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Dedicated to the Protection, Preservation and Management
of Cultural and Natural Parks and Reserves
Through Research and Education

The George Wright Society

Executive Office

P. O. Box 65, Hancock, Michigan 49930-0065 USA
☎ *1-906-487-9722; fax 1-906-487-9405*
info@georgewright.org ■ *http://www.georgewright.org*
David Harmon ■ Executive Director
Robert M. Linn ■ Membership Coordinator

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On the Cover: A "froglogger"—an automated device for recording frog calls. USGS photo taken at Okefenokee National Wildlife Refuge

Wiliam E. Brown

Box 65: **Commentary from the GWS office and our members**

Thoughts on the Arctic Refuge's Future

I remember the shock that swept the country when the *Exxon Valdez* became grounded on Bligh Reef in 1989. Day after day the crude oil spewing from her punctured hull spread at whim of wind and current. Eventually the black muck coated a thousand miles of mainland and island coastline, killing countless sea mammals, birds, and fish. Who can forget the nightly pictures of doomed, oil-soaked creatures staring at us from the TV screen? The residues of this calamitous spill still poison Alaska's Pacific shores and the animals that live there.

This was a singular event. The Alaska National Interest Lands Conservation Act of 1980 had transformed Alaska from Seward's Folly and Gold Rush plunder into America's last citadel of expansive wild lands. Nearly two-thirds of the nation's protected lands—national wildlife refuges, national parks, national wild and scenic rivers—were created by that single act of Congress. In a mystical, even repentant way, we as a nation had tried in Alaska to make up for what we had done to most of the country Down Below. But the oil spill had shaken our vision of this remote domain.

Now, these spectacular and biologically stunning shores where harmony existed, where "the wild ran free upon the crisp fresh land," have lost that freshness. They have joined the larger neighborhood where industrial accidents routinely happen and are as routinely dismissed: "An anomaly. Statistically insignificant. Part of the external costs of progress and industry." Neither these places nor our luminous vision of them will ever be quite the same again.

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So far, the 19-million-acre Arctic National Wildlife Refuge has been lucky, despite its proximity to Prudhoe Bay and adjacent oil fields. Now comes the push to get inside the refuge. Why? Is our national security at risk because of dependence on foreign-oil imports? That's what Alaska's congressional delegation and its political and corporate allies say. But these are the same people who in 1995 lifted the ban on Alaska oil exports. Prudhoe oil sold to Japan resulted in higher gas prices on the West Coast—to the benefit of Alaska's oil-tax revenues, the profits of big oil, and the campaign funds of the politicians.

Given these bottom-line realities, and the prodigal waste of oil since the discarding of President Carter's energy conservation programs (and the

mindless perpetuation of such waste in the Bush Administration's new energy policy), the national security argument fails to persuade.

Beyond the dollar sign, the urgent rationale for a new Arctic oil rush flows from the pending implosion of Alaska's fading oil boom. As in territorial days, modern Alaska still depends on a colonial economy—by definition a boom-and-bust economy. It exports raw materials (principally oil) and imports virtually everything that it eats and uses to support its inflated urban lifestyle and population. Excepting traditionalists who live off the land, modern Alaska depends on Prudhoe Bay oil as the engine of its economy. But that oil draws down and the pipeline flows at half capacity. So the rush is on to develop a combined oil-and-natural-gas extension of the boom. That's where the Arctic Refuge comes in.

No one knows whether the refuge's geologic structures hold oil, or, if so, how much. U.S. Geological Survey estimates indicate a potential for a large oil discovery of several billion barrels—which would translate to a few months' equivalent of the nation's annual rate of consumption. Experts are skeptical of a mega-giant field of Prudhoe or Persian Gulf scale.

Are these same old, same old ploys reason enough to invade the Arctic Refuge? I don't think so. At the least we should conserve Arctic oil resources until we're forced to use them for valid societal purposes, i.e., in the transition from prodigality to sustainability, under a rational national energy regime that combines conservation, alternative energy sources, and fossil-fuel production. All we have now, and for at least the next four years, is wanton waste, which means the wanton impairment and destruction, in part, of a very special place.

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More than 20 years ago I conducted historic-site surveys along the Arctic Coastal Plain for the North Slope Borough, both within and adjacent to the Arctic Refuge. For longer periods I worked on a cultural landscape plan with the Inupiat people of Nuiqsut, a small village near the mouth of the Colville River, west of the refuge. During extended visits I was privileged to accompany village elders to several hunting-and-fishing, historic, and sacred sites. These tradition bearers shared with me their cultural history in these places. Their stories gave me great appreciation of the people, their homeland, and the creatures that sustain their lives and culture.

The Nuiqsut people were concerned about oil developments in their traditional lands. Because these hunter–gatherers live in a spare Arctic desert, they must roam far and wide, as do the animals they hunt for food. The traditional-use area of the Nuiqsut people is as big as a good-sized state Down Below.

My job was to listen and observe as these people pursued their way of life in a homeland they have occupied for thousands of years. Then to translate—for the invading world from Outside—their concerns for their

homeland. Then, maybe, the Outsiders would see the value of these seemingly barren lands and seas. And be careful how they would use them.

After many drafts and discussions we finally agreed on this translation, this approximation of their core ideas:

> The cultural landscape of Nuiqsut is occupied by a heritage community that perpetuates Inupiat culture by harvesting the wild resources of land and sea, by preserving places and ideals of value, and by transmitting this heritage to future generations. It is a place that cannot be truly owned by any transient human group nor consumed for any ephemeral human purpose, for it must be passed on intact. It is a cosmos that unites time and space, people and nature, resources and values. This place cannot be understood in simple economic or physical-resource terms. Such tools of understanding are too primitive. Yet those from afar who have plans to alter this landscape are using such primitive tools, as did their predecessors.

Sometimes I lose my way and wonder what it's all about—these endless struggles to hold on to the valued places of this world. Then I go back to this statement, to these ideas that I finally understood after many evenings of sitting around campfires in the lee of a skin boat listening to old people in skin clothes who haltingly—with the help of a translator—told me what it's all about.

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Why were these people worried about oil developments in their homeland? Because they had seen Prudhoe Bay and the other oil fields. They had even worked in them. They knew that oil development is fraught with catastrophe, especially in the Arctic. What are some of the things they feared? Here is a sampler:

- Oil and chemical spills into rivers and Arctic seas that would kill under-ice algae, the first link in the Polar marine food chain;
- Disturbance of caribou calving and snow-geese nesting sites, with international implications for Alaskan and Canadian indigenes;
- Industrial sprawl from collection and distribution pipelines, residence and work camps, roads, power and pump stations, etc.;
- Industrial-scale water needs that would drain ponds and lakes for many miles around every development site—all of them fish-spawning, nursery, or overwintering water bodies;
- The immeasurable aesthetic violation and disaster;
- And on, and on, and on.

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But I want to stop this catalogue of bad things that will happen in the Arctic National Wildlife Refuge—if it is opened to oil development. For I want to conclude with the wisdom of the Inupiat elders, whose principal goal is to pass on intact the homeland over which each generation temporarily exercises stewardship.

The views and values of these homeland people have capacity for infinite expansion and application to all special places, to the world in its entirety. The universal goal must be balance between the true needs of a stabilized humankind and sustaining natural systems. But there is nothing balanced about the current assault on the Arctic National Wildlife Refuge. In the present prodigal temper, industrial invasion would simply waste the refuge's oil. It would *define* the ephemeral, the primitive, the socially useless.

Let's hold on to this place. Let it stand for its own sake. The Arctic National Wildlife Refuge should be a marker, a symbolic turning point in the human condition, not a sacked industrial wasteland.

William E. Brown *is retired from the National Park Service. His column "Letter from Gustavus" appeared for many years in The George Wright Forum.*

Reminder: this column is open to all GWS members. We welcome lively, provocative, informed opinion on anything in the world of parks and protected areas. The submission guidelines are the same as for other GEORGE WRIGHT FORUM articles—please refer to the inside back cover of any issue. The views in "Box 65" are those of the author(s) and do not necessarily reflect the official position of The George Wright Society.

Roger Kennedy

The Human Element

*Ed. note: These remarks were delivered at the close of the National Park Service conference*Cultural Resources 2000: Managing for the Future, *held in Santa Fe, New Mexico, December 2000.*

My text for this morning's sermon is drawn from the gospel according to Henry David Thoreau and Wendell Berry. First, the familiar verse from Thoreau: "In wildness is the preservation of the world." And then the gloss put on it by Berry: "In human *culture* is the preservation of wildness."

With those texts in mind, let's talk about why your work is especially important at this moment to American society, and will always be important to this ravished yet still magnificent continent upon which we live.

Berry defines the work of the National Park Service, though without quite saying so, situating its role in society at the frontier between what is frequently stated to be "civilized," or "civic," or "urban," "urbane," or "cultural" activity—the adjectives all mean roughly the same thing—and what is often presented as essentially unaffected by humans—or "wild." Our qualities, as humans, are "cultivated." The quality of nature, while affected by human activity, is that which has not been so altered by that deliberate activity as to lose its essential "wildness." We all know that there isn't a square mile of this continent that hasn't been affected by humans, nor will there be one unaffected by what humans do henceforward. Nonetheless, let's stick with the artificial construct of a division between cultural and natural life just long enough to look up the word "culture" in the dictionary and see what it implies. Then we can get on to the moral consequences of re-defining it as Wendell Berry urges us to do.

The first usage is that which gives dignity to you as professionals—we use culture to mean "development of the intellect through *hard work* —training and development." From which comes the verb "to cultivate," as in: to *cultivate* a singer's voice, a teacher's skill, a rock climber's balance, a dancer's grace, the skill of a preserver of adobe buildings or the competency of an analyst of changes in the minnow population of a stream. You are cultivated people. You have worked hard to learn your professions. You spend years sharpening your skills. If you are superintendents, you derive from your own cultivation a profound

commitment to helping the people who work for you to improve their competency. You rejoice that the National Park Service has heeded E.O. Wilson's admonition to make use of the Advanced Studies Program, and such implements as the Bearss Fellowship, to go back to school and get better. You will of course see to it that these implements are used in the parks where you work, and maybe by yourselves. Because you respect yourselves, and revere your teachers, you want to make it easier for those who work around you to get better at theirs—to cultivate their competency .

You do this in the context of the knowledge, painfully gained, that there are people who want a *weakened* set of stewards for our parks, because they have designs upon those parks that are incompatible with high standards of stewardship. They want you either to be frail—inept, insufficiently trained, and therefore easily dismissed—or out of the way. They don't want you to cultivate your skills and help others to cultivate theirs.

These are not necessarily evil people. They are just impatient. They want what they want—and they do not hold stewardship to be very important if it gets in their way. Besides, you are professionals, and professionalism, cultivation, is insufficiently honored in this society. Because your adversaries do not revere the things you revere, and do not respect your work very much, whenever they increase in power you are required to show courage in demonstrating your faith in that work and in yourselves as professionals. Complacency is even less appropriate at this meeting, here in Santa Fe, than it was a few months back in St. Louis [at the Discovery 2000 Conference].

My theme is cultivation and professionalism; my conviction is that the National Park Service must be fully professional so that it may be continue to be a credible steward. The watchword *is* and *ought to be:* you can trust the National Park Service. To merit that trust, we must develop in greater numbers experienced and competent people who know they are the first line of defense of resource protection and of good science. Already, the people of NPS are the first teachers many Americans encounter on the ground—as soon as they leave home—to learn about biology and history.

Every person in this hall knows that competent resource protection begins with knowing what you're doing—doing with and to the resources for which you are the steward. Protectors are also expositors of applied science and applied history. Competent resource protection requires constant interaction with academic institutions and with "applied science"—science on the ground, tested and made useful. And explained to the public through effective education.

I've said it before and I'll say it again: resource protection has to walk out of the park in the heart of the visitor. Resource protection only

has staying power if it is also education.

The pride of Park Service people in their work as professionals must radiate outside the parks. Only if it is radiant, in that way, will it educate the public about the values that led to the establishment of the parks themselves.

There are calls to remove wilderness designation from many areas now protected. The best defense against these pressures are: unassailable professionalism in protecting resources, education, and constituency building. In a democratic system, that is where resource protection begins.

This leads me to the second primary meaning of the word "cultural" and to that interaction to which Wendell Berry calls our attention—an interaction among humans and non-human species, between human activity and natural processes. When he writes that "in human *culture* is the preservation of wildness," what does he mean by "human culture?" The dictionary says he must mean "the totality of socially transmitted behavior patterns, arts, beliefs, institutions, and all other products of human *work* and thought."

We've talked a little about human *work*—recognizing how much hard work there is in becoming and sustaining one's right to be heeded as a professional. Let's talk for the rest of our time together about how *beliefs* and *thoughts* may preserve "wildness."

First let's be clear about a fact so obvious and fundamental that it is seldom a subject of remark: wilderness does not know that it is wilderness. Humans know it is wilderness. Few eagles cogitate much about being wild. They are wild. We think about their wildness, and when they fly they carry our metaphors as additional weight upon their pinions. But they show little resentment, perhaps because they know that we are the concept-making species.

We may not make wilderness, but we have made up the concept of wilderness. Every natural phenomenon—from the soaring of an eagle to the reproduction of an amoeba, from the explosion of a volcano to the erosion of a granite outcrop, is seen by us through some kind of lens of our own creation. Microscopes and telescopes, cosmologies and chaos theories are our contrivances through which we observe nature. And here is my primary point: because we possess such contrivances as the toolmakers and concept-makers we are, because we have memory and are capable of anticipation—we are the responsible species.

We have moral obligations arising from competencies. What we have learned as we became professionals directs what we do with and to the other species with which we co-inhabit this earth—and to the inanimate earth itself. And as people who share a set of beliefs, as people who spring from a continuous culture, we have strong judgments upon what is mined, grazed, timbered, or pre-

served.

The job of the National Park Service is to stand between the eager visitor-learner—and we are all, wherever we are, visitors to this earth for our allotted span—and learners—and the natural world. We see that natural world through the lenses of our culture—through lenses ground and shaped by that "totality of socially transmitted behavior patterns, arts, beliefs, institutions, and all other products of human *work* and thought." And we can decide to preserve "wildness," by which we mean nature on its own terms, because we believe in certain fundamental principles, which are also cultural.

May I once again suggest that included in that "totality"—indeed, at its core, around which all else constellates and nucleates—is our religion—a *cultural* reality. We believe that we humans are not masters of the universe; we are not even masters of this *earth*. We are, instead, *co-inhabitants* of the earth with a multitude of other creatures. We are not masters, though we try to be good stewards of some portions of it which fall within our specific responsibilities. Of course from time to time nature brings us fire and flood and great winds to remind us of a central attribute of wildness which is more widely diffused outside of what we call wilderness than we in our pride like to admit—it is essentially beyond control. We do manage the way people act upon wildness, and when it has been too obviously ravaged we attempt to restore it to health. When the damage can be repaired without much intervention from us, or when that damage is imperceptible to us, we leave place alone.

When we were enduring, together, the last set of assaults upon wilderness and upon the parks, I suggested that among our caring allies were explicitly religious people. The central concept of religious life is the same as the central concept of wilderness preservation. That concept is a sense of scale, of human scale. We humans believe ourselves to be important, but not *all*-important. Religious people speak of ourselves as humbled in the presence of God; even the most secular of conservationists would admit, I think, that they often feel humbled in the presence of wilderness—a feeling that is deeper than *awe*—it can truly be said to be *reverence*. Most religious people think of the universe as intentional, as a creation—not necessarily all at once, nor necessarily taking only a week's time—but intentional. Therefore, all its parts have value, all it species, all its mountains, waters, fields, and oceans. Humans, in the religious tradition, are not the only significant species on this earth. *Our* orchards, farms, and woodlots are not the only places worthy of respect. All creation is worthy of respect.

That respect requires a moral focus, and a determination, culturally, that we resist the current and recurrent tendency of people living in market economies to become fascinated—obsessed indeed—with money, with reducing all values to money

values. Thomas Jefferson warned us of that; looking toward us, his posterity, he feared lest "the people will forget themselves in … making money," losing sight of larger and longer values. It is a noble endeavor to keep a check-book, but that is not the only Good Book. There are other applications for the human brain than counting. We should be good accountants, but we should also be good stewards.

