 1999. Capitalizing on nature: Protected area management. *Science* 283: 1856–1857.
- Kenya Ministry of Planning and National Development. 1998. *First Report on Poverty in Kenya*. Nairobi: Central Bureau of Statistics.
- Kremen C, Merenlender AM, Murphy DD. 1994. Ecological monitoring—A vital need for integrated conservation and development programs in the tropics. *Conservation Biology* 8: 388–397.
- Larsen P, Freudenberg M, Wyckoff-Baird B. 1998. WWF Integrated Conservation and Development Projects: Ten Lessons from the Field, 1985–1996. Washington (DC): World Wildlife Fund.
- Leach M, Mearns R, Scoones I. 1999. Environmental entitlements: Dynamics and institutions in community-based natural resource management. *World Development* 27: 225–247.
- Ludwig D, Hilborn R, Walters C. 1993. Uncertainty, resource exploitation, and conservation—Lessons from history. *Science* 260: 17–19.
- Margoulis R, Salafsky N. 1998. *Measures of Success: A Systematic Approach to Designing, Managing, and Monitoring Community-Oriented Conservation Projects*. Washington (DC): Island Press.
- Musgrave RA. 1959. *Theory of Public Finance: A Study in Public Economy*. New York: McGraw Hill.
- Navarro M. 1989. The personal is political: Las madres de plaza de mayo. Pages 241–258 in Eckstein S, ed. *Power and Popular Protest: Latin American Social Movements*. Berkeley: University of California Press.
- North D. 1990. *Institutions, Institutional Change, and Economic Performance*. Cambridge (UK): Cambridge University Press.
- Norton-Griffiths M, Southey C. 1995. The opportunity costs of biodiversity conservation in Kenya. *Ecological Economics* 12: 125–139.
- Oates WA. 1991. *Studies in Fiscal Federalism*. Worcester (UK): Billings & Sons.
- Olson M. 1965. *The Logic of Collective Action: Public Goods and the Theory of Groups*. Cambridge (MA): Harvard University Press.
- Ostrom E. 1990. *Governing the Commons*. Cambridge (UK): Cambridge University Press.
- Ostrom E, Burger J, Field CB, Norgaard RB, Policansky D. 1999. Sustainability—Revisiting the commons: Local lessons, global challenges. *Science* 284: 278–282.
- Redford KH. 1992. The empty forest. *BioScience* 42: 412–422.
- Redford K, Mansour J, eds. 1998. *Traditional Peoples and Biodiversity Conservation in Large Tropical Landscapes*. Rosslyn (VA): Nature Conservancy.
- Simpson RD. 1999. The price of biodiversity. *Issues in Science and Technology* 15: 65–70.
- Takasaki Y, Barham BL, Coomes OT. 2001. Amazonian peasants, rain forest use, and income generation: The role of wealth and geographical factors. *Society and Natural Resources* 14: 291–308.
- Uphoff N. 1992. *Learning from Gal Oya*. Ithaca (NY): Cornell University Press.
- Wells M, Brandon K. 1992. *People and Parks: Linking Protected Area Management with Local Communities*. Washington (DC): World Bank, World Wildlife Fund, and US Agency for International Development.
- Western D, Wright RM, eds. 1994. *Natural Connections: Perspectives in Community-Based Conservation*. Washington (DC): Island Press.
- Wilkinson JB. 1999. The state role in biodiversity conservation. *Issues in Science and Technology* 15: 71–77.

EVERYDAY SCIENCE



THE SPLENDID FEAST OF REASON

S. Jonathan Singer

"*The Splendid Feast of Reason* is the testament of that rarest of breeds, an honest man, at once fearless and modest and decent, presenting scientific rationalism at its best. Singer's superb humanistic summary of modern biology alone is worth the price." —Edward O. Wilson, Harvard University

\$24.95 hardcover

A DIFFERENT NATURE

The Paradoxical World of Zoos and Their Uncertain Future
David Hancocks

"A well-written and provocative, opinion-rich account of zoos, their history, and their goals and purposes." —John Alcock, author of *Animal Behavior*

\$35.00 hardcover

AHEAD OF THE CURVE

David Baltimore's Life in Science
Shane Crotty

"A fascinating history of the life and science of one of the twentieth century's most important scientists."

—Phillip A. Sharp, 1993 Nobel Prize winner and Cancer Institute Professor, MIT

\$29.95 hardcover

NEW IN PAPERBACK



TINY GAME HUNTING

Environmentally Healthy Ways to Trap and Kill the Pests in Your House and Garden

Hilary Dole Klein and Adrian M. Wenner

NEW EDITION

"[The authors] present commonsense, forgotten, and little-known tactics for dealing with troublesome pests in and around the home." —*Backyard Bugwatching*

\$14.95 paperback

LIFE'S MATRIX

A Biography of Water

Philip Ball

WITH A NEW PREFACE

"Marvellous.... This is one of the best science books of the year." —Graham Farmelo, *New Scientist*

\$16.95 paperback

GENES, PEOPLES, AND LANGUAGES

Luigi Luca Cavalli-Sforza

"There may be no contemporary scholar who has a more detailed understanding of human diversity or a more compelling vision of its unified history."

—Edward Rothstein, *New York Times*

\$15.95 paperback

At bookstores or order 800-822-6657 www.ucpress.edu

UNIVERSITY OF CALIFORNIA PRESS