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# Dollars and sense

Approaches to conservation that seek to protect the most endangered species have had only mixed success. Is it time to move away from biodiversity 'hotspots' and stress the economic value of ecosystems? **Lucy Odling-Smee** investigates.

**T**he Florida panther is living on the edge. Once, these majestic cats prowled throughout the southeastern United States. But today, fewer than 90 of the creatures cling to fragments of habitat in southern Florida. And not everyone agrees that efforts to save this subspecies make economic or scientific sense.

Male Florida panthers (*Puma concolor coryi*) stalk hunting grounds that average 550 square kilometres. Given the exorbitant cost of land in the Sunshine State, protecting sufficient habitat to support a population viable over the long term is a tall order. And although some argue that protecting the panther will rescue other threatened animals and plants along the way, this remains little more than an article of faith. Even the panther's evolutionary heritage has been called into question: genetic studies suggest that it is not as distinct from other subspecies of mountain lion as was once thought<sup>1</sup>.

Attempts to save the Florida panther epitomize an approach to conservation that is increasingly coming under fire. A new, hard-headed breed of conservationists say we should not concentrate exclusively on saving

the rare and endangered or on protecting species diversity. Instead, they say, decisions need to be made within a rigorous economic framework. Some argue that the key to effective conservation is quantifying and promoting the economic 'services' that ecosystems provide for people — a mantra that has gained momentum with the completion this year of the most comprehensive survey yet of these benefits, the Millennium Ecosystem Assessment<sup>2</sup>.

At the same time, conservationists are being urged to develop better tools to measure the effectiveness of their projects, and to share data on best practice. In other words, say critics, it's time for the organizations involved in conservation to admit that they are fallible, and to learn from past mistakes (see 'Taking quackery out of conservation', overleaf).

## On the spot

In recent years, the field of conservation biology has been dominated by the goal of preserving biodiversity — a slippery concept, which can be defined in various ways. The most dramatic push came from an article<sup>3</sup> published in 1988 by Norman Myers, then at Cornell University in Ithaca, New York. His

paper introduced the idea of biodiversity 'hotspots'. To earn hotspot status, Myers said, a region must contain 1,500 or more endemic plant species, which are found in that area but nowhere else, and it must have lost at least 70% of its original habitat. Myers identified ten areas of tropical forest as hotspots on the basis of these criteria.

It was a seductive idea: focusing scarce resources for conservation on hotspots offered maximum bang for buck. Conservation International, one of the leading organizations in the field, adopted the idea as its guiding principle in 1989. And subsequent analyses by Myers and others extended the concept from tropical forests to other habitat types and taxonomic groups<sup>4</sup>.

Conservation International, based in Washington DC, now recognizes 34 hotspots. These occupy just 2.3% of the Earth's land surface, yet are the sole home of half the world's vascular plant species and 42% of terrestrial vertebrates.

"Conservation International's maps have been an incredible political tool," says Ian Owens, a conservation biologist at Imperial College London. "They made rescuing biodiversity seem achievable."

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Counting costs: humans need vast forests (above), but these may be ignored if conservationists focus on the Florida panther (left) or hotspots in Peru (right).

But recently, the hotspot concept has come under fire. Analyses have revealed an alarming lack of overlap between hotspots identified using different criteria<sup>5,6</sup> (see map, below). And some experts argue that focusing on biodiversity hotspots is fundamentally misguided. "It's like being a butterfly collector or having a zoo in which you protect a tiny sample of the Earth," says Peter Kareiva, a lead scientist for The Nature Conservancy, based in Arlington, Virginia. "Meanwhile, you could be ignoring ecosystems that are hugely important to humankind."

Hotspots are "questions waiting for answers," concludes Hugh Possingham, a mathematician and conservation biologist at the University of Queensland in Brisbane, Australia. He echoes Kareiva's call for emphasis on the importance of ecosystems to people, and wants conservation biologists to embrace the tools of decision theory. This theory is widely used in planning by engineers and financial advisers to work out how their funds

should best be allocated. Mapping more of the world's biodiversity hotspots is "like fixing the antenna on your car when the engine's broken", Possingham quips.

Possingham and his colleagues argue that spending money on those areas containing the most species at risk of extinction isn't necessarily the best strategy. Often, these are areas in which there is a small chance of success — because of overwhelming development pressure or official corruption, for example. In many cases the future of areas with fewer threatened species can be secured more easily and cheaply, he says.