We may recall that Daniel Boorstin, America's greatest living conservative historian, helped us understand that Jefferson was the philosophical father of the Endangered Species Act: "in his writings, we frequently come upon the appropriate verses of the Psalmist, 'O Lord, how manifold are thy works! in wisdom hast thou made them all: the earth is full of thy riches.'" And Jefferson himself wrote that "if one link in nature's chain might be lost, another and another might be lost, till this whole system of things should vanish by piece-meal."

When Boorstin or Jefferson write in that way, they recall to us the cultural tradition that unites them, Thoreau, Wendell Berry, and John Donne, a tradition that provides us with lenses with which to scrutinize the natural world. When we take off our glasses, remove those lenses, and hold them in our hands, we see in their inner surfaces ourselves reflected. We see ourselves as nature sees *us.* And we are reminded of that reciprocity of which Thoreau and Berry wrote, a reciprocity between the observer and the observed, between wildness, preserving us, and us preserving wildness.

With that interchange in mind, we may recall a passage from a sermon of Donne's. It provided to Ernest Hemingway a book title. It provides us with a text to set beside those of Thoreau and Wendell Berry, recalling to us the moral basis for our professional lives: "No man is an island, entire of itself; every man is a piece of the continent, a part of the main.... Any man's death diminishes me, because I am involved in mankind; and therefore never send to know for whom the bell tolls; it tolls for thee." And, looming beyond John Donne, are the great figures of an older and broader tradition, Saints Patrick and Francis, and Buddha among them, who remind us of other endangered species beyond our descendants: The tolling of the bell is for the death of any living thing; we are "involved" in all life.

Our "involvement" with other species of living things arises in part because we share with those species—indeed with earth, air, water and fire—a place in an intentional and not an accidental universe, in which all these, all animate species and all inanimate objects from stars to starfish, have a place.

"...if one link in nature's chain might be lost, another and another might be lost, till this whole system of things should vanish by piece-meal."

And so they might, friends, and so they might, one species after another.

Unless we rally round each other, and join with all others who acknowledge with us that the bell is tolling constantly now, tolling all day and all night without surcease, as species after species dies, creation after creation, friend in the earth after friend in the earth.

I urge, therefore, that we cultivate our competence the better to serve the cultural values we bring to this work, in order that we may serve all nature and some portion of humankind. It is true that the Organic Act of the National Park Service only requires that the people in its service sustain "unimpaired" the places put into their trust, but that Act is merely one expression of a cultural tradition requiring us to give heed to the seamless, coherent fabric of God's creation, in all its interlinked parts. Each of those parts is of ultimate value, each is essential, each cardinal, each indispensable. There is no surplus in God's creation.

All of us are conservationists; we would not be in our line of work if we were not. Some are secular conservationists. Others are religious conservationists, unabashedly affirming that our obligation arises from a due respect for this *created* universe. We are preservationists because we are in awe of the accomplishments of our predecessors in the American tradition and do not wish to lose a single cubic foot of the ground they hallowed.

The dictionary has helped us define our task—and our role as good stewards—by providing two meanings of the word "cultural." One reminds us that we are professionals. The other reminds us that we are citizens—standing in a great tradition.

Let us get on with our work—respectful of each other, as fellow-laborers toward a moral end, courteous even to those who bore us, or infuriate us, or who don't seem to "get it." We are fellow voyagers on a vessel which is heading into rough seas—we will need each other to man the oars and the pumps, and, if necessary, to repel the boarding parties. Indeed, we will require all the help we can get.

Much of that help will come from within, from our religious convictions, from our cultural values. They are the values that led us into this line of work.

Roger Kennedy, 855 El Caminito, Santa Fe, New Mexico 87501-2842

Russell J. Hall
Catherine A. Langtimm

The U.S. National Amphibian Research and Monitoring Initiative and the Role of Protected Areas

Introduction

In response to concerns about the worldwide status of amphibians (Alford and Richards 1999; Bury 1999; Daszak et al. 1999; Houlahan et al. 2000), Congress in Fiscal Year 2000 provided initial support to agencies of the U.S. Department of the Interior for research and monitoring of amphibians. Most funds came to the U.S. Geological Survey (USGS), but additional funds for the U.S. Fish and Wildlife Service and the National Park Service (NPS) were provided for activities that directly or indirectly support the amphibian research and monitoring effort. The goal of the program is to provide timely and reliable information on the status of U.S. amphibians so that causes of declines can be understood and appropriate management responses initiated.

The Interior Department was fortunate to have a cadre of scientists who had already conducted pioneering work to document and understand declines of amphibians, primarily in the western states. These scientists were enlisted along with hydrologists, geospatial analysts, database managers, and others to plan a comprehensive national effort. After several rounds of planning that ultimately involved scientists from a number of disciplines, representing both federal and state agencies, a comprehensive framework was developed to guide the program, now known as the U.S. Amphibian Research and Monitoring Initiative (ARMI).

The difficulty of the task and the limitations posed by available staffing and funding soon became clear. The roughly 200 species of amphibians dispersed across the vast land area of the USA encompass a diverse range of life histories, habits, and habitats, and share few common characteristics. Even if the scientists and technicians in the ARMI had the resources of an actual army, it seemed doubtful that they could effectively determine the status and monitor the well-being of the U.S. amphibian fauna without major innovations in methodology and organization. The realization that it would be impossible to simply build the new program on the model of past efforts led to a strategy that

seeks the active involvement of biologists and resource managers in all sectors of the public and private conservation community and that identifies a clear but highly restricted role for the federal science agencies. Paralleling this specified role for federal research scientists is a special role for protected areas. We believe that protected areas should play a vital role in all or most large environmental monitoring networks, and below we advance that argument from the point of view of the ARMI.

The Framework for Amphibian Research and Monitoring

The framework for the national ARMI is modeled on the 1997 Committee on Environment and Natural Resources (CENR) report *Integrating the Nation's Environmental Monitoring and Research Networks and Programs: A Proposed Framework* (CENR 1997). This report presents a pyramid model (modified in Figure 1) of research defined by different levels of geographic scope and intensity. At the base of the pyramid, planners envisioned a network of geographically extensive surveys, such as the development of state-based amphibian atlases, and broad-based activities, such as the amphibian call surveys coordinated by USGS as the North American Amphibian Monitoring Program (NAAMP). In the apex of the pyramid, intensive monitoring, research to develop and improve monitoring protocols, and development of baseline data useful at all levels would occur at a few "index sites." Occupying the broad middle range of the pyramid would be more extensive operational resource surveys conducted by state and federal agency personnel responsible for managing land units or tracking the status of species of special concern. Integration of these components would be achieved by agreement among participants to adopt certain protocols and share data, and through development of models that present a coherent view of the regional status of amphibians.

The role of the USGS scientists in the framework includes the following activities:

- **Field protocols.** Working at index sites, USGS scientists, in cooperation with others, will develop methods and protocols for inventory and monitoring, and will conduct research to test and improve the effectiveness of available protocols.
- **Disease and malformities.** The USGS National Wildlife Health Center will investigate disease and malformation problems and help to develop biosecurity plans to avoid inadvertent transmission of disease.
- **Species indentification.** The USGS will collect and maintain specimens, tissue samples, and genetic materials necessary to document species found in inventories, and attempt to ascertain the species of specimens not easily identified.

- **Monitoring at index sites.** Through intensive monitoring at index sites, USGS scientists will provide data to managers and others that may help in the interpretation of data collected at other sites.
- **Design and analysis strategy.** The USGS will develop sampling designs and strategies to implement the ARMI program nationwide, involving biometricians, statisticians, hydrologists, cartographers, geospatial analysts, and modelers, as needed.
- **Database management.** A national database at the USGS Patuxent Wildlife Research Center will serve as a repository for ARMI data and will make data available to scientists and the public on the Worldwide Web.

The Role of Protected Areas

Protected areas are a significant and essential component of large and comprehensive research and monitoring programs such as the ARMI. They are invaluable as index sites and often provide the physical and organizational settings for resource surveys (see Figure 1). Their multiple contributions are based on several qualities:

1. They can provide comparative sites for the evaluation of effects in less protected areas because they are insulated from many small-scale direct effects of human activities and thus can help distinguish these effects from large-scale natural and human-related events, such as storm damage, fire, global climate change, acid rain, and changes in regional hydrology patterns resulting from human manipulation or consumption.
2. Because many protected areas are actively managed for their natural resources, they offer the opportunity to study the effects of management practices on amphibian communities and populations.
3. Protection makes it likely that land units will retain their ecological integrity and will be available far into the future for continued monitoring and research on long-term trends.
4. By design or by chance, protected areas often harbor remaining examples of rare or declining species and biotic communities. In general, networks of protected areas include habitats and communities that are broadly representative of the regions in which they occur.
5. Protected areas have frequently served as sites for ecological studies or other kinds of environmental data collection, and when monitoring is co-located with on-going or past studies, it can often benefit from the knowledge developed in them.
6. Managers of protected areas have a vested interest in monitoring the status of resources under their protection and it may be advantageous to them to provide

material support to broadly based research and monitoring initiatives. Also, the management staff of protected areas often include biologists and other experts who can contribute local and regional knowledge that can enhance the quality of large-scale efforts such as the ARMI.

In recognition of the important role of protected areas in the ARMI, the four operational ARMI regions operational in 2000 (all seven will have been initiated by 2002) included surveys of at least 32 protected areas in their FY2000 study plans (Table 1). Specific examples of how a network of protected areas can be used in the ARMI program are discussed below.

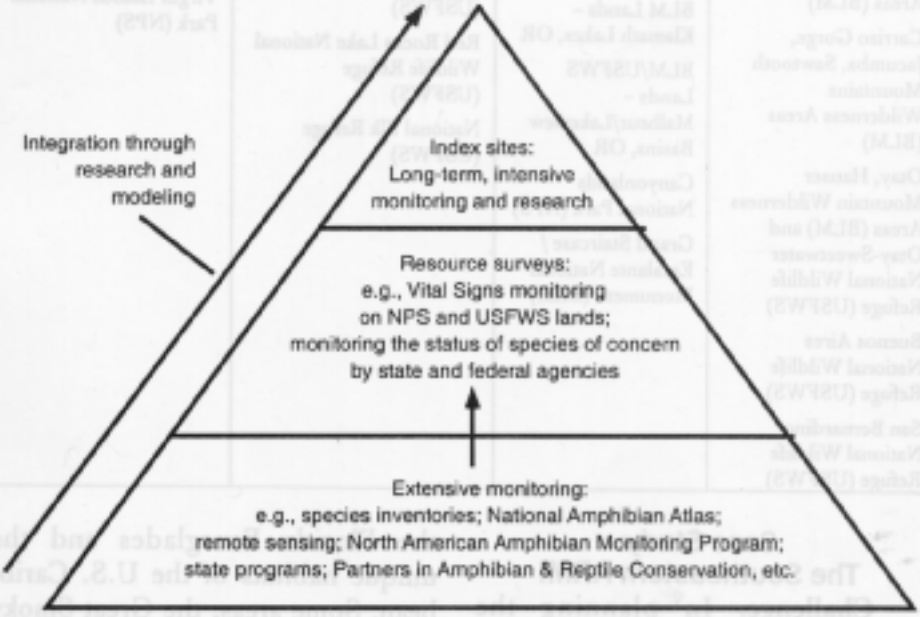

Figure 1. Conceptual diagram of the components of a national framework for amphibian monitoring in the United States, with surveys becoming more intensive and less extensive as one moves from the base to the apex of the pyramid. Activities at the different levels are integrated by: common databases and reporting; compatible protocols, analytical tools, training, and planning; research, which at all levels is guided by monitoring results; synthesis across ecological regions (National Atlas; synthesis reports); research on causes of change; and modeling.

Table 1. Major protected areas identified in FY2000 ARMI study plans.

ARMI Region			
Southwest	*Pacific Northwest*	*Northern Rocky Mountains*	*Southeast*
Yosemite National Park (NPS)	Olympic National Park (NPS)	Glacier National Park (NPS)	Great Smoky Mountains National Park (NPS)
Point Reyes National Seashore (NPS)	Crater Lake National Park (NPS)	Theodore Roosevelt National Park (NPS)	Okefenokee National Wildlife Refuge (USFWS)
Santa Monica Mountains National Recreation Area (NPS)	National Wildlife Refuges – Willamette Valley, OR (USFWS)	Yellowstone National Park (NPS)	Everglades National Park; Big Cypress National Preserve (NPS)
San Gorgonio and Bighorn Wilderness Areas (BLM)	Redwood National Park (NPS)	Grand Teton National Park (NPS)	Virgin Islands National Park (NPS)
Carrizo Gorge, Jacumba, Sawtooth Mountains Wilderness Areas (BLM)	BLM Lands – Klamath Lakes, OR	Grays Lake National Wildlife Refuge (USFWS)	
Otay, Hauser Mountain Wilderness Areas (BLM) and Otay-Sweetwater National Wildlife Refuge (USFWS)	BLM/USFWS Lands – Malheur/Lakeview Basins, OR	Red Rocks Lake National Wildlife Refuge (USFWS)	
Buenos Aires National Wildlife Refuge (USFWS)	Canyonlands National Park (NPS)	National Elk Refuge (USFWS)	
San Bernardino National Wildlife Refuge (USFWS)	Grand Staircase / Escalante National Monument (BLM)		

Case Study: The Southeastern ARMI

Challenge. In planning the southeastern component of the ARMI, we faced some significant challenges. At least 141 species of amphibians occur in the southeastern USA, not counting putative species identifiable only by genetic analysis.

Landscapes range from the high peaks of the southern Appalachians, to the swamps of the coastal plain, to the Florida Everglades and the unique habitats of the U.S. Caribbean. Some areas, the Great Smoky Mountains and the Okefenokee Swamp for example, may have up to 40 amphibian species each, while sharing fewer than 10 species between them. Species range from those that never leave the water to those that are entirely terrestrial, and include many that undergo dramatic shifts in ecological relationships as

they transform from aquatic to terrestrial life stages. A practical consequence of this diversity is difficulty in identification; some amphibian species cannot reliably be distinguished in hand, even by experts. Also problematical is the fact that the places with the greatest diversity of amphibians are often poorly accessible to researchers. The high altitudes of the southern Appalachians and the trackless expanse of the Everglades and Big Cypress are but two examples of places poorly accessible by normal modes of transportation. Yet another problem results from the great differences in abundance seen across the range of southeastern amphibians: rare or isolated species may be restricted to a single mountaintop, whereas other species such as the green and squirrel tree frogs *(Hyla cinerea* and *H. squirella),* are so abundant and ubiquitous within their broad geographic ranges that measuring abundance is nearly impractical.

These challenges and the limited resources available for the southeastern ARMI made it necessary for us to select broadly representative index sites. The sites selected—Great Smoky Mountains National Park, Okefenokee National Wildlife Refuge, the Everglades National Park–Big Cypress National Preserve complex in South Florida, and Virgin Islands National Park—

A salamander, *Plethodon jordani,* found in Great Smoky Mountains National Park. USGS photo.

encompass much of the diversity of southeastern amphibians. Three of the four are part of the PrimeNet program, a shared NPS–U.S. Environmental Protection Agency effort that measures and monitors air quality in 14 parks nationally. Co-location of PrimeNet and ARMI sites is an opportunistic effort to benefit from environmental data collected for different, although not unrelated, purposes. In FY2000, NPS supported inventories of amphibians in ten of the PrimeNet Parks nationwide, and these have been integrated into the ARMI program. Funding for the southeastern ARMI was sufficient to support major efforts in only four primary sites in any given year, but the availability of NPS funds for inventories in the Great Smokies, Everglades, and Virgin Islands parks permitted the USGS to get an early start on these important areas.

