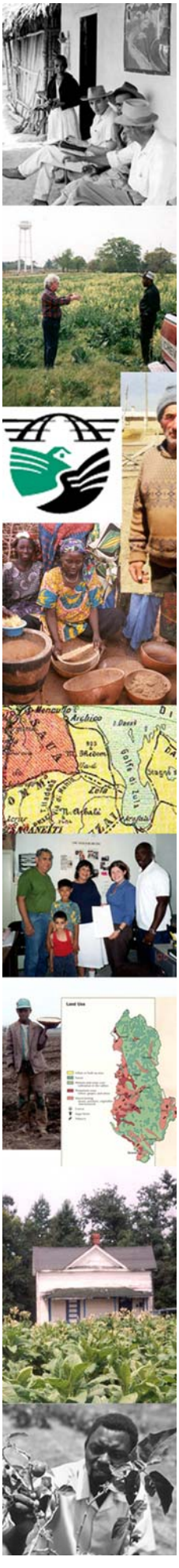

This work was funded with the generous support of the American people through the Leader with Associates Cooperative Agreement No.EPP-A-00-06-00014-00 for implementation of the TransLinks project. The contents of this report are the responsibility of the author and do not necessarily reflect the views of the United States government.

Land Tenure Center
AN INSTITUTE FOR RESEARCH AND EDUCATION ON SOCIAL STRUCTURE, RURAL INSTITUTIONS, RESOURCE USE, AND DEVELOPMENT

TENURE BRIEF

No. 13; October 2010 UNIVERSITY OF WISCONSIN — MADISON

CREDIBLE CONSERVATION:

USING BIODIVERSITY MONITORING TO SUPPORT INCENTIVE PROGRAMS THAT PROTECT ENDANGERED WILDLIFE

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Market-based, economic incentive programs reward land users for conserving environmental services, habitat, or biodiversity. Such programs can be instrumental in protecting endangered wild animals persisting on private lands. To ensure success, these programs must be accompanied by effective monitoring strategies that can reveal whether conservation is occurring or not.

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AS HUMAN POPULATIONS GROW and expand, protected areas will become increasingly isolated, and competition between humans and wildlife for space and resources likely will intensify. Many of the most charismatic and ecologically important wildlife species, such as elephants, bears, and tigers, have large ranges that often extend outside protected areas, bringing them into conflict with people on private property. Such conflicts can result in lost income for land users and, in extreme cases, loss of life for both humans and wildlife.

Direct interventions to protect wildlife by changing or prohibiting human activities often are unpopular because they interfere

Alpaca ranchers in the Nudo del Azuay, Ecuador. Many areas of high biodiversity are home to people who participate in agricultural activities.
Photo by Fundación Cordillera Tropical.

with people's economic activities, subsistence strategies, or recreation. In contrast, indirect, market-based interventions focus on creating economic incentives for preserving wildlife and wildlife habitat on private land. These incentives promise to link private lands to protected-area networks in a way both profitable for land users and good for wildlife.

Private lands for conservation

When protected areas are too small to maintain viable populations or when wild animals cross reserve boundaries onto human-settled lands, then methods for conserving endangered species on private lands becomes vital. Eco-labeling is an example of a market-based program that can be attractive to the type of rural landowners who often disproportionately bear the costs of wildlife presence, including threats to life and livelihood. (See ***LTC Brief* 7** for recent advances in managing human-wildlife conflicts.)

Community members examine camera trap photos of wildlife on their property.
Photo by Becky Zug.

In the Nudo del Azuay watershed of south-central Ecuador, All Things Alpaca is a 1400-hectare alpaca ranch that shares land with native Andean wildlife, while producing high-quality garments made from fine alpaca wool. In 2009, All Things Alpaca became a Certified Wildlife Friendly property, meaning the managers follow wildlife friendly practices to conserve threatened and endangered species on their land and can use the Certified Wildlife Friendly label on their products. They use non-lethal methods to reduce the loss of alpaca to Andean bears, puma and Andean foxes. They also conduct native forest and pasture restoration on their land. Wildlife Friendly certification provides them with a connection to environmentally conscious consumers in other parts of the world and enables them to include conservation as part of their products' value. These types of incentive programs empower land-users by making conservation a sustainable and profitable choice rather than a burden.

For landowners participating in conservation incentive programs, evidence that endangered wild animals are persisting on their lands demonstrates that their stewardship and conservation efforts are succeeding. With transparent methods of identifying individuals repeatedly over time, donors, consumers, and markets gain confidence that incentive payments are worthwhile investments.

Advances in monitoring

To be credible to donors and markets, an incentive program like eco-labeling must employ reliable monitoring methods, including assessments of the condition of biodiversity or of a focal species on participating properties over time. The greater the investment in verifying conservation outcomes, the more confident consumers and donors become. (See table, next page, for the strengths and weaknesses of different monitoring methods.)

The greater the investment in verifying conservation outcomes, the more confident consumers and donors become.