In their current work, as yet unpublished, Possingham and his colleagues are using decision theory to lay economic factors over the maps of priority areas used by major conservation organizations. After plugging in the cost of action — which depends on factors such as land prices and human population density — their algorithms churn out an optimized strategy for allocating a limited pot of

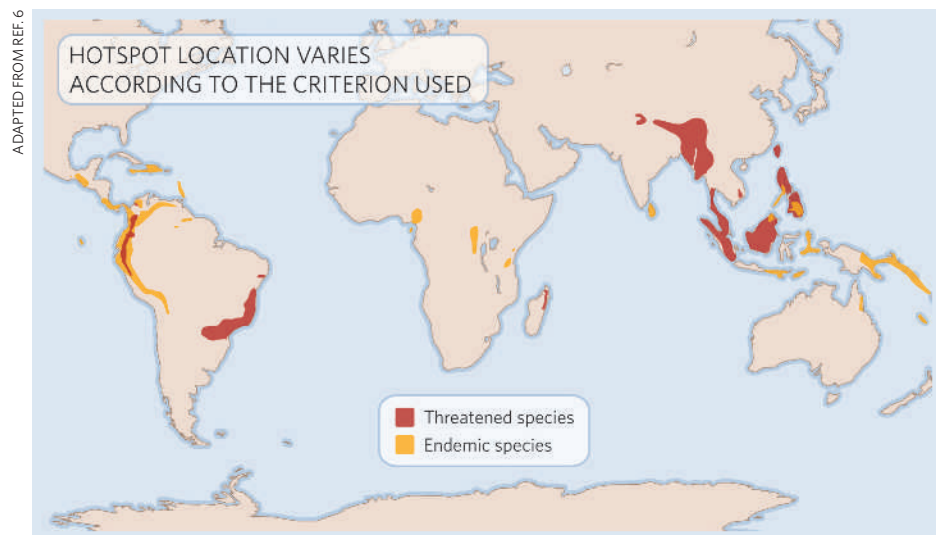
conservation funds. Kareiva sees Possingham's analyses as an early sign of a much-needed shift in thinking. "The whole conservation movement needs to deal more with people and with ecosystem services," he says. If it did so, he suggests, greater emphasis would be given to habitats such as the vast tracts of boreal forest that stretch from Russia to Canada. Nicknamed 'the world's lung', this habitat is an important carbon sink, providing a natural brake on the greenhouse effect, and it is arguably the planet's most important nitrogen-fixing ecosystem. Yet boreal forests are not a priority for several major international conservation groups.

### Service not included

Natural ecosystems provide a wide variety of resources that have a social and economic value. These include services, such as clean water, stable soils and protection against natural catastrophes, and potential benefits, such as a storehouse of biodiversity from which drugs might be discovered. But studies to quantify these benefits, especially the financial costs and gains attached to protecting them, are only just beginning to gain momentum.

Preliminary results are eye-opening. Recent research indicates that the catastrophic loss of life seen in the Asian tsunami of 26 December 2004 could have been lessened had the clearance of Sri Lankan mangrove forests been prevented<sup>7</sup>. In Costa Rica, experiments have shown that maintaining a patch of forest, and so a supply of pollinators, near coffee plantations increases coffee yields by 20% — an economic gain that easily matches revenues obtained by converting the forest to farmland<sup>8</sup>.

At least now there is a solid base on which to build further analyses of the costs and benefits of protecting specific ecosystems: the Millennium Ecosystem Assessment. Requested by United Nations secretary-general Kofi Annan,



# TAKING QUACKERY OUT OF CONSERVATION

Michael Wright knows he isn't being told the whole truth. The director of conservation and sustainable development for the Chicago-based MacArthur Foundation, Wright says he "falls out of his chair" if any of his grantees admit that their plans have misfired. "You get a proposal that says, 'Here are the things we want to do in the next three years', and then you get a report that says everything went according to plan," he says.

The true picture cannot be quite so rosy, Wright argues. But, in a field dominated by a few large organizations that rely on goodwill from foundations and the public to keep the money flowing, few conservationists are brave enough to admit to failure. "As much as fear of donors, it's institutional egos between organizations," says Wright.

In the past few years, efforts have been launched to make evaluation more rigorous and transparent. The three-year-old Conservation Measures Partnership, for instance, draws together big players in the field to create a common framework for deciding whether a project has succeeded. One goal is to harmonize terminology: for example, what Conservation International calls 'pressures' on a habitat or species, the WWF calls 'threats'.