Great Smoky Mountains National Park, a World Heritage Site, is of special importance because it represents a region regarded as a major center of evolution and distribution of lungless salamanders, and it has long attracted the interest of amphibian specialists (Huheey and Stupka 1967). Moreover, in FY2000 the USGS Florida Caribbean Science Center was in the final year of a three-year effort supported by the USGS–NPS Prototype National Park Monitoring Program to develop an amphibian monitoring program for the park. Despite the significant efforts devoted to Smokies amphibians in the past, USGS biologists have recently discovered species formerly not known from the park and rediscovered species that had not been recorded there for as long as 40 years.

Okefenokee National Wildlife Refuge is another site of special importance in that it comprises 80% of one of the world's largest and most significant wetlands. It is being considered for nomination as a World Heritage Site and is a Ramsar Wetland of International Significance. Although its diversity of amphibians approaches that of the Great Smoky Mountains, its dominant amphibians are frogs rather than salamanders. Like the Smokies, the Okefenokee swamp has been the site of surveys and research on amphibians in the past (e.g., Wright 1932), but, as in the Smokies, surveys and research have been neither systematic nor fully representative of habitats present. Much of the swamp is inaccessible, so, aided by past studies that have provided excellent delineation and characterization of habitats, we will use a stratified sampling scheme to adequately sample all amphibian populations likely to occur on the refuge.

The Everglades–Big Cypress complex in South Florida has a lower diversity of amphibians than the Smokies or the Okefenokee, but they represent a unique ecosystem and a biological region subject to unique driving forces. Native species in South Florida are a subset of those

found in the more diverse sites, but the area has three or more established nonindigenous species of amphibians and the interaction of these species with native biota is of interest. There is much available data on the ecology of the greater Everglades (which, like the Smokies, is a World Heritage Site). Excellent maps and physical science information are available, and other on-going studies in the physical and biological sciences are likely to add to the value of our findings on amphibians. With the recent approval of plans to restore the Everglades to its natural hydrology, scientists will be studying all aspects of this historic management action.

Virgin Islands National Park on the island of St. John is the smallest of the protected areas chosen for study and has the smallest number of amphibian species, but its combination of native Caribbean and introduced amphibian species is far different than that found anywhere on the mainland. Although less studied than our other index sites, it is better known biologically than most of the U.S. Caribbean.

Conceptual approach. Available methods for inventorying and monitoring amphibians are inadequate to

A southern toad, *Bufo terrestris*, found in the Okefenokee National Wildlife Refuge. USGS photo.

meet needs in the Southeast. Published protocols and manuals developed for conducting inventories and monitoring of amphibians (e.g., Heyer et al. 1994) do not address the problems of scope, scale, and synthesis needed for design of a program intended for implementation across the entire USA, and these methods seem particularly lacking when it comes to addressing the diversity and abundance of amphibians of the Southeast. We need methods that do not require technically sophisticated field surveys; that can be tailored to different kinds and configurations of habitats, landscapes, and amphibian communities; and that are potentially transferable to persons and organizations who are not specialists in amphibian biology.

We in the southeastern ARMI have been fortunate to recruit an outstanding team of biometricians who are working with us to develop protocols that are statistically sound, regionally and nationally comparable, but flexible and relevant at different locales. The approach we are taking eschews attempting to achieve the nearly impossible objective of estimating abundance of amphibians on a species-by-species and population-by-population basis, and relies instead on the more reliably and easily obtained data of presence or absence of species within habitats and communities across the landscape. From this data, the proportion of area occupied by selected species can be estimated and changes can be monitored over time. Communities of amphibians can also be monitored for changes in species richness. This approach will be augmented with focused monitoring of sentinel species or species and populations of special concern, and this is the second area of protocol development. Critical issues in protocol development include how to spatially sample the landscape and how to estimate what proportion of an amphibian community or population may go undetected in sampling. Poor spatial representation and not knowing what fraction of the community or population was missed during sampling can both seriously flaw conclusions drawn from monitoring, and compromise actions taken in response to those findings.

Benefits for managers of protected areas. Our conceptual approach for the southeastern ARMI provides for a series of statistically rigorous inventories that produce lists of documented species, some measure of habitat association, and estimates of species present but not observed. The inventories alone should have value to managers in that they can help to identify species of special concern, habitats important for those species, and areas or types of habitats deserving of special protection because of their importance to amphibians and wildlife in general. Repeating these protocols over intervals of time can provide managers with statistically reliable indications of change in the local distribu-

Weighing a captive frog in the Okefenokee National Wildlife Refuge. USGS photo.

tion and abundance of amphibians, alert them to degradation of habitats or other changes that result in losses of biological diversity, and lead to implementation of management remedies. Repeating such inventories over intervals of space can provide a regional context to observed changes and can serve managers by distinguishing changes occurring locally from those resulting from broad regional or even global trends. Better knowledge of the origins and extent of environmental change may help managers to devise actions that will correct, mitigate, or encourage such change as appropriate to their conservation goals.

Complementary Objectives of ARMI and the Land Protection Agencies

The framers of the ARMI see themselves as working in concert with land and resource protection agencies in that both rely upon inventory and monitoring to determine the condition of the protected resources and to explain how and why these conditions may change. Information generated in inventory and monitoring programs like the ARMI can lead to regional and national assessments and at the same time to development of management plans specific to protected areas. While scientists and managers participating in the ARMI program may view their short-term goals differently, the information resulting from the program can provide meaningful input and insights on a wide variety of scientific, resource management, and conservation issues. Such information may be essential to land managers in fulfilling their mandates for protection. For example, the National Wildlife Refuge System Improvement Act of 1997 requires the U.S. Fish and Wildlife Service to develop comprehensive conservation plans for all refuges to ensure protection of living resources, based in part on programs to monitor the status and trends of fish, wildlife and plants. If the ARMI achieves its intended role, it will enlist scientists from a variety of academic, governmental, and other research organizations who can also lend their efforts to solving a broad range of problems. Because the ARMI and the agencies responsible for protecting the nation's natural heritage share so many objectives, enlistment of additional land protection agencies into the ARMI effort will produce benefits for all partners.

Ed. note: You can follow the progress of ARMI through the USGS Florida Caribbean Science Center Web site http://www.fcsc.usgs.gov/.

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Russell J. Hall and **Catherine A. Langtimm,** U.S. Geological Survey, Florida Caribbean Science Center, 7920 NW 71st Street, Gainesville, Florida 32653; russ_hall@usgs.gov, cathy_langtimm@usgs.gov

James P. Bennett

Searching for Biological Specimens from Midwestern Parks: Pitfalls and Solutions

Introduction

This paper describes the results of searches of herbarium and museum collections and databases for records of vertebrate and vascular plant specimens that had been collected in 15 midwestern National Park System units. The records of these specimens were previously unknown to the National Park Service (NPS). In the course of our searches, numerous obstacles were encountered that prevented us from fully completing our task. These ranged from difficulties with the way databases are structured, to poor record-keeping, to incomplete or incorrect information on the actual location of specimens within collections. Despite these problems, we are convinced that the information to be gained from such searches is invaluable, and we believe that our experience, and the recommendations we offer, may well prove instructive to others undertaking this kind of work.

NPS is responsible for administering lands that contain natural resources of value to the USA. In the midwestern part of the nation, some of the lands are particularly important for managing and preserving natural prairies and woodlands of the Mississippi River Valley and the surrounding region. Parks in this "Heartland Network" are shown in Table 1. These 15 parks range from just under 200 to almost 95,000 acres in area, and occupy a total area of 234,191 acres.

Plant inventories for some of the parks are not complete (Bennett 1996). The status of animal inventories is summarized in the NPS Midwest Region status of inventories report. Inventories are typically based on anecdotal records of species (sight records), although a few may have voucher specimens as their basis (e.g., Hopewell Culture; Bennett and Course 1996).

Recently, NPS has become interested in determining if there are voucher specimens for plants and animals collected in the parks, either before the park was authorized or afterwards. Park records of specimens collected using the NPS permit system are incomplete and unreliable, particularly in earlier years.

Repositories of plant and animal specimens (herbaria and museums,

Table 1. The 15 National Park System units in the Heartland Network.

Park	Year authorized	Acreage
Arkansas Post National Memorial (Arkansas)	1960	389
Buffalo National River (Arkansas)	1972	94,309
Cuyahoga Valley National Park (Ohio)	1974	32,525
Effigy Mounds National Monument (Iowa)	1949	1,481
George Washington Carver National Monument (Missouri)	1943	210
Lincoln Boyhood National Memorial (Indiana)	1962	200
Herbert Hoover National Historic Site (Iowa)	1965	187
Homestead National Monument of America (Nebraska)	1936	195
Hopewell Culture National Historical Park (Ohio)	1923	1,130
Hot Springs National Park (Arkansas)	1832	5,549
Pipestone National Monument (Minnesota)	1937	282
Pea Ridge National Military Park (Arkansas)	1956	4,300
Tallgrass Prairie National Preserve (Kansas)	1996	10,894
Ozark National Scenic Riverways (Missouri)	1964	80,790
Wilson's Creek National Battlefield (Missouri)	1960	1,750

respectively) exist throughout the USA, and are typically found at colleges and universities, while a few exist as separate institutions. Some have been in existence longer than the parks, and collectors typically deposit specimens at such repositories to guarantee a long life for the collection. It is highly likely, therefore, that there exist collections of specimens from these national parks that are unknown to the NPS. The agency would benefit from the knowledge of these specimens in at least eight ways. Such knowledge would:

- Make the species inventories specimen-based;
- Make inventories more complete;
- Aid in understanding vegetation changes through time;
- Help determine the effects of management;
- Determine if particular species are no longer found in the parks;
- Aid in ecological restoration projects;
- Document previously unknown collecting activity; and
- Aid in understanding the history of the area.

Objectives

This project was initiated to search selected herbarium and museum collections and databases for records of vertebrate and vascular plant specimens collected in the 15 Heartland parks. The objectives

were to:

- Improve our knowledge of park biota by tracing unknown collections and locating specimens;
- Gather collection-level data for newer collections;
- Gather specimen-level data for older collections; and
- Assemble such data in a format usable to NPS for inclusion in the NPSpecies database.

Methods

Collections on the Worldwide Web. The study began by consulting the Natural History Collections Database, compiled for the NPS Midwest Regional Office by Susan Gucciardo (2000). This database provides statistics on flora and fauna repositories in the USA, including Universal Resource Locator addresses for those repositories having Web sites. Some of these Web sites could access the database of the repositories' collections, while others had no links at all. Each one was viewed, and those which were searchable were searched by park name/locality, or by county or state name, if possible.

Next, the database was filtered to include only those repositories which had placed information on their collections into a database, although they had Web site access to the information. This list was then reviewed for relevance and usefulness to the project. Approximately ten institutions were selected and all were contacted by phone or e-mail, with varying degrees of success. The names of all contacts and the status of the computerization of the collections were recorded in a Microsoft Excel spreadsheet / database.

Collection site visits . It was discovered that the Zoological Department of the Field Museum in Chicago had a complete database of their specimens, but the staff did not have time to query it for this study. Therefore, a trip was made to the museum in order to perform queries of the database on-site. Although there was a locality field in the database, the staff member we consulted was not sure if it had ever been used when entering data. Queries were thus performed for each county in which the 15 Heartland parks are located, and the results printed out.

Because the Field Museum also has extensive botanical collections, the Herbarium staff was consulted to determine a method to search the non-databased specimens. First, the collector's log book was studied to determine if links could be found between collectors and the parks, but such information was not recorded there. Second, the folders containing a common grassland species, *Bouteloua curtipendula*, were searched manually for those counties in which the Heartland parks are located. Three were found, but the labels did not give specific locality information. This species was picked at random and no others were tried. No published list of specimens from any of the 15 parks was ever found that referred to them being deposited in the Field Museum.

A site visit to the Missouri Botanical Garden (MBG) in St. Louis was made specifically to look for specimens from Hot Springs National Park collected by E. J. Palmer in the 1920s and 1930s. The original reference to these specimens (Palmer 1926) was discovered in the park archives by the park historian. One day was spent by at the MBG's Monsanto Center searching for woody plant specimens of half the species in the 1926 Palmer report. The curator of the herbarium printed out the records for all the Palmer collections from Arkansas that were in the herbarium database. These were searchable on the Web, but a search would have taken too long to do because the Web site does not allow multiplex searching by several fields.

Floristic references . It was thought that references providing historical narratives on collecting in the parks would be useful, because non-computerized institutions could search for species names that the collectors had recorded, and collectors' names could be entered into databases without locality queries being available. Floras of all states in the study were consulted for this purpose. The bibliography information was then recorded along with a code to explain how the text relates to this study.

Natural Heritage Inventories . The Natural Heritage Inventories of the eight states in the study were considered to be possibly valuable sources. Since the inventories have information on which species are rare in the state, it was thought that, consequently, they might also have information on historical collections of those species. The eight Natural Heritage Programs were contacted by letter, telephone, or fax, and each was requested to search its database for information relating to the parks of the state. The results from those who responded were also recorded in the Excel spreadsheet.

Index Herbariorum. The latest *Index Herbariorum* (Holmgren 1990) was consulted, and all herbaria in the USA were evaluated based on the information on collections provided there. An attempt was made to contact all herbaria that appeared to be useful to the study. All attempts were recorded in the Excel database. In cases where contact attempts were successful, the status of the computerization of the collections in those herbaria was recorded. For herbaria with adequate databases, searches of collections were performed by the herbarium staff.

Park managers . It was necessary to contact resource managers of ten of the fifteen parks in order to refine the reference list provided in the proposal for this project. It was not clear whether the references were already known to the park, or were to be considered leads for further searching. Some managers had more to add to the list of references, others said it was complete, and still others said that many of the collections of the listed studies were not known. The suggestions given by the re-

source managers were then undertaken.

NPS Natural Resource Bibliography. The NPS Natural Resource Bibliography on the Web (NPS 2000) was searched for each of the 15 parks and relevant references, if any, were recorded.

Automated National Catalog System (ANCS) records. A file containing records of specimens from the ANCS listings for 10 of the 15 parks was reviewed for specimens that were not on-site at the parks. All the repositories listed for off-site specimens were contacted for information about the specimens and others that may be at the repositories.

Latitude and longitude searches. No searches using park latitudes and longitudes were performed. Only one herbarium Web site was searchable via latitude and longitude, but it was not necessary to use those coordinates because it was also searchable by park name. A few other repositories allowed searches by park latitude and longitude, but no results were found.

Results

In the time allotted to this project, 329 sources of specimen information were evaluated for the 15 parks (Table 2). In the final report of the project as submitted to the NPS Midwest Regional Office, an appendix was included containing a complete listing of the 329 sources with information on each, extracted from the Excel file. The appendix (which had to be omitted from the present paper because of space considerations) also contains hot links to other files, all of which are provided with the final report in the form of computer files at a file transfer protocol (FTP) site: http://www.ies.wisc.edu/pub/jpbennet/NPS. Access to these files does not require a password. Instructions for using the files are provided at the FTP site. The appendix does not contain fields for specific collector names or collection dates because the sources do not consistently have this data. For example, collector names are not available for the Tulane University or University of Kansas collections, and the dates are not available for New York Botanical Garden collections. The information displayed in each hotlink is the total amount of data recovered from the source, and any missing information is simply not available.

The individual park for which we found the greatest number of sources was Hot Springs, with 30 sources (9% of the total). Homestead had the least, with 8 sources (2% of the total). Individual parks averaged about 18 sources.

The sources fell into two groups: computerized data sources and literature sources. The characteristics of the source, and the degree of usefulness of each, were coded and are shown in Table 3. These codes are used in the appendix for brevity. Almost a fourth of the sources were computerized databases that could be searched on-site, but not via a Web site. Almost a fifth were collections that were not computerized in

Table 2. Number of sources of specimen data for the 15 parks. The category "All 15 parks" includes sources of data that could be searched for all the parks in the study, not just a single park.

Park; number of data sources			
Arkansas Post	17	Hot Springs	30
Buffalo	24	Lincoln Boyhood	16
Cuyhoga Valley	24	Ozark	14
Effigy Mounds	18	Pea Ridge	19
George Washington Carver	14	Pipestone	17
Herbert Hoover	18	Tallgrass Prairie	17
Hopewell Culture	21	Wilson's Creek	12
Homestead	8	*All 15 parks*	*60*
			Grand total = 329

Table 3. Number of sources by characteristic code for 329 specimen data sources.