Method	Requirements and strengths and weaknesses
Infra-red, remote photography (camera trapping) and direct observation	• Unique scars or surface patterns (e.g., Andean bear fur color, lion whiskers, leopard spots, gorilla nose wrinkles, nicks in elephant ears, botflies on howler monkeys, injuries) • ***Strengths***: Photos can be disseminated worldwide via the internet, rewards for landowners, helps build a connection between producers and consumers • ***Weaknesses***: Can be costly, fixed locations, not all animals are individually identifiable in photos
Capture, mark, release, observe/recapture	• Unique marking added to animal: GPS or radio collars, colored or numbered tags or bands, dyes applied externally or internally through bait • ***Strengths***: Provides information on individual condition (age, sex, reproductive status, physiological data, DNA) and moves with the animal. • ***Weaknesses***: Costly, technically complicated, risky for animal and researcher, evidence is difficult to disseminate
Genetic analysis	• Tissue samples required: Blood, hair, feces, saliva • ***Strengths***: passive, non-invasive collection of feces or shed hair possible, provides information on individual condition (age, sex, relatedness to other animals) • ***Weaknesses***: Costly, technically complicated, data are uninteresting to donors and consumers and evidence difficult to disseminate

Simply using the presence of focal species (rather than persistence of individual animals) to declare the success of an intervention could mask individual animals moving onto the property and dying or simply passing through without finding suitable places to live, reproduce, and mature. Among the methods that do *not* accurately distinguish persistence from transience are indirect sign surveys (tracks, scat, feeding remains, etc.) and simple one-time visual observations.

In the past only two methods were available for detecting individual persistence of wild animals: capture-mark-recapture methods such as live trapping and radio collaring, or visual observation of individually recognizable animals. Advances in non-invasive methods make individual identification less labor-

Facial patterning is unique to each Andean bear and can be used to recognize individuals over time.

Photo by Taylor Jones.

Camera traps provide photos of non-target species that indicate biodiversity on participating properties. Pictured here is the little spotted cat, a species previously unknown in the Nudo del Azuay.

Photo by Taylor Jones.

intensive in the field. In particular, recent advances in remote photography by infra-red-sensitive digital cameras generate the needed evidence and simultaneous benefits for landowners.

Like human fingerprints, the unique physical markings of many animals make them individually recognizable. The spots on a leopard and the stripes on a tiger are unique to each individual; humpback whales have distinctive patterning on the bottoms of their tails; manatees have characteristic markings and scars; elephants can be identified by the notches along the edges of their large ears and rhinoceri by the pattern of their ear hair. Identification of individuals can be used as the basis for estimating population, determining range size, and measuring survival over time. Individual identification also can help verify landowners' success in protecting individuals of endangered species.

Camera traps are remotely triggered, take time-stamped photos, and can store thousands of images digitally. Because camera traps take photos when any animal of sufficient size walks in front of the camera, they can help monitor multiple species of interest, as well as identify species not known to be in the area. Camera trap photos are also an excellent way to involve local people in conservation and encourage ownership of the wildlife on their land, which can result in higher tolerance for wildlife and better participation in verification efforts. Higher tolerance can translate into increased protection for habitats and wildlife. Finally digital photos can be shared with distant consumers via the internet and be used to tell an unfolding story of wildlife conservation on the lands of producers.

Individual identification of Andean bears in the Nudo del Azuay

In 2008 and 2009, the Carnivore Coexistence Lab at the University of Wisconsin-Madison collaborated with Fundación Cordillera Tropical to survey Andean (spectacled) bears on private lands participating in conservation incentive programs. Camera trap photos identified at least 10 different bears within 17 square kilometers over 13 months. These photos captured a cub and two pairs of bears traveling together, which may indicate mating pairs or young siblings. Repeated photos of two of the bears over 10 months confirmed that the private properties were used consistently as habitat by individuals of this globally imperiled species. Work is ongoing to determine the fate of the other bears.

The private landowners welcomed evidence of their ongoing success in conserving Andean bears. An advantage of camera trap technology is the wealth of wildlife photos that can be shared with participating landowners to create a connection with the wildlife on their land. Improved protection and local enforcement followed when the landowners informed surrounding communities that hunting on their land would not be tolerated. Based on the success of this initial collaboration, 10 local community members have been trained to use camera traps. They will survey the properties of landowners and assume the roles of community monitors and environmental educators (see *LTC Brief* 14, which outlines lessons learned in a monitoring strategy).

Any method for individual identification can be costly, but few studies have examined comparative cost-effectiveness over time across methods. Camera trap models can range widely in cost ($100-$700) and effectiveness. We used Reconyx™ camera traps, which cost $500-700 per unit. We identified 10 bears in 11 field months over 24 square kilometers. The cost per individually identified bear was approximately $2000, but this cost diminishes over time as the cameras continue to function in the field.

Credible conservation

Without monitoring, the long-term effectiveness of a conservation incentive program cannot be credibly verified. Land-users, wildlife experts, and payers/certifiers must collaborate to develop effective monitoring programs at all levels: to determine whether the program was carried out as planned, whether the program reduced the threat to biodiversity, and whether the condition of biodiversity actually improved (see ***LTC Brief* 14** for lessons learned from monitoring strategies aimed at protecting wildlife). Otherwise, incentive schemes will lose credibility and participants. Monitoring can validate the efforts of all parties, providing a tool for adaptive management of conservation incentive programs while rewarding land stewardship.

Related reading

Jones, T. 2010. "Detection probability and individual identification of the Andean bear (*tremarctos ornatus*) using camera trapping methods." Nelson Institute for Environmental Studies. University of Wisconsin-Madison, Madison.

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Acknowledgements

We thank Fundación Cordillera Tropical for their partnership. Additional funding was provided by Latin American, Caribbean, and Iberian Studies at the University of Wisconsin-Madison, the Doris Duke Charitable Foundation, the International Bear Association, the Nelson Institute for Environmental Studies, and the United States Fish and Wildlife Service International Program Wildlife Without Borders.

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Published by the **Land Tenure Center.** Comments encouraged:

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