

PEOPLE AND WILDLIFE: CONFLICT OR CO-EXISTENCE?

What do you do when an elephant eats your garden?... or a tiger eats your brother?

A joint symposium of the Zoological Society of London and the Wildlife Conservation Society



PROGRAMME and ABSTRACTS

Conflict between people and wildlife is a major conservation issue that is difficult to resolve. A wide array of wildlife species threaten – or are perceived to threaten – human lives and livelihoods, and are killed for this reason. Some of these species are common pests; unfortunately, others are threatened with extinction. Species as diverse as elephants, predatory birds and ground squirrels are endangered because people kill them. Even animals nominally protected by reserves can be affected. The impact of endangered species on human lives and livelihoods can be severe. Bears and elephants really do kill people. A pack of African wild dogs can decimate a herd of goats in a few minutes. For many years lethal control has been the simplest and most effective way to reduce these impacts. It is difficult to decide what to do when the needs of people clash so directly with the needs of threatened species. At this meeting, speakers with first-hand experience in this difficult area of conservation will present a variety of approaches to resolving human–wildlife conflict. Topics will include alternatives to lethal control, such as improved farming practice, offsetting the costs of wildlife damage through hunting and tourism, and the development of local and national policies.

Organised by Drs Rosie Woodroffe, Simon Thirgood and Alan Rabinowitz

5th and 6th December 2002

PROGRAMME: THURSDAY 5 DECEMBER

09.00 Registration

09.30 **Introduction** - Alan Rabinowitz (WCS, USA)

SESSION 1: DEFINING THE PROBLEM

Chair: Alan Rabinowitz (WCS, USA)

09.35 **How conflict with people affects wildlife populations**

Rosie Woodroffe (U.C. Davis, USA), Simon Thirgood (CCS, UK), Alan Rabinowitz (WCS, USA)

10.00 **The impact of threatened species on human lives and livelihoods**

Simon Thirgood (CCS, UK), Rosie Woodroffe (U.C. Davis, USA), Alan Rabinowitz (WCS, USA)

10.30 *TEA & COFFEE*

SESSION 2: REDUCING THE LOSSES: TECHNIQUES TO MITIGATE WILDLIFE IMPACT

Chair: David Macdonald (Oxford University, UK)

11.00 **Non-lethal techniques for reducing predation**

Urs Breitenmoser (KORA, Switzerland) Christopher Angst (KORA, Switzerland), Jean-Marc Weber (KORA, Switzerland), Jean-Marc Landry (KORA, Switzerland), John Linnell (Norwegian Institute for Nature Research), Christine Breitenmoser-Würsten (KORA, Switzerland)

11.30 **Techniques to reduce crop loss to elephants and primates in Africa: the human and technical dimension**

Loki Osborne (Mid-Zambezi Elephant Project, Zimbabwe), Catherine Hill (Oxford Brookes University, UK)

12.00 **Characterization and prevention of attacks on humans**

Howard Quigley (WCS, USA), Stephen Herrero (University of Calgary, Canada)

12.30 *LUNCH*

SESSION 3: ADJUSTING THE BALANCE SHEET: ECONOMIC INCENTIVES TO INCREASE TOLERANCE

Chair: Glyn Davies (ZSL, UK)

14.00 **Paying for tolerance: compensation and other schemes**

Kimberly Rollins (University of Guelph, Canada)

14.30 **Safari hunting and conservation on communal land**

Dale Lewis (Admade Programme, Zambia), John Jackson III (Conservation Force, USA)

15.00 **Can hunters and wildlife co-exist in the humid tropics?**

Liz Bennett (WCS, USA), John Robinson (WCS, USA)

15.30 **Increasing the value of wildlife through non-consumptive use**

Matt Walpole (DICE, UK), C.R. Thouless (Kenya)

16.00 *TEA & COFFEE*

SESSION 4: CASE STUDIES

Chair: James Deutsch (WCS, USA)

16.30 **Zoning as a means of mitigating conflicts with large carnivores**

John Linnell