Code	**Number of sources**	**Code explanation**
0	61	0 = Collections are not computerized in any way; no database at all.
	21	
2	76	1 = Collections are currently being entered into a database but are not yet searchable, even on site.
3	17	
4	33	2 = Collections are databased and can be searched on site, but not via a Web site.
5	2	
A	31	3 = Collections are searchable through the Web but not through search fields that are useful, or specimens that are useful have not been entered into the database.
B	6	
B,C	1	
C	18	4 = Collections are fully searchable through remote access on Web site.
C,D	2	
D	6	5 = Web site only describes collections but does not allow searches.
E	2	
F	2	A = Text contains no search leads.
G	3	B = Text contains some vegetation distribution by county.
H	2	C = Text contains some history of past collectors.
I	1	D = Text listed where a collection/voucher specimens is/are located.
n/a	2	
nc	43	E = Text mentions that live specimens were released, or that data was observational, i.e., no collections were made.
		F = Text contains flora/fauna distributions by some area other than county but none of particular relevance to this study.
		G = Text implies a collection was made but does not provide further information.
		H = Text lists species present or provides an inventory.
		I = Text not seen, but collections were found serendipitously at MBG and University of Missouri.
		n/a = Not applicable.
		nc = No contact made.

any way at all. Ten percent were fully searchable on a Web site. Thirteen percent of the sources were not contacted. Six percent of the collections were being entered into a database but were not yet searchable. Ten percent of the literature sources provided no leads at all as to collections, while 5% provided some history of collecting. Five percent of the searchable collections did not have useful search fields or specimens entered that were relevant to this study.

We were able to retrieve record information from 56 sources (17%) (Table 4), with Hot Springs having the greatest number. All parks had some record information, although Lincoln Boyhood had the smallest, with only one source.

The 56 sources contained a total of 3,292 specimens representing 991 species across all 15 parks. It is not known if there are duplicates in these tallies, so the actual numbers may be lower. Time did not allow us to break down the species and specimens by park. However, the breakdown by biotic group is shown in Table 5. This table is a bit misleading because the herpetofauna and mammal sources are mostly all one source, the University of Michigan collections, and are repeated for many parks. The plants group are actually the largest category of specimens and collections (17%), followed by birds at 12%.

A tabulation of results by source and park is shown in Table 6. Fifteen sources contained specimens or specimen data from all the parks in the study.

The 56 sources are hotlinked in the final report's appendix. Some of these sources are actual Excel spreadsheets in native format from the source and have not been edited. Many contain county-level information only, and each park will have to determine individually if the records refer to specimens from within park boundaries. Other hotlinks are for Microsoft Word text files or images of texts. Some of the hotlinks are only for the first page of a set of records because including the entire original document would have been prohibitively long. All originals will be sent to each park and the NPS Prairie Cluster long-term ecological monitoring office for their files.

As a result of contacts found in *Index Herbariorum*, some curators were able to provide helpful information. For example, Iowa State University provided bibliographic information on many studies performed in the Iowa counties of Allamakee and Cedar, in which Effigy Mounds National Monument and Herbert Hoover National Historic Site, respectively, are located. These studies often mentioned the location of voucher specimens, although no subsequent action could be taken because the repositories mentioned were not computerized, and it was too late in the study for travel to those locations. Also, the herbaria are too understaffed to search for hundreds of specimens by hand.

Table 4. Number of sources from which records were retrieved for the 15 parks. The source category "All 15 parks" (see Table 2 caption) contained no source records because once records were found for a particular park, that information was moved to the park category to which it belonged.

Park; number of data sources from which records retrieved			
Arkansas Post	2	Hot Springs	9
Buffalo	5	Lincoln Boyhood	1
Cuyhoga Valley	5	Ozark	5
Effigy Mounds	2	Pea Ridge	4
George Washington Carver	5	Pipestone	5
Herbert Hoover	2	Tallgrass Prairie	4
Hopewell Culture	2	Wilson's Creek	2
Homestead	3	*All 15 parks*	*0*
		Grand total = 56 (17% of 329 total sources)	

Table 5. Number of record sources by biotic group.

Biotic group; number of record sources			
All	1	Herpetofauna	13
Birds	7	Mammals	19
Bryophytes	5	Plants	10
Fish	1	**Grand total**	**56**

A large amount of specimen data was found for two parks: Pipestone and Hot Springs. For Pipestone, we were able to locate label data for almost 500 specimens at the University of Minnesota Herbarium. These specimens contained "Pipestone National Monument" in the management area field, and were fully searchable at the Web site. However, twenty-five records were viewable on a screen, and it was not possible to download the results of the search from the Web site. We contacted the database manager with a request for the full query results, and these were sent by e-mail at no charge. The Pipestone records represent the best retrieval of all the parks in the study, and are the model which other collection institutions should follow. The complete set of Pipestone records are in an Excel spreadsheet as part of the final report to NPS.

It appears that there has been a lot of collecting activity at Hot Springs for some time. The park provided a list of collectors dating back to 1804, and we were able to locate specimens gathered by one of the collectors, E. J. Palmer. We also discovered collections by another botanist, Delzie Demaree, of whom park officials had no knowledge. There is also evidence of collections by H. R. Gregg at the National Herbarium in Washington, but we were unable to verify their existence.

The earliest collections from Hot Springs were those of Palmer in the early 1920s. Palmer published findings on specimens of the woody spe-

Table 6. Specimen collections from the 15 parks by source and biotic group.

Source	Biotic Group	Parks	Completeness
Cleveland Museum	Plants	Cuyahoga Valley	Complete
Field Museum	Birds	Arkansas Post, Buffalo, Pea Ridge, Pipestone, Ozark, Homestead, Cuyahoga Valley	Complete
Field Museum	Mammals	Hot Springs, Herbert Hoover	Complete
Kansas State University	Plants	Tallgrass Prairie	Complete
Minnesota Natural Heritage Program	Many	Pipestone	Complete
Missouri Botanical Garden	Plants	Hot Springs	Incomplete
New York Botanical Garden	Bryophytes	Buffalo, Hot Springs, Pipestone, George Washington Carver, Ozark	Complete
Smithsonian	Plants	Hot Springs	Incomplete
Truman State University	Plants	George Washington Carver, Ozark	Complete
Tulane University Museum	Fish	Buffalo	Complete
University of Arkansas at Fayetteville	Mammals	Hot Springs	Complete
University of Kansas	Mammals	Buffalo, Pea Ridge, Effigy Mounds, Herbert Hoover, Tallgrass Prairie, Pipestone, George Washington Carver, Ozark, Wilson's Creek, Cuyahoga Valley, Hopewell Culture	Complete
University of Michigan Museum	Herpetofauna	Arkansas Post, Buffalo, Hot Springs, Pea Ridge, Lincoln Boyhood, Effigy Mounds, Tallgrass Prairie, George Washington Carver, Ozark, Wilson's Creek, Homestead, Cuyahoga Valley, Hopewell Culture	Complete
University of Michigan Museum	Mammals	Pea Ridge, Tallgrass Prairie, George Washington Carver, Homestead, Cuyahoga Valley	Complete
University of Minnesota Herbarium	Plants	Pipestone	Complete
University of Missouri	Plants	Hot Springs	Incomplete

cies he collected (Palmer 1926), but not on those of the herbaceous species. He stated that the woody specimens were deposited at the Arnold Arboretum, the MBG, and the University of Arkansas. A visit to the MBG located 115 records in their database of Palmer specimens from Garland County, many with the phrase "hot springs" in the locality field. However, of these 115 records, only 11 of the specimens were actually at MBG, because the remainder are located at the University of Mis-

souri Herbarium in Columbia. The MBG database includes the University of Missouri records, so both are retrieved. The MBG database only contains about one-quarter of all the specimens at MBG because it is not yet complete. A physical search of part of the MBG herbarium for Palmer specimens using the woody species mentioned in Palmer 1926 located 20 out of 35 taxa.

A search by the curator at University of Missouri located 97 Palmer specimens, even though MBG listed 111. Some of the supposed University of Missouri specimens in the MBG database were actually physically at MBG, which could explain the discrepancy. Another search at the university also located some of Palmer's Hot Springs specimens from the 1930s. A search of the National Herbarium's type database, which is on the Worldwide Web, located two Palmer isotype specimens from Hot Springs. These are very important specimens for the park. Finally, findings on the herbaceous specimens that Palmer 1926 refers to were never, to our knowledge, published. The only way to discover these specimens is by manual searching of the herbarium, but without a species list it may not be possible. Only a few of them can be retrieved using the printouts from each herbarium.

Another collector at Hot Springs was H. R. Gregg. Park officials provided a 1935 list of 451 specimens from the park that are supposedly deposited at the National Herbarium, but this can only be verified by a visit there.

Finally, a specimen collected by Demaree in 1942, with "Hot Springs National Park" actually written on the label, was located by chance at MBG (Figure 1). Curators at MBG and University of Missouri were able to retrieve records for Demaree collections at both herbaria. The park had no record of Demaree collections. Those Demaree specimens which are in the two databases can be incorporated into the park's database, but others will have to be searched for manually.

It should also be pointed out that MBG may not contain all the Palmer and Demaree specimens they are supposed to have because some of them may have been deaccessioned by Robert E. Woodson during his tenure as herbarium director in the period 1948-1963 (Solomon 1998). Some specimens therefore could have been transferred to any of 68 other botanical institutions during this period, and it may not be possible to locate them.

Discussion

In three months of searching for specimen records we were able to locate 329 sources of data, and found specimen records in 56 (or 17%) of them. This is not a very high return rate. A more acceptable rate of return would be closer to 50%. This low rate of return is due to a number of factors, including technological limitations at specimen repositories, poor communication by repository

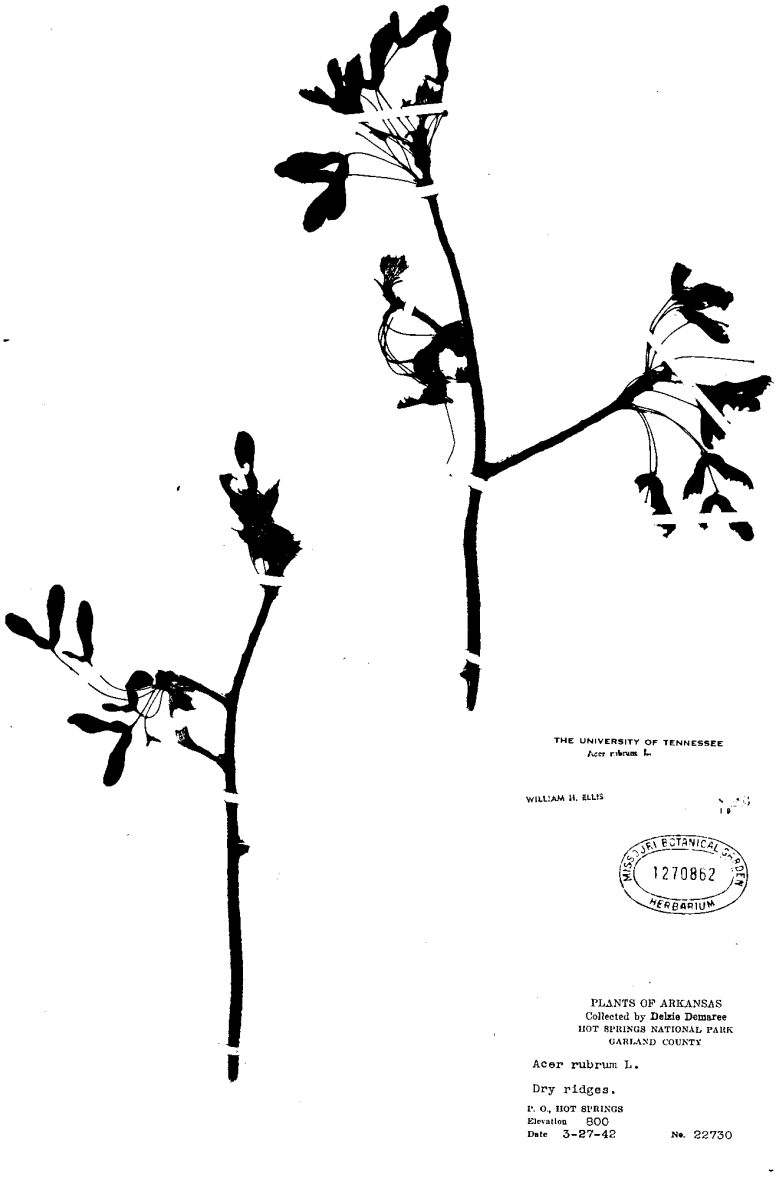

Figure 1. Red maple specimen collected by Delzie Demaree, 27 March 1942. Note that it is specifically labelled as having been collected in Hot Springs National Park. Missouri Botanical Garden Herbarium specimen #1270862.

officials, incomplete record histories, and the lack of time to concentrate on a single park because the project scope included 15 parks.

We found more specimen data for plants than for animals. This may be due to the investigators' greater familiarity with herbaria, the fact that there are more herbaria in existence than museums, that more herbaria are computerized, or that there are more plant specimens in existence.

Although we found only one source of data for Lincoln Boyhood, it was encouraging that we found specimen data for every park in the study. This is an indication that national parks are attractive to collectors and that there is a good chance that data do exist for any park under study. More investigation may turn up even more sources for these parks.

The quality of the data is highly variable, ranging from detailed label information that includes the park name in a field, to lists of species with no label information at all. Label information fields are inconsistent among repositories, as there is no standardization between them. Even though we were able to collect data for almost 3,300 specimens, there is little we could do with it because of the lack of standardization. Each collection will have to be hand-entered into NPS databases because there is no way to automate the process.

In addition, historical collections, when found, often have very incomplete data associated with them. Label information is very sparse, and location data is often non-existent. It is very rare to find specimens with park names or township, range and section identifiers. One specimen may require a day or more of research just to determine its geographic location.

We were unable to tally the number of species and specimens by each park from this data. This is because some of the collections sources are for more than one park. We did not have time to break out the specimens by park in these sources.

Some of the sources contain data that is specific to the county level only, not to the park level. This means some of the specimen data may not be useful at all because the specimens may not be from parks. These records will have to be checked by park officials before they can be useful.

Recommendations

Our first recommendation is to not conduct similar searches in the future for more than one park. Our survey of 15 parks led to constant confusion about which source was for which park. We were unable to concentrate our efforts because we were trying to find records for so many parks. A higher rate of return would be more acceptable, and could be achieved, if the focus were on one park instead of many.

Our second recommendation is to have searches performed by subject-matter experts. Our expertise is in botany, and we were able to locate botanical specimens easily and accurately. Our success with animal specimens was not good because our familiarity with the subject was not

expert.

Third, future searches should include more time for manual searches based on species lists from published sources. Many collections are still not yet computerized or Web-enabled, and on-site searches will be more productive. Of the 15 parks we studied, the one that would benefit the most from a more detailed study of off-site specimen collections is Hot Springs. This study uncovered what appear to be very site-specific collections that are sufficiently documented to merit further study. Some of the specimens are known by species and repository.

Twenty-three specific recommendations by park and specimen repository are listed in the spreadsheet version of the final report's appendix. These recommendations refer to both complete and incomplete searches, and are too detailed to summarize in a narrative. Future work could include follow-up investigations of the incomplete searches, either by resuming the contacts to determine if more computerization has been performed, or carrying out the recommendations listed in the final report's appendix.

For Hot Springs, the Palmer and other collections at MBG, University of Missouri, and the Smithsonian can be completed by following these steps:

1. Complete the inventory of woody specimens by manually searching for them in the herbaria using the published list.
2. Locate the herbaceous specimens using computer lists from the herbaria. Specimens not yet computerized cannot be located.
3. Locate specimens collected by Demaree at MBG and University of Missouri using computer lists from the herbaria. Determine if there are any at the Smithsonian.
4. Locate specimens collected by Gregg at the Smithsonian using the list from the park.

Specimens not yet computerized in any of these herbaria that are not on published lists cannot be located except by chance. Specimens that have been deaccessioned by any of the herbaria probably cannot be located at all. The four tasks outlined above, however, would add considerably to our knowledge of off-site Hot Springs collections.

Conclusions

This project began with a worthy goal: discover specimens of plants and animals from national parks that the parks have no knowledge of. The goal, however, contains a paradox: How can one find specimens from parks if the specimens are unknown? This paradox made the project difficult from the start, and frustrated our efforts throughout. The project was unable to focus on tangible items and products. There is no easy solution to this problem because, by nature, the project is searching for positive evidence based on negative evidence.

In spite of this inherent problem, we were able to uncover evidence of almost 1,000 taxa and almost 3,300

specimens that could be from the 15 parks. Records of plants outnumbered animal records. Almost a fourth of the sources were computerized databases that could be searched on-site, but not via a Web site. Almost a fifth were collections that were not computerized in any way at all. Ten percent were fully searchable on a Web site. Records of specimens were found for all 15 parks. Data quality was highly variable, and we were unable to standardize the data for automatic incorporation into NPS databases.

Further work is needed to focus the work on sets of records with a high probability of success for NPS. Just searching for records is only half the work. The other half is performing quality assurance checks on the data, standardizing the data, and finally, entering the data into NPS databases. This project was unable to carry out these latter steps due to time, funding, and logistical constraints.

On the plus side, however, NPS is to be lauded for initiating this project and getting started on this important task. The biological resources of the national parks are under increasing pressure from humanity. Changes in biota are often subtle and go unnoticed until it is too late. Retrospective studies such as this are a start to uncovering the biological history of an area, and hopefully will lead to greater preservation and restoration of park biodiversity. The NPS should not abandon this work because one project such as this yielded a low return.

Ed. note: This article is based on a final report (dated 23 February 2001) to the Heartland Network Inventory and Monitoring Program, National Park Service Midwest Regional Office, Omaha, Nebraska (Interagency Agreement IA6370A0002).

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James P. Bennett, U. S. Geological Survey Biological Resources Division and Institute for Environmental Studies, University of Wisconsin, Madison, Wisconsin 53705; jpbennet@facstaff.wisc.edu

David Sheppard

Twenty-first Century Strategies for Protected Areas in East Asia

Introduction

The dawn of the new millennium provides an excellent opportunity to assess the future of conservation in the 21st century. The Fontainbleau Symposium, held in France in November 1998 to mark the 50th anniversary of IUCN–The World Conservation Union, reviewed conservation achievements over the previous half-century and assessed future challenges. The symposium noted a dichotomy. On the one hand, awareness of conservation issues has never been higher. Concepts such as biodiversity conservation and sustainable development are increasingly being mainstreamed into key sectors of the economy. The recent proliferation of international environmental conventions also reflects growing awareness of the significance of the environment for life on earth. However, on the other hand, many key environmental indicators give rise to major concerns. The rate at which humans are altering their environment, and the impact of this on biodiversity, is accelerating and likely to increase by an order of magnitude over the next century or so. This dichotomy shows a clear need for the establishment and implementation of clearer and more effective conservation priorities.

These messages are particularly relevant in East Asia, where high populations and rapid economic development are placing pressure on remaining natural resources. The scale of the problem is underlined by the fact that Asia accounts for less than 15% of the world's land but is the home of 50% of the world's population. The need for effective conservation of natural resources is increasingly apparent, and most countries in the region are responding. Protected areas are playing an increasingly important role in addressing the challenges of biodiversity conservation and sustainable development in East Asia. Protected areas have been established throughout the region and these areas represent a vital investment by East Asian countries to ensure a healthy environment in the 21st century. However, the full potential of this investment will not be realized unless dynamic and forward-looking strategies are developed and implemented in the region. This paper provides background on protected areas within East Asia and suggests some strategies

to ensure that their potential is reached.

Protected Area Status in East Asia

The East Asian Region, as defined by IUCN's World Commission on Protected Areas (WCPA), covers the Democratic People's Republic of Korea (North Korea), Republic of Korea (South Korea), Japan, Mongolia, People's Republic of China (including Hong Kong), Macau, and Taiwan. This is an area of almost 12 million sq km and encompasses a diverse range of biogeographical and cultural features. As one of the world's most populous regions, the interface between nature and humans is often blurred. As Mishra (1994) notes: "The line where nature ends and human influence begins is indistinct and only an artifact of our limited perception of time."

Conservation of important natural resources has a long history in Asia. McNeely and Wachtel (1991) record the long history of traditional conservation systems and note practices such as hunting rituals which allowed people to live in balance with available resources. People in East Asia have always had a strong awareness of nature and the need for its preservation. Often this was based on aesthetic values of a particular site rather than a conscious awareness of the need for conservation (McNeely et. al. 1994). Ancient thinking on conservation and on protecting important natural resources was also embodied in the work of scholars such as Confucius. Such thinking is reflected in China, for example, where the values of forests have been recorded for at least 2,500 years, leading to the establishment of temple gardens, restricted hunting areas, and landscape forests. This long history of nature conservation is shared by the other countries of the region, such as North and South Korea, where conservation efforts date back to King Chinsi (540-576 AD) of the Sinra Dynasty, who stressed the importance of scenic areas. In Japan, some of the first references to wildlife conservation date from the 7th century AD when the Japanese Emperor organized a "bird hunting and preservation section" in the Imperial Government. Mongolia has its own tradition for protecting nature that goes back to the 13th century, when many forested hills were protected as holy areas; in the late 1700s the first reserve, Boghdkhan Mountain Strictly Protected Area, was established.

Protected areas have been established in almost all countries in the region. Table 1 shows the current extent of protected areas in the region according to IUCN management category. The coverage of protected areas in East Asia is variable between countries and between ecosystems. There is also considerable variation in the effectiveness of management of these protected areas. Nevertheless, in the East Asia region there has been a

major expansion in the number of protected areas over the last 30 years, going from far fewer than 100 to nearly 900. Some countries, such as Japan, have had well-established systems of national parks and other protected areas for many years. Others, such as Mongolia, have recently witnessed a large expansion of the protected area estate (Chimed-Ochir 1996). The expansion of protected areas in the region has often led to conflicts over the use of natural resources. In many East Asian countries it is clear that conservation efforts must consider and be linked with the needs of local communities. In Asia, rural people are part of nature and have always seen themselves as such (McNeely and Wachtel 1991).

Table 1. Total number and area of protected areas in East Asia by IUCN management category.

IUCN Category	Number (% of Total)	Area, sq km (% of Total)
Ia — Strict Nature Reserve	35 (4.57%)	90,681 (10.27%)
Ib — Wilderness Area	24 (3.13%)	498,673 (56.48%)
II — National Park	56 (7.31%)	74,437 (8.43%)
III — Natural Monument	30 (3.92%)	11,281 (1.28%)
IV — Habitat / Species Management Area	195 (25.46%)	63,449 (7.19%)
V — Protected Landscape / Seascape	96 (12.53%)	60,601 (6.86%)
VI — Managed Resource Protected Area	330 (43.08%)	83,725 (9.48%)
Total	**766 (100%)**	**882,847 (100%)**

There is no question that East Asia has made progress in the establishment of protected areas. However, there are still significant challenges:

- Key habitats, particularly marine ecosystems, are under-represented. In East Asia, marine and coastal ecosystems are particularly vulnerable to the environmental impacts of development activities. East Asia is characterized by very high human populations along the coasts, which contribute to considerable pressures on marine biodiversity. A number of marine protected areas (MPAs) have been established in East Asia, but still more are required (Kelleher et. al. 1995). It is critical that decisions regarding the establishment of protected areas, both on land and at sea, are based on a rational assessment system and clear priorities. They also need to link with the sustainable development aspirations of local communities, particularly in relation to the role of MPAs in sustaining fish stocks.
- The majority of area under protection falls within the IUCN protected area categories I and II, thus suggesting a need for a broader focus.
- The globally recognized imperative of linking conservation and development is particularly pertinent in East Asia, where population pressures and the requirement for economic development can and does conflict with conservation and protected area programs. Economic factors have a major influence within the region. The early 1990s witnessed the economic growth of the "Asian Tigers," with East Asian countries and territories having an unparalleled period of economic growth and development. This was followed by the economic downturn in 1998, leading to significant cuts in the budgets of conservation agencies. This factor underlines the need for accurate valuation of the services provided by protected areas and the need for this information to be clearly communicated to key decision-makers.

21st Century Strategies

Establish more protected areas and make more use of the range of IUCN management categories. As noted above, there are gaps, at the global and East Asian level, in terms of protected area coverage. A comparison of areal coverage by IUCN management category (Table 2) shows that almost 9% of the world's surface is under protected status, while only 7.5% of the East Asian region is. Furthermore, the majority of this area is in IUCN categories I and II. IUCN suggests, through its "Guidelines for National Systems Planning," that any national protected area system plan should include the full range of protected area categories, covering all terrestrial and marine ecosystem type. In East Asia,

Table 2. Proportion of land area coverage by IUCN management categories: Global vs. East Asia.

IUCN Category	Global	East Asia
I — Strict Nature Reserve / Wilderness Area	1.28%	5.00%
II — National Park	2.67%	0.63%
III — Natural Monument	0.13%	0.10%
IV — Habitat / Species Management Area	1.64%	0.54%
V — Protected Landscape / Seascape	0.71%	0.51%
VI — Managed Resource Protected Area	2.40%	0.71%
Total	*8.83%*	*7.49%*

gaps still exist for grasslands and lake systems as well as in coverage of the marine environment. In many East Asian countries the traditional emphasis has been to extend the number of protected areas in Categories I to IV. However, a major change of emphasis, and perception, is required to bring more category V areas into protected area networks, and additional, larger category VI areas. There are several reasons to give more attention to these multi-use protected area categories in East Asia:

- Future opportunities to create new category I-IV areas in East Asia are limited;
- Category V and VI areas are potentially important as buffer and corridor areas to more strictly protected areas;
- The biodiversity and other values to be found in such areas are often significant;
- Such areas offer good opportunities to build new partnerships with stakeholders, particularly local communities; and
- Such areas can provide models for the sustainable management of rural land generally (after Phillips 1998).

Although few Category V areas have been designated in East Asia, they are very common in other regions, such as Europe. A typical example are the national parks of England and Wales, which are mainly upland areas where traditional farming practices and a relatively harsh climate means that much of the country is left open for low-intensity grazing, and is thus also suitable for recreation and access. Category VI expands the protected areas concept to link conservation with sustainable development and also covers those relatively natural areas in which local

communities have traditional rights to access to natural resources for their sustainable use.

- The message for East Asian countries is the importance of ensuring that full use is made of the range of protected areas. Also, those biomes which are currently under-represented should be given more attention.

Plan systematically to place protected areas in a broader context. The central message from IUCN's 1997 Albany symposium [a "mid-term review" of progress since the 1992 World Parks Congress; the symposium was held in Albany, Western Australia — ed.] was to move planning away from individual "islands" of protection towards networks of protected areas that link with each other and with surrounding land-uses. The consequence of *not* planning in this way is that existing protected areas will continue to become more and more fragmented and increasingly vulnerable to external threats such as climate change. WCPA is thus encouraging new approaches that link protected areas with the management of entire watersheds and marine ecosystems and also that link protected area "islands" with corridors of wildlands. These initiatives recognize that management of protected areas cannot be separated from what happens on surrounding lands—as is clearly shown for the marine environment, where 50% of all pollutants in the sea come from the land. The common elements of these approaches are: strictly protected core areas, surrounded by buffer or support zones, and linked by corridors of "ecologically friendly" land management. This approach is showing that protected areas can be integrated into broader regional land-use planning if there is the political will, local support, and the necessary administrative and legal framework to make it happen.

The opportunities for such approaches should be assessed in East Asia. Models, such as the biosphere reserve, are well-established in the region and provide an excellent framework for broader bioregional planning. The biosphere reserve approach has more than 20 years of practical application and the concept is particularly valid in East Asia, where conservation efforts must be considered in the context of national and regional development imperatives. A number of countries in the region, such as China, have developed networks of biosphere reserves, under the direction of effective National MAB (Man and the Biosphere) committees. In China, more than 60 nature reserves constitute the China Biosphere Reserve Network. This network fulfils a valuable role in facilitating exchange and information, both within China and between China and other countries.

Protected area planning should also be linked with other planning frameworks, such as National Biodi-

versity Strategies, which call on all contracting parties to the Convention on Biological Diversity to develop (under Article 8) systems of protected areas, thus providing a useful framework for integrating concepts such as bioregional planning and corridors.

- The key strategy for East Asian countries should be to widen traditional approaches to protected areas, so that they are seen as core conservation areas within wider land-use planning. Specifically, protected areas in East Asia should: (1) form an integrated aspect of regional planning; (2) be concerned with an interlinked network, rather than a series of individual sites; and (3) encourage managers to give even higher priority to outreach and communication with local communities and other land users.

Increased support, at all levels, for protected areas is essential if they are to have a viable future. In many parts of the world, protected areas are seen as marginal to other areas of policy, such as economic development and agriculture. If protected areas are to have a strong and viable future, this situation must change. Protected areas need to be accepted as credible sectors in their own right and mainstreamed along with other policy areas. A key issue is to appropriately identify and communicate the many values and benefits that protected areas offer society.

Often such values are neither identified nor articulated in government policy forums, even though they can be significant. Clearer articulation of the benefits of protected areas can show how they relate to different sectors of government policy. Table 3 gives examples.

Protected area values need to be clearly articulated and communicated. Recent work by IUCN on the economic values of protected areas (IUCN 1998) reveals that they are often significant revenue-earning entities and can make an important contribution to local economies. For instance, recent studies indicate that Canada is expected to create CDN$6.5 billion dollars in annual Gross Domestic Product from the expenditure of participants in wildlife-related activities, which sustain 159,000 jobs and creates CDN$2.5 billion in tax revenue each year. Australia receives over AUS$2 billion in expenditure from eight national parks—at a direct cost to governments of only some AUS$60 million. In Costa Rica, about US$12 million is spent annually to maintain the national parks, but foreign exchange associated with the parks was more than US$330 million in 1991, with 500,000 overseas visitors; park-generated tourism is the second largest industry in the country.

There is a clear message here: investment in protected areas can provide significant benefits to national and local economies. Far from being

Table 3. Values of protected areas and principal sectoral policy implications.

Biodiversity conservation	· nature conservation · health · agriculture · industry · foreign affairs
Watershed protection	· natural resources management · water supply
Storm protection	· disaster prevention
Tourism	· economic development · transport
Local amenity	· local government · recreation · public health
Forest products	· forestry · economic development · community affairs
Soil conservation	· agriculture · natural resources management
Carbon sequestration	· energy policy • foreign affairs
Research and education	· research · science • education (all levels)
Cultural values	· community affairs • local government
Source: Phillips 1998	

locked up and lost to local users, these areas represent an opportunity for sustainable industries and for the generation of financial returns.

It is assumed that similar figures exist in East Asian countries, particularly in the context of the tourism industry. To date, there has been little

assessment of the economic contribution of protected areas in East Asia. However, those studies which been undertaken indicate that the contribution is significant. Yoshida (1996) notes that, since 1992, there have been many efforts to increase awareness of the importance of protected areas for tourism in the region. Although tourism benefits associated can be significant, it is important that tourism be carefully planned so it does not destroy the natural resource on which it is based in the first place. There are many examples around the world of high tourist use of protected areas, coupled with poor planning, which have caused significant adverse environmental impacts. The high populations in East Asian and increasing leisure time contribute to increasing tourism impacts on protected areas in the region. Strategies to address high visitor use are suggested by Jim (1996), in relation to country parks in Hong Kong, and may have application elsewhere in the region.

Tourism is rapidly growing in many countries in the region. For example, in China the tourism sector is one of the most thriving industries in the country. Data from the World Tourism Organization indicates that in 1993 China ranked fifteenth in tourist arrivals and had the highest annual growth rate, 16.5%. The nature-based tourism sector is increasing rapidly within the region, with particular focus on internationally designated areas, such as World Heritage sites.

Protected areas thus provide major benefits through nature-based tourism; however, the benefits from ecosystem services are much higher. For example, protected areas can play a major role in minimizing the impacts of catastrophic storm events, such as those in China in 1998. Protection of upper catchment areas provide watershed protection to lowland river valleys, preventing soil erosion and reducing the severity of flood and drought. In China, for example, it has been found that the annual added value of water and soil conservation, air purification, acid rain buffering, and other functions in three forested areas was between two and ten times the gross output value of timber, wood processing, and orchard production. At the national level, it has been estimated that the economic value of the water storage function of China's forests is three times the actual value of the wood in those forests. The clearer identification of benefits from protected areas, and the use of such information to support protected areas in various economic and political forums, is essential. Xue and Tisdell (1999) quantify the many values of ecosystem services associated with the Changbaishan Mountain Biosphere Reserve in northeast China. Their research focuses on a monetary valuation of ecosystem services using the methods of market pricing, shadow engineering, op-

portunity cost, and alternative expense. Using these approaches, they note that the value of the reserve for ecosystem services is 16 times higher than the opportunity cost for regular timber production.

Similarly, protected areas must broaden the base of support at the local community level. Global and East Asian experience shows that only planning which fully involves all relevant actors is likely to be successful in the long term, though it may often be more expensive and complex initially. The more effective involvement of local communities is one of the major challenges facing protected areas in East Asia, and the key issue is how this can be done most effectively. In many cases, the answer will require an attitude shift on the part of those responsible for protected areas, such that involving local communities is seen as an integral part of good management. Protected area professionals in many parts of East Asia need to expand support for protected areas. This should include developing structures to allow more effective local input, such as through locally based management structures which are designed to give key local decision makers a "voice" in protected area decision-making [see Senga article on the Philippines, this issue — ed.]. Various co-management structures for protected areas are increasingly being applied in many parts of the world, and their relevance in East Asia should be examined.

There have been many recent initiatives to more effectively involve local communities in East Asia, such as through some of the Integrated Conservation and Development Programs underway in China. Increasing population pressures, both in and adjoining protected areas, have meant that local people must be involved in decisions regarding the establishment and management of protected areas. All countries in the region either have, or are planning to initiate, community involvement programs in their protected areas. There are already a number of innovative examples of community involvement in East Asia. Wong (1996) outlines the wide range of formal (e.g., statutory) and informal (e.g., volunteer) mechanisms used for involving local communities in protected area management in Hong Kong. In Japan, the "Shiretoko 100m^2 Movement" has engaged local people and organizations in an innovative campaign to purchase land for addition to the Shiretoko National Park and to prevent it being developed for industrial purposes. Such examples may provide a good basis for application elsewhere in the region and should be communicated.

- The key message for East Asian countries is to ensure that the full range of benefits from protected areas are identified and appropriately factored into government decision-making. Also, local communities

must be more closely and effectively involved in the establishment and management of protected areas.

Make use of the full range of models for establishing and managing protected areas. Around the world, protected areas have traditionally been managed by government agencies. Institutional arrangements vary, but in many cases protected areas are managed by small and under-resourced departments. In East Asia, protected areas are generally managed by different government agencies in ministries or departments of environment or forestry, although other agencies are increasingly becoming involved. In addition, academic institutions often play an important role in nature conservation efforts. For example, in China the Chinese Academy of Sciences, and its specialized institutes, play an important role in aspects such as natural resource monitoring in protected areas. An important issue in East Asia is the need to improve coordination between different agencies which are involved in protected area and natural resource management.

In many parts of the world the private sector is becoming increasingly involved in protected areas. There are few successful examples to date of private sector management of protected areas, but this appears to be an area with potential in East Asia, although not without its pitfalls. Potential advantages of private sector involvement in protected areas are the high level of motivation, relative efficiencies in management, and economies of scale available to large companies. On the other side of the coin is the need for *care,* to ensure that conservation objectives are not subsumed by the profit motive. Furthermore, very few private companies currently have the expertise necessary for effective conservation management. There are several examples of private sector involvement in nature conservation in East Asia. For example, Amway Japan Limited (AJL) established the Amway Nature Centre, which has assisted in a wide range of nature conservation projects in Japan. The Keidanren Nature Conservation Fund, also based in Japan, has made a considerable contribution to nature conservation, with many programs focused on protected areas, both in the region and internationally (Matsukawa 1996). Another example is found in the public-service corporation established in support of the Nikko National Park in Japan. The initiative results from a partnership between prefectures, cities and neighboring towns, and an electric company and other related business enterprises. The corporation is aimed at cleaning park sites, providing visitor guidance and supervision, repair and maintenance of facilities, and research; experience to date is positive.

Nongovernmental organizations (NGOs) are also becoming increasingly active in conservation throughout the world. They often have particular strengths in working with and through local communities. In East Asia, it is clear that NGOs have major potential in the future establishment and management of protected areas. Such involvement ranges from international NGOs such as WWF, the World Wide Fund for Nature, which is particularly active in China and Mongolia, to small NGOs involved in the establishment and management of specific protected areas within countries in the region. Examples of NGO involvement in East Asia include the Wild Bird Society of Japan, which owns a number of bird sanctuaries, and the National Parks Association of Korea, which has been active since 1971 in encouraging the establishment of protected areas in South Korea. The work of the Wildlife Conservation Society's field division in China has made important contributions to protected areas designed to conserve the giant panda and associated flora and fauna. Its wildlife surveys in Tibet (Xizang) and Xinijang led directly to the identification of protected areas, including the 4.5-million-ha Arjin Mountains Nature Reserve and the 33-million-ha Chang Tang Nature Reserve, the world's second-largest protected area. It is anticipated that the role of NGOs in protected areas in East Asia will increase. A critical aspect in relation to NGOs is the need to build more effective and long-term partnerships with government agencies involved in protected areas. In many parts of the world the relationship between government and NGOs is marked by suspicion. This needs to be replaced by an attitude of co-operation, partnership and mutual benefit.

As well as examining alternatives to supplement government management of protected areas, there is a need to improve existing government structures and procedures in relation to protected areas. Options such as amalgamation of conservation-oriented departments with similar objectives and the development of mechanisms for improving inter-agency coordination are being examined in many countries, such as Australia and Africa. One interesting trend in many countries, particularly in Africa, is the establishment of *parastatal* bodies with responsibility for protected area management. Such agencies, which have been established in countries such as Kenya, Tanzania and Uganda, have a greater level of independence and autonomy than traditional government agencies, particularly in relation to the ability to generate and retain revenue. This latter point is an important consideration for revenue generation programs for protected areas in East Asia.

There is no right answer to the question "What is the ideal

institutional structure for protected areas in East Asia?" The right approach will depend on the unique circumstances of each country; in most cases it will involve a mix of the above options. In reviewing protected area trends in the 1990s, it is clear that the involvement of the private sector and NGOs in protected area management has been significant. It may be assumed that this trend will accelerate in the 21st century. While this appears positive, it is important to be clear on the respective roles of these sectors in relation to government. It is critical that there be clearly defined management objectives for each country's protected area system as a whole, and that they provide the framework for the clarification of roles of different actors.

- The key message for East Asian countries is that the number of approaches to managing protected areas will increase and that it is important to ensure that a range of approaches are used, tailored to the needs and circumstances in each country.

Improve management capacity for protected areas. Protected areas management is evolving rapidly. Traditionally, the protected area manager is an expert in the natural sciences, and management is seen as an exercise involving the application of expertise to natural systems. However, the challenges facing the protected area manager in the 21st century are increasing in scale and complexity. The range of skills thus needs to be broadened to include, for example:

- *Management skills,* such as in strategic planning and financial management;
- *Cultural and social expertise*, relating, for example, to partnership and stewardship skills, dispute resolution, and networking with a complex array of stakeholders;
- *Technical skills* in project design, report writing, and information technology; and
- *Policy expertise*, such as understanding the broader legal framework and the other sectoral policies within which protected area activities need to be implemented.

This will require a change on the part of protected area agencies, both in terms of recruitment strategies and in training and career development. The need for training protected area managers in East Asia has never been higher and it is critical that it be broader than the traditional focus on natural resources. Relevant training centres should be developed and, where they already exist, strengthened, to increase management capacity. Existing training efforts, such as those implemented through the Japan Environment Agency, should be strengthened and expanded. Training is essential, but it must focus on the types of skills, as outlined

above, that will be necessary if protected area managers are able to face the challenges of the next century in East Asia.

Another key element of capacity is the need to improve regional and international cooperation on protected areas. Benefits from this include a broader exposure to issues as well as the potential to develop cooperative approaches to common protected area problems. The benefits of such regional approaches can be clearly seen in a number of parts of the world. For example, the South Pacific Regional Environment Programme has developed into a very effective regional environmental body in the Pacific and has strong support from governments of the region. In Africa, SADC, the South African Development Community, has made a significant impact in increasing the levels of support for wildlife and environmental conservation, as well as promoting technical exchanges between countries.

Such regional networks should be encouraged in East Asia. A number of organizations have been active since the 1960s in assisting countries in the region to plan and develop their protected area networks. Bodies such as UNESCO, WWF, and IUCN have all been involved, in partnership with relevant national agencies. Ishwaran (1996) notes the increasing activities of networks in East Asia implemented under UNESCO as World Heritage sites and biosphere reserves. For example, there is currently a proposal to establish an Asian Regional Network for the management of World Heritage sites, which would provide a forum for the exchange of information and experience on World Heritage matters. UNESCO also foresees the development of Asian networks on biosphere reserves to complement networks developed at the national level, such as in China. In fact, China, North Korea, South Korea, Japan, and Mongolia have been cooperating since 1993 to establish an East Asian Biosphere Reserves Network (Aruga 1996). During the last decade many countries in the region have also acceded to various international conventions and programs associated with protected areas, such as the Convention on Biodiversity, and these provide useful opportunities for cooperation between the countries and territories in East Asia. There are also important opportunities for cooperation between specific countries in the region, through the establishment and management of transboundary protected areas—contiguous protected areas between two or more countries.

WCPA plays a small but growing role in strengthening networks in the East Asia region; there is considerable scope for broadening this role. Since the first regional meeting of WCPA in East Asia (in Beijing, 1993), and the second (in Kushiro, Japan, 1996), there has been steady but significant

progress. Activities have included the development of a regional action plan for protected areas; implementation of seminars on topical protected area issues, such as tourism; and the fostering of communication and exchange of experience between protected area managers in the region. The implementation of four projects identified in the regional action plan for protected areas is also contributing to strengthening protected area capacity in the region. One of these projects deals specifically with options for developing an exchange program in the region. Networks such as WCPA can play a potentially valuable role and should be a critical component of approaches to improve protected area management in the region. To work effectively, these networks must have a clear focus and be adequately funded and staffed. The strengthening and harnessing of such networks is a very important challenge for building capacity for protected areas in the East Asian region in the next century.

- The key message for East Asian countries is the need to build protected area capacity at all levels, with particular emphasis on ensuring managers are equipped with the skills needed for the 21st century, as well as expanding and strengthening protected area networks in the region.

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David Sheppard, Protected Area Program, IUCN—The World Conservation Union, Rue Mauverney 28, CH-1196 Gland, Switzerland; das@hq.iucn.org

Rafael G. Senga

Establishing Protected Areas in the Philippines:
Emerging Trends, Challenges and Prospects

The Philippine Protected Areas System: An Overview

The Philippines has always been considered one of the major biodiversity hotspots in the world. For while it boasts of one of the highest levels of diversity and endemicity of life forms and some of the most unique habitats in the world, it is also home to some of the planet's critically endangered species of wildlife, such as the Philippine eagle, one of the most magnificent raptors in the world and our country's symbol of biodiversity conservation. The country's habitats and ecosystems, which play a major role in maintaining ecological balance and in the day-to-day lives of Filipinos, are in constant threat, mainly from unwise resource use and development paradigms that tend to increase pressure on the world's already scarce resources. The recent book *Megadiversity* by Russell Mittermeier of Conservation International, which documents the world's seventeen most important countries in terms of biodiversity, concludes that the Philippines belong to the top five biodiversity hotspots in the world.

In view of these reasons, the Philippine government, in cooperation with the public and international donors, embarked on a mission to establish a system of protected areas in the country. The last remaining representatives of Philippine habitats and ecosystems were set aside for conservation through innovative approaches spelled out in the National Integrated Protected Areas System (NIPAS) Act of 1992, a landmark piece of legislation which provides the framework for a decentralized, community-based reserve management strategy.

There are more than 200 protected areas in the Philippines, ranging from large natural parks, to landscapes and seascapes, to wildlife sanctuaries and small watersheds that form the initial components of the NIPAS Act. Of these, however, less than a quarter receive some form of protection, either through foreign funding or local initiatives. This is because after the passage of the NIPAS Act, very little money was allocated by the government to effectively manage these reserves.

Currently, two major projects are piloting the implementation of the

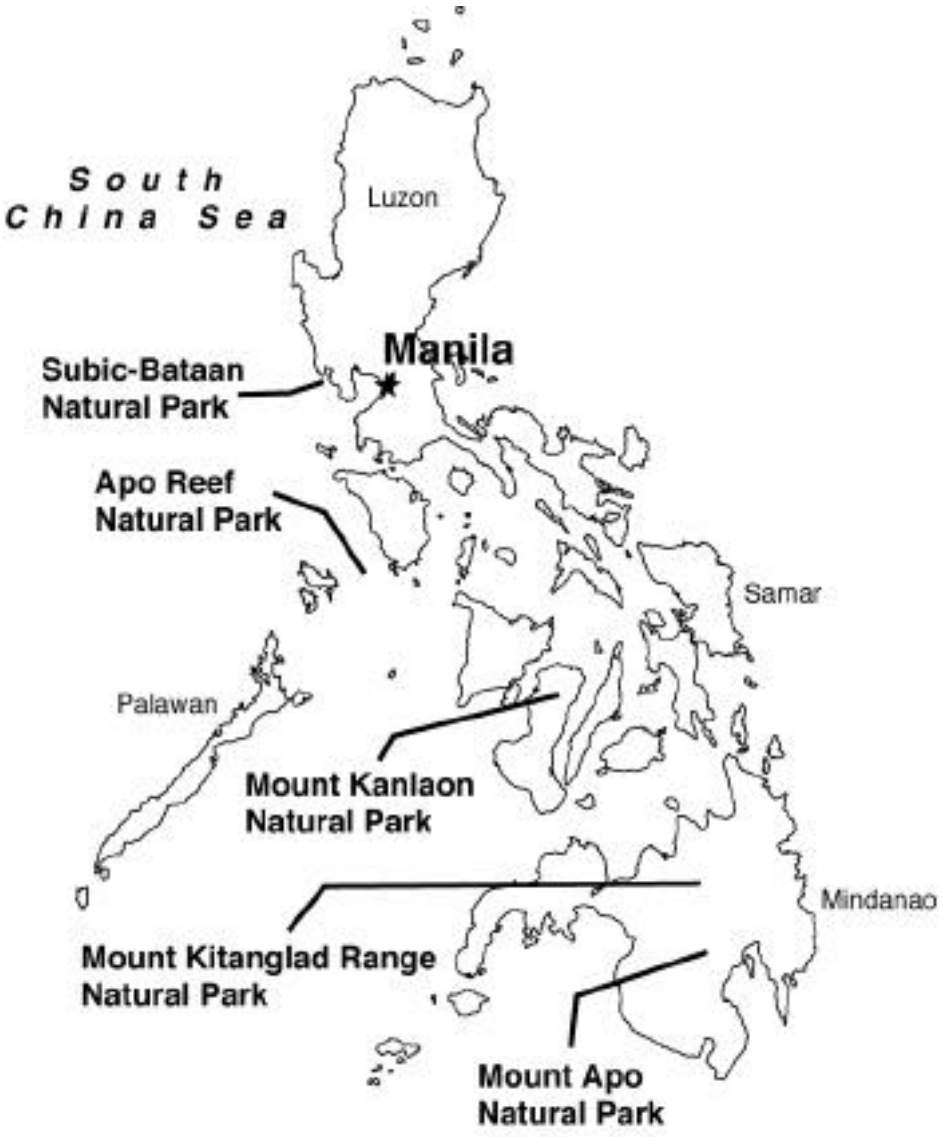

Figure 1. General location of some of the protected areas mentioned in the text.

NIPAS Act: the Conservation of Priority Protected Areas Project, a seven-year initiative funded by the Global Environment Facility (GEF) through the World Bank, and the National Integrated Protected Areas Project, a five-year undertaking funded by the European Union. While the two projects share the same broad objectives of biodiversity

conservation and sustainable development, they differ in their modes of implementation. While the National Integrated Protected Areas Project is being implemented by a European consulting firm in partnership with government, the Conservation of Priority Protected Areas Project is being implemented through an experimental partnership between the Philippine government and the public. The former is represented by the Department of Environment and Natural Resources (DENR), while civil society participation is done through the NGOs for Integrated Protected Areas (NIPA), a consortium of Philippine nongovernmental organizations (NGOs) bonded together by a common vision of establishing protected areas that are sustainably managed by local communities in collaboration with government. Although the partnership got off to a rocky start, it has since evolved into a viable model of cooperation between two important segments of society working towards the common goal of biodiversity conservation.

The Conservation of Priority Protected Areas Project covers the first ten priority reserves in the system:

- *Batanes Protected Landscapes and Seascapes*–the northernmost province of the Philippines, composed of scenic islands and beautiful seascapes inhabited by the indigenous Ivatans peoples. It has a high level of floral endemicity and is a major flyway for migratory birds from northern Asia.
- *Northern Sierra Madre Natural Park*—the largest and most important protected area in the country in terms of biodiversity. It is home to 12 habitat types and 40 species of wildlife (most of them endemic) included in the IUCN list of globally threatened species.
- *Subic-Bataan Natural Park* —the major protected area nearest to Manila and a test case to demonstrate how the nation's economic development can take place successfully alongside the conservation of the country's last remaining forests.
- *Apo Reef Natural Park*—the biggest atoll-type reef in the Philippines and a natural haven for marine life, bird life, and a variety of endangered plants.
- *Mount Kanlaon Natural Park* —an active volcano and the tallest peak in the Visayas group of islands, which is also a microcosm of the fragmented state of Philippine ecosystems.
- *Agusan Marsh Wildlife Sanctuary*—the most biologically diverse marshland in the country, where more than 200 species of birds from Japan, China, and Russia spend the winter months.
- *Mount Kitanglad Range Natural Park*—the second highest peak in the country and the headwater catchment area for the major rivers of northern Mindanao; home

to the Talaandig, Higaonon, and Bukidnon tribes, as well as the Philippine eagle.

- *Siargao Islands Protected Landscapes and Seascapes*—a surfer's paradise with an extensive system of old-growth mangrove stands and rich marine reserves.
- *Mount Apo Natural Park*—the country's tallest peak and host to a diverse variety of endemic flora and fauna, including the Philippine eagle, and home to numerous indigenous cultural communities.
- *Turtle Islands Wildlife Sanctuary*—the only remaining large marine turtle rookery in all of Southeast Asia.

The project employs a multi-stakeholder approach among government, local communities, NGOs, the scientific community, the private sector, and international partners. It is anchored on a community-based resource management strategy which seeks to empower local communities residing inside and within the buffer zones of parks to manage their own resources and become active partners in protected area management. Providing alternative livelihood opportunities and improving tenurial security of park residents are integral components of this strategy.

Participatory management in each park is ensured through the Protected Area Management Board (PAMB), a multi-sectoral body composed of representatives from government, peoples' organizations, NGOs, and indigenous cultural communities. It is the highest policy-making body in Philippine protected areas and the venue for democratic participation of all sectors with a stake in the effective management of these reserves. The structure may be cumbersome and unwieldy at times, but, through time, we strongly believe that the PAMBs will evolve into effective stewards of our country's last repositories of biodiversity—a monumental responsibility to the whole of humankind.

In five years of implementing this trailblazing project, NIPA and its partners have established a foundation for models in different aspects of protected area management that could be replicated in the other protected areas of the Philippines and possibly in other parts of the world.

Community-Based Resource Management

Resource management planning. In the area of community-based resource management, a viable alternative model is taking shape with the active participation of local communities in drawing up resource management plans and creating local resource management structures. Community volunteers take part right from the very start of the process, such as in socioeconomic profiling and natural resource inventories. In the case of Mount Kanlaon, for example, local herbalist and wildlife experts from communities inside the park were considered as

important members of the resource inventory team owing to their familiarity with the native flora and fauna and their use to communities. The scientific integrity of the exercise is ensured by the biologists and other technical experts of the project.

Community resource maps are then drawn up which serve as one important basis in the formulation of management plans. This particular challenge of marrying community approaches and scientific methodologies is in itself an important part of the whole experiment. The preparation of site-specific protected area management plans (which is on-going) essentially follows the same participatory procedure to ensure that, at the end of the day, park managers will have management plans that are implementable and that stakeholders can call their own.

Community resource protection volunteer groups. Local communities are likewise actively involved in the protection and monitoring of biodiversity in their respective areas. Presently, community resource protection volunteer groups in Mount Kanlaon, Mount Kitanglad, Bataan, Apo Reef and Batanes—numbering nearly a thousand strong—are on the front line of enforcing park laws side-by-side with park rangers. With a current ratio of one park ranger for every 6,000 hectares of parkland, these local volunteers provide a vital link in protection efforts over the long haul.

These DENR-deputized volunteer groups conduct regular patrol work within the vicinity of their communities, establish checkpoints in hotspot areas, apprehend violators and confiscate illegally gathered forest and aquatic products, and maintain a community-based surveillance system that alerts the DENR and other law enforcement agencies to park law violations.

Biodiversity monitoring system. A biodiversity monitoring system which encourages community participation has also been installed. Although the more technical components of the system need further refinement to maximize community participation, determining resource-use patterns through focused-group discussions form an important part in establishing trends or changes in biodiversity in a specific area. The results of the biodiversity monitoring system are intended for the use of PAMBs and local government units in making decisions related to resource use and management.

Decision-Making and the PAMBs

On the whole, the Protected Area Management Boards are gradually evolving into dynamic forces as envisioned under a decentralized reserve management regime. The complexity of the set-up cannot be overemphasized, though, with different sectors advancing their own resource-use interests often clashing. But that is

precisely the essence of it all: creating a mechanism that will distill ideas into decisions that all local stakeholders can call their own. A radical departure indeed from the old system, in which decisions affecting reserves in faraway places were made in Manila.

A key element to the success of empowering the PAMB is ensuring the authenticity of sectoral representatives that sit on the board. Certain representatives of dubious affiliation served on some interim PAMBs during their initial five-year term. After the lapse of the first term, NIPA and its site partners made sure to put in place a selection process that produces genuine sectoral representatives. Through this, all stakeholders are now assured that their interests are advocated by representatives they can trust. The process of an enhanced capability-building strategy for the new PAMBs can now proceed in earnest to better prepare them for the new challenges that lay ahead.

Very recently, the strength of this decision-making structure was put to a severe test in Mount Kanlaon. The Mountaineering Federation of the Philippines was able to obtain a court order to restrain the PAMB from enforcing a two-year-old trekking ban which had been put into place to let the trails recover from the ravages of the most recent El Niño event and unregulated trekking in the past. Believing in the wisdom and legitimacy of the PAMB decision, community members took it upon themselves to enforce the decision and prevented three hundred members of the federation from embarking on a potentially destructive mass climb. Although this has temporarily set back a looming alliance with the mountaineering community, a series of dialogues is planned to renew cooperation with this important stakeholder. Nevertheless, this particular experience showed that a decision arrived through consensus among major stakeholders is more binding and implementable.

Strengthening of Indigenous Structures and Traditional Knowledge Systems

Cognizant of the important role that indigenous cultural communities play in managing these reserves, the project puts special focus on the revitalization of indigenous social structures and the enhancement of traditional knowledge systems. In Mount Kitanglad, for example, the Higaonon, Talaandig, and Bukidnon tribes are now enforcing their traditional laws and practices on all park visitors to ensure respect for the cultural and biological integrity of the mountain they consider sacred. Aside from securing necessary permits from the protected area superintendent, visitors are required by the Council of Elders, which the project helped strengthen, to perform rituals to seek permission from the mountain spirits so that no untoward incidents happen to them.

Admittedly, it is still a long way

before the process of harmonizing traditional beliefs and practices with protected area laws is completed. Currently, there is tension between the protected area superintendent's office and the Council of Elders regarding the management of Mount Kitanglad, and this is actually one of the major concerns being addressed by the project. But we believe that by creating the right atmosphere for dialogue and negotiation, the inherent strengths of the two systems will eventually complement each other to create a viable model in managing protected areas with indigenous peoples.

Building Multi-Stakeholder Partnerships for Biodiversity Conservation

The foundations of these models and their future sustainability would not be possible without the multi-stakeholder partnerships established by NIPA at the local and international levels.

At the reserve level, the partnerships already exist (albeit at varying levels of development) among the local government units, park communities, NGOs, indigenous cultural communities, DENR, and academia. In Mount Kanlaon, for example, several city and municipal governments are now directly funding some of the key activities critical for park management, such as protection work, restoration of degraded habitats, and the construction of interpretive and visitor centers. Likewise, the academic community has been contributing valuable staff time toward the conduct of biological and social research. Some NGOs, on the other hand, are funding livelihood activities aimed at creating alternatives that will ease pressure on park resources. More importantly, the high level of cooperation between the DENR and MUAD (the local NGO implementing the Conservation of Priority Protected Areas Project in this particular reserve) has surmounted the atmosphere of distrust that usually characterizes government–NGO relations.

By its very nature as a consortium, NIPA has built-in mechanisms to draw from the strengths and capacities of its NGO members, which are engaged in diverse activities such as biodiversity conservation, rural development, livelihood and enterprise development, rural finance, gender issues, and indigenous cultural community concerns, among others. Although efforts need further streamlining to improve the involvement of some of its members, NIPA serves as the only model in the Philippines of a consortium that groups together some of the biggest and oldest NGOs engaged in different facets of development work, bound together by a common vision of establishing a sustainably managed protected areas system. NIPA also collaborates with other NGOs in pursuing this vision. The Foundation for Philippine Environment, a national NGO managing an endow-

ment fund for conservation, has been consistent in its support by way of financing some of the more critical capability-building activities of NIPA. Moreover, the strategic partnership that NIPA has established with government is an indispensable element in NIPA's quest to realize this vision.

NIPA's experience of collaboration with international partners in biodiversity conservation work has tremendously enriched its reservoir of resources and capacities in biodiversity conservation, particularly in the areas of resource assessment, capability-building, biodiversity monitoring, management planning, and funding for conservation activities, among others. Our partnership with the World Bank-GEF, now in its fifth year, is an experiment in itself, being the first of its kind in the Philippines (and probably the world) in which these multilateral agencies have engaged with civil society to push biodiversity conservation. A lot of lessons have been learned by both sides which can be used to improve future partnerships between them and with others.

Our current collaboration with other international NGOs has likewise been very fruitful. Our cooperation with the Nordic Agency for Development and Cooperation (NORDECO) in biodiversity monitoring resulted in a system that combines scientific methodologies with community approaches. Furthermore, our efforts to combine resources and expertise with Conservation International and Plan International in managing the Northern Sierra Madre Natural Park have gradually led to a better management regime in the country's biggest and most important protected area. In the same vein, NIPA's partnership with foreign volunteer organizations is contributing a great deal in technical assistance to the sites. Volunteers to the national office and the sites from the Volunteer Service Overseas (Great Britain), the Peace Corps (USA), and the Overseas Service Bureau (Australia) provide assistance in the areas of management planning, resource inventory, watershed and range management, ecotourism, and environmental education. Strengthening these multi-level partnerships will definitely be high in the NIPA agenda for the coming years.

Challenges and Threats

Among the various challenges confronting the Philippine protected areas system, nothing is more serious than the lack of a conducive policy environment that can enhance and sustain what have been started by the Conservation of Priority Protected Areas Project and the other biodiversity conservation projects. After the enactment of the NIPAS Act in 1992, a series of government-sponsored laws that directly impinge on the integrity of protected areas were passed. The most notable of these are the Mining Act of 1995 and the Fisheries Act of 1998, which, along

with existing forestry laws, further expose our dwindling natural resources to unbridled exploitation. Although these interests are legally barred from conducting their operations in our protected areas, the government has been ambivalent in enforcing relevant laws, in part due to the higher priority given to economic growth—which more often than not comes at the expense of the environment.

The failure of government to issue policy decisions that will strengthen the NIPAS Act also reflects the low level of priority that protected areas occupy in the policy agenda. Up to now, the protected area superintendent's office has not been an integral part of the official DENR structure, which makes it doubly difficult for the superintendent to enforce park laws and secure adequate allocations for their operations.

Likewise, the prolonged delay in the issuance of appropriate tenurial instruments for both indigenous communities and tenured migrants threaten the sustainability of the community-based initiatives that the project has started. Without tenurial security, park communities have fewer reasons to be effective stewards of resources around them.

The task of gazetting priority protected areas is crucial. The failure of Congress to pass site-specific protected area bills that will permanently establish these reserves tremendously weakens the foundations of the system. The project has yet to come up with an effective strategy to make our politicians appreciate the urgency of passing the protected area bills pending in Congress.

The need to improve the pace and quality of management planning in our protected areas is equally daunting. The participatory nature of the process has proven to be cumbersome and time consuming. But there is simply no other way to do it, and we are in the process of exploring options that will hasten the process without sacrificing the quality of the plans for the management of our protected areas.

Lastly, the grinding poverty in communities within and adjacent to protected areas, if not systematically addressed, will further increase the pressure on these precious life-support systems. It is a well-known fact that, outside of the indigenous peoples, the majority of protected area residents are very poor migrants driven to the inhospitable slopes of terrestrial reserves by the severe lack of economic opportunities and landholdings in the lowlands. Social inequities, specifically those pertaining to land ownership, are still an essential feature of Philippine society and remain the greatest threat to the protected areas and biodiversity of our country.

Prospects for the Philippine Protected Area System

Undoubtedly, the foundations of a viable protected area system attuned to the conditions of a developing

country like the Philippines is slowly being established. But let nobody be deluded into thinking that from here on it will be smooth sailing all the way. The threats and challenges are just too formidable to dismiss lightly and will need the concerted efforts of all stakeholders to surmount. More importantly, the necessary follow-through to what CPPAP and the other biodiversity projects have started is crucial if Philippine protected areas are to have a fair chance of surviving the onslaught of current and future threats to their integrity.

Given the current state of our economy, however, we recognize the importance of further strengthening our collaboration with international partners to address the following broad areas of concern:

- Strengthening of community-based resource management systems;
- Capacity-building (training) of protected area managers;
- Improvement of tenurial security of park residents;
- Restoration of degraded habitats;
- Biological and social research; and
- Information, education and communication activities.

Although we still need to see a better policy environment being created by government, we believe that enough goodwill have been established between civil society and its government partners to go a long way toward putting environmental concerns at the top of the policy agenda.

With two years left in the Conservation of Priority Protected Areas Project, one of the most important tasks of NIPA and its partners is influencing government, specifically the DENR, to integrate protected area management into its organization and elevate biodiversity conservation in its order of priorities, at a par with or even higher than its current resource-use priorities. Given the long period of time before the poverty of the Philippines is alleviated, this much-needed political will on the part of our government will at least give our protected areas a breathing spell.

Finally, influencing the public to create a society more responsible to its natural environment is definitely a linchpin. Without this, no effort in biodiversity conservation can be sustainable in the Philippines. NIPA believes that in its efforts to create workable models in protected area management, it is putting forward some of the most powerful arguments for creating just such an environmentally responsible society.