But measuring the effectiveness of a particular project is only the start — the data must be disseminated to be useful. One attempt to do this is the website ConservationEvidence.com, run by William Sutherland of the University of East Anglia in Norwich, UK. The site accepts various accounts of how

interventions have gone, from journal articles to reports from wildlife managers. Several accounts of an issue are reviewed by an expert and encapsulated in an easy-to-read summary.

"I became increasingly uneasy about the fact that conservationists just make pronouncements about what is 'the right way'," explains Sutherland. He surveyed the people in eastern England who do the real work of conservation, such as park managers, and found that they get only 2.4% of their information from primary scientific literature<sup>9</sup>. His idea, he says, is to emulate the evidence-based medicine revolution launched in the 1970s, in which doctors began switching from tradition and intuition — and sometimes ineffective quackery — to remedies that

had been shown to work by scientific review.

The Centre for Evidence-Based Conservation at the University of Birmingham, UK, has similar goals. Since its launch in 2003, the centre has put out reviews on such topics as whether controlled burning of upland heaths helps to maintain floral diversity. "Conservation has stood still," complains Andrew Pullin, who heads the centre. "We're still making the same mistakes. Until we can get critical appraisal of our own actions, and make it available, we are not going to advance."

Nevertheless, both he and Sutherland are optimistic that their approach will eventually prevail. "I think we will cause a shift in the way conservation is done," Pullin predicts.

**Emma Marris**

it has been drawn up by more than 1,300 researchers from 95 nations over four years. It reviews the state of 24 different ecosystem services — from easily measured benefits, such as the provision of food, to elusive ones, which include the regulation of air quality and climate. Of these 24 services, 60% are being degraded, and fast<sup>2</sup>.

Those involved in the assessment are disappointed with the response so far from the world's media and politicians. "If you went out and said we've looked at 24 indicators of economic well-being, and only four of them are improving, and of those four, one is about to crash, the world would panic," says Georgina Mace, a conservation biologist with the Zoological Society of London. The problem, she suggests, is that people aren't yet used to thinking about the environment as an economic resource.

## Capital ideas

Nevertheless, the message is being picked up by influential figures within the conservation movement. Among the converts is Eric Dinerstein, chief scientist with the WWF, formerly the World Wide Fund for Nature, in Washington DC. "I don't think conservationists have sufficiently exploited the value of certain habitats that maintain services essential for human life and welfare," he says.

Eager to capitalize on this approach, the WWF is planning a scheme called 'hydrosheds'. This will use climate and hydrological models to identify the places where people get their water from. The goal is to produce a series of maps that can convince governments of the merits of conserving habitats that include economically important watersheds.

The practical difficulties of making such arguments work, however, are daunting. Andrew Laurie is chief technical adviser to a wetlands biodiversity project in China funded by the United Nations Development Programme and the Global Environment Facility. As well as providing diverse habitats for animal and plant species endemic to China, the

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— Peter Kareiva

wetlands that Laurie is trying to protect act as water purifiers, floodwater and climate regulators, and suppliers of grass and reed building materials. Although the overall cost-benefit analysis gives a strong economic case for conservation, the equation is different for local farmers, who would lose the opportunity to convert wetlands for their own use. Devising specific financial mechanisms to reward these farmers will be key to success.

In Laurie's wetlands, there is at least a strong overlap between protecting biodiversity and promoting ecosystem services. Elsewhere, this isn't necessarily the case. Boreal forests, for instance, fare poorly on standard measures of biodiversity. And economic arguments relating to ecosystem services can, in some cases, usurp the goal of conserving wildlife. "You can cut down a mountain-top forest that has a lot of rare endemics, plant eucalyptus and probably get the same watershed benefit from the

introduced exotics as you would from native plants," Dinerstein admits.

Indeed, many conservation biologists are concerned that giving natural habitat a monetary value risks losing sight of the ethical and spiritual dimensions of conservation — driving forces in campaigns such as those to save the Florida panther.

"We mustn't rely only on an ecosystem-services approach because it misses out so much," says Laurie. "The argument that only by instilling respect for life are we going to get anywhere with conservation still carries a lot of weight."

But against the backdrop of environmental devastation now gripping the planet, and the scant resources devoted to conservation, there is a growing realization that economic arguments must become a key weapon in the movement's arsenal. "If conservation is to have any chance of being relevant in the next century," warns Kareiva, "it will only be because we have figured out how to protect ecosystem services at the same time as we protect biodiversity."

**Lucy Odling-Smee is a subeditor for Nature.**

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