Rafael G. Senga, NGOs for Integrated Protected Areas (NIPA), IPAS-PCU Building, Ninoy Aquino Parks & Wildlife, North Avenue, Diliman, Quezon City, Metro Manila 1100, Philippines; cppapops@mozcom.com

Pakkawadee Panusittikorn
Tony Prato

Conservation of Protected Areas in Thailand:
The Case of Khao Yai National Park

The General Setting

Thailand is a country rich in natural resources. Its mild year-round climate and high humidity and rainfall support a biologically diverse flora and fauna that include tropical, deciduous, and mangrove forests. Each forest type provides a unique habitat for plants and animals. Thailand's tropical climate supports not only fertile forests, but also colorful and fragile coral reefs and marine ecosystems. There are 3,000 km of coral reefs along Thailand's coastline (Gray et al. 1994). Thailand's rich biodiversity is evidenced by the 3,000 species of fungi, 600 species of ferns, over 1,000 types of orchids, and 282 mammalian species (Gray et al. 1994). Species such as the Asian elephant, tiger, and hornbill are endangered. Some forests contain valuable trees such as teak, rosewood, bamboo, and rattan. These tree species are in high demand for furniture making, housing, and the export market (Gray et al. 1994).

Thailand's 513,115 sq km of land is divided into four natural regions (Mewongukurd 1987). The mountainous Northwest region contains natural forests, ridges, and deep, narrow valleys. The Northeast region is a plateau that occupies one-third of the total area of Thailand (Nuttonson 1963). It has very favorable soils and climate, which supports agricultural production (Donner 1978). The Central region contains the most valuable land in Thailand (Nuttonson 1963). The Southern region is mountainous and contains two enormous mountain ranges (Donner 1978).

Thailand has a tropical climate with wet and dry seasons (Nuttonson 1963; Vithayarut 1988). The two northern regions of Thailand receive most of their moisture from tropical storms and typhoons. The Central region is influenced by both monsoon and local storms and has similar weather to the two northern regions (Nuttonson 1963). South Thailand, which is surrounded by seas, has the highest rainfall in the country.

Climate, soils and other biophysical features determine the spatial distribution of Thailand's evergreen and deciduous forests. Tropical evergreen forest is the predomi-

nant type. Teak, which is located in the northern forests, is the most valuable and abundant tree species (Royal Forestry Department 1996). Thailand's natural forested areas provide ecological services—such as providing clean water and air, mitigating floods and droughts and pest control—that benefit people and communities (Daily 1997). Mangrove forests play a key role in protecting coastal areas from strong winds and wastewater.

Thailand is historically an agricultural country. The main agricultural export commodities are maize, cassava roots, rubber, and sugarcane (Bangkok Bank 1996). Export value of livestock products has continually increased, whereas timber exports have declined slightly because of the ban (since 1989) on logging in natural forests and mangrove conservation.

Water is crucial for Thailand's economic development and transportation system (Donner 1978). Thailand has two major rivers, the Chao Pharya and Mekong, and other local rivers, such as the Chi and Mun in the Northeast. Riverine areas comprise the heart of cultivation in the Central Plain and Northeast regions.

Rapid growth in the Thai economy has resulted in increased demand for land, energy, agricultural products, raw materials and investment. Real gross domestic product trended upward in the mid-1990s along with other indicators, such as the value of exports and imports (Bangkok Bank 1996). However, many Southeast Asian economies collapsed in 1998 because of fundamental economic problems.

Natural Areas and National Parks

The Royal Forest Department was established in 1896 to manage the country's forests. The first act to conserve wildlife was the Wild Elephant Protection Law in 1900. This law was enacted because of significant declines in elephant populations. The Wild Animals Reservation and Protection Act of 1960 (WARPA) regulates the establishment of wildlife sanctuaries and nonhunting areas (Gray et al. 1994). Khao Yai National Park, Thailand's first, was established in 1962. Three additional national parks and one wildlife sanctuary were established in the 1960s (Dixon and Sherman 1990; Ghimire 1994; Gray et al. 1994).

During World War II, the population of Thailand was 15 million and the forested area was about 70% of total land area. Forested lands have since decreased significantly due to rapid post-war economic development and population growth, so that in 1995 only about 26% of the country was forested (Gray et al. 1994; Royal Forestry Department 1996). Expansion in farmland and construction of dams, roads, and other infrastructure

caused significant losses in natural areas. In addition, over-fishing, shrimp farming, dynamiting, and booming tourism degraded ecosystems in general (Gray et al. 1994). Some natural areas have been damaged as well because of these pressures.

In 1989, a ban was placed on logging in Thailand's natural forests, including the national parks. Since then, many areas have been established as national parks and wildlife sanctuaries (IUCN 1992). Currently, Thailand has 95 national parks (Thaiparks.com 2001), 42 wildlife sanctuaries, 50 non-hunting areas, 57 forest parks, and several other protected areas, including mangrove forests, botanical gardens, and arboretums (Royal Forestry Department 1996). The total size of Thailand's protected areas is approximately 84,616 sq km, or 16% of the country's land area (Royal Forestry Department 1996; Thaiparks.com 2001). Tables 1 and 2 show the distribution of national parks in Thailand by region and size, respectively. To achieve the Thai government's goal of conserving 40% of the country's forested land area, several management plans have been issued in the last decade (IUCN 1992). The reforestation plans have a goal of using natural resources in a sustainable manner.

Table 1. Regional distribution of national parks in Thailand. Source: Thaiparks.com 2001.

Region	Percent
North	38
Central	20
Northeast	18
South	23

Table 2. Size Distribution of National Parks in Thailand. Note: Data for two national parks are missing. Sources: Gray et al. 1994; Thaiparks.com 2001.

Size (sq km)	Number	Percent
More than 1,000	14	15
801-1,000	5	5
601-800	7	8
401-600	15	16
201-400	26	28
0-200	26	28
Total	93	100

The legal authority for Thailand's protected areas is the WARPA of 1960 and the National Park Act of 1961 (Arbhabhirama et al. 1988; Dixon and Sherman 1990; Gray et al. 1994). There are four main types of protected areas in Thailand: national park, wildlife sanctuary, non-hunting area, and forest park. The purpose of a *national park* is to preserve a natural area for educational and recreational activities, which are defined by the National Park Act of 1961 (Arbhabhirama et al. 1988). The National Park Division of the Royal Forest Department administers all national parks according to established guidelines (Dixon and Sherman 1990). The Royal Forestry Department receives assistance from the Tourism Authority of Thailand and related organizations in surveying and establishing new national parks.

A *wildlife sanctuary* is designed to conserve habitat in which wildlife can breed and expand in a natural setting (Dixon and Sherman 1990). Educational and research activities are allowed. The Wildlife Conservation Division of the Royal Forestry Department has responsibility for managing wildlife sanctuaries. Of Thailand's 42 wildlife sanctuaries, Haui Kha Khaeng and Thung Yai Naresuan were the first to be established.

A *non-hunting area* is protected from hunting and capture of animals and dedicated to conserving specific wildlife species. There are 50 non-hunting areas in Thailand, some of which allow educational and limited recreational activities (Arbhabhirama et al. 1988). Non-hunting areas are under the authority of the Wildlife Conservation Division. Compared with wildlife sanctuaries and national parks, non-hunting areas are smaller, protection is afforded only for specific species, and fishing, recreation, tourism, logging, and collection of plants and herbs are allowed (Dixon and Sherman 1990).

A *forest park* is smaller than a national park and contains features considered valuable for recreation, e.g., waterfalls and caves (Dixon and Sherman 1990). There are 57 forest parks in Thailand.

Other kinds of protected areas include *botanical gardens* (15 total), which are reserved for collecting and planting native and exotic rare and economically valuable plant species; *arboretums* (47 total), used for collecting and preserving useful plants and flowering plant species (Dixon and Sherman 1990); and designated *watersheds*, which are classified based on the land-use activities that occur within them. The level of protection afforded watersheds depends on physical characteristics of the landscape, such as elevation, slope, geology, and soils (Arbhabhirama et al. 1988).

Most of the income from national parks and other protected areas (excluding wildlife sanctuaries) is de-

rived from recreation and tourism. Those activities are thus primary motivations for establishing natural and protected areas in Thailand.

Problems in Protecting National Parks

As with the country's natural environment as a whole, the protected areas of Thailand have been degraded by rapid growth in population; exploitation of timber, land and energy; tourism; and residential development. As far as recreation is concerned, national parks are especially popular for hiking, camping, and sight-seeing. Currently, Thai tourists outnumber foreign tourists in the national parks because of a lack of promotion and tourist information written in foreign languages (Arbhabhirama et al. 1988).

The intentional and unintentional acts of tourists disturb fragile ecosystems. For example, the Phi Phi Islands (Phuket) are popular because of their beautiful coral reefs and beaches. The white sand beaches of the islands have been degraded by growth in resorts and poorly planned human waste disposal. Tourists who break off pieces of coral reef as souvenirs, or who anchor their boats to reefs, have caused extensive damage. Tourist-related developments have degraded other protected areas. For example, Doi Suthep National Park in the North is well known for its Buddhist temple. Roads, parking lots, and other tourist facilities have been built in the park, and the government has allowed construction of a cable car from the foothill to the temple area.

Despite the official ban on logging, deforestation continues in Thailand's protected areas. A primary cause is the increasing demand for agricultural and forest products, and the conversion of land to aquaculture. Local residents and hill tribes contribute to deforestation by practicing shifting cultivation, which has degraded the quality of soil and water, particularly in national parks located in the northern and northeastern regions of Thailand. Resident populations can be high; for example, approximately, 4,000 Hmong and Karen people live in the Haui Kha Khaeng and Thung Yai Naresuan wildlife sanctuaries (Arbhabhirama et al. 1988). Furthermore, many national parks are surrounded by local villages whose residents tend to run out of forested land because much of it is clear-cut to make way for agricultural production (Arbhabhirama et al. 1988). The resultant illegal poaching and logging in national parks have had a negative impact on endangered species, including hornbills, elephants, and tigers. There is illegal local and international animal trade, which the Royal Forestry Department is not able to control.

Management of Thailand's national parks focuses on direct and indirect protection. Direct protection is the responsibility of National Park

Division headquarters, which has a branch in every national park. Their job is to control illegal activities and provide visitor services for tourists. Rangers patrol the vicinity of park boundaries to deter illegal activities and create goodwill in local communities. Indirect protection relies on radio, television, and brochures to increase nature appreciation.

Although the National Park Division of the Royal Forestry Department putatively manages natural resources according to a plan, on-the-ground management has not achieved its goals because of two problems with the national park system:

- The inadequate budget of the Royal Forestry Department limits effective management. Since the Thai government is less concerned with biological conservation than economic development, only a small portion of the national budget is allocated to the management of protected areas. In 1995, the budget for forest conservation was the equivalent of US$347 million—just 1.2% percent of the forestry department's total budget of US$2.86 billion (Kaosa-ard 1995). This relatively small budget hinders the park's ability to control illegal activities, such as poaching.
- Unauthorized settlements of local villagers and hill tribes in national parks have become a serious problem. Poor relationships between local people and law enforcement agencies have resulted in inefficient management and major conflicts. Law enforcement is used to try to control the illegal use of forested land. This of course negates the traditional rights of local people to use the land now included in the parks for agriculture and other activities. While villagers have not received compensation for these losses, the Royal Forestry Department has offered to relocate them to areas outside of and adjacent to parks. However, many national park managers believe that relocation of such settlements is not feasible. The Royal Forestry Department has been unable to solve this problem (Ghimire 1994).

Khao Yai National Park

In 1962, Khao Yai was established as Thailand's first national park (Figue 1). This biologically diverse park contains numerous endangered species, including elephant, gaur, hornbill, and tiger. The park is home to 200 Asian elephants, 318 migrant and resident bird species, three species of hornbills, and 5,000 species of butterflies (Gray et al. 1994; Thaiparks.com 2001). The park supplies agricultural water to four provinces. Due to its rich biodiversity, Khao Yai is also a magnet for illegal collecting, logging, and poaching.

Figure 1. General location of Khao Yai National Park.

Khao Yai has a total area of 2,169 sq km. The park has elevations in excess of 1,000 m and many valleys and plateaus. Along with some grasslands, the park contains hill evergreen, dry evergreen, dry mixed deciduous, and secondary-growth forests, with most areas being in tropical rain forest (TDRI 1995; Kasetsart University 1993).

Since Khao Yai is only 200 km from Bangkok, Thailand's capital and largest city, it is a popular destination for Thai and foreign tourists. The number of tourists visiting the park increases every year. The five most popular tourist activities in the park are visiting waterfalls (Figure 2), viewing scenery, leisure walking, trekking, and wildlife watching (TDRI 1995). The park provides housing accommodations and other facilities, including a visitor center, a big open room for presentations, restaurants, and a small souvenir shop. Lodging and camping facilities have a limit of 1,900 people. Trekkers are limited to 100 per day, and visitors to the open room, to 500. Half of the revenues generated by Khao Yai come from tourism and the other half from the government (TDRI 1995).

The Forestry Faculty of Kasetsart University has identified several problems in the park. Insufficient law enforcement capabilities have hampered the ability to protect the park's

Figure 2. Two of Khao Yai's renowned waterfalls: Haew Surat (l) and Haew Narok.

natural resources. Local villagers engage in illegal logging and poaching in the park. The arrest rate remains high, even though a previous development plan tried to reduce illegal uses of the park. Forested areas of Khao Yai are subject to continuous human disturbance for several reasons:

- The insufficient amount of available agricultural land causes villagers to move to areas adjacent to Khao Yai, and limited income sources cause them to collect and sell forest products from the park.
- Sections of the park itself contain permanent villages, including roads and other infrastructure.
- Local villagers, both inside and outside the park, lack the knowledge and goodwill needed to support conservation.
- Development plans made by other governmental departments often contradict the goals of park management, e.g., expanding agricultural projects encourage villagers to cut forested areas.

Increasing pressure from visitation has caused several problems as well. Human waste has become a problem because disposal facilities are insufficient and the methods used, such as incineration and burying, are inadequate. Public health measures in the area's restaurants are below standards, which results in periodic outbreaks of disease in both humans and animals.

Wildlife in the park is directly threatened by human activities and many species are almost extinct on a local basis. Poaching has thrived because it is profitable for local restaurants surrounding the park to use certain organs of animals in preparing expensive dishes. Continued destruction of wildlife habitat has occurred due to conversion of forestland to agricultural land in areas adjacent to the park. Increased use of pesticides has harmed wildlife. Exotic species have increased disease transmission and compete with native species for habitat. Finally, there are not enough experienced wildlife specialists to monitor wildlife populations and protect their habitat.

Park Administration

Since Khao Yai is large, administration of the park requires highly qualified personnel and effective cooperation between officials of the National Park Division and the four provinces that the park covers. Administrative management of the park has been stymied by three factors. First, the current administrative structure is not compatible with the number and scope of management tasks and the large size of the park. Second, the quality and quantity of personnel are insufficient, and the park budget, very limited to begin with, is declining. The 2000 budget was 18 million baht (US$453,000), significantly less than the 1998 budget of 27 million baht (US

$680,000) (U. Suphanpong, personal communication). Third, coordination of policy and management activities among departments has been inadequate. Currently, promotion done by the Tourism Authority of Thailand conflicts somewhat with the conservation of park resources. Fourth, private land development, in the form of golf courses and resorts, is degrading the park's natural resources.

The Forestry Faculty of Kasetsart University has responsibility for studying park management problems and preparing the master management plan (Khao Yai Management Master Plan II) for the Royal Forest Department. The plan is based on terms of reference issued by managers of national parks and wildlife sanctuaries, and aims to resolve existing problems and improve park administration.

Conclusion

The case of Khao Yai National Park illustrates well the challenges faced by park managers and those concerned about conserving the biodiversity and natural resources of Thailand's protected areas. The country faces unrelenting pressures on natural resources from population and income growth, which have resulted in rapid depletion of forests and associated biodiversity and encroachment of protected areas. In addition, there are long-standing equity issues related to the treatment of local people in and near the parks. In this respect, Thailand is typical of many rapidly developing countries. Hopefully, rational planning efforts, such as Kasetsart University's plan for Khao Yai National Park, will result in a higher level of protection for Thailand's protected areas.

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Pakkawadee Panusittikorn, 2300 Avent Ferry Road, Apt #F5, Raleigh, North Carolina 27606; pukypuky@hotmail.com
Tony Prato, Department of Agricultural Economics, 130 Mumford Hall, University of Missouri-Columbia, Columbia, Missouri 65211 USA; PratoA@missouri.edu

The George Wright Society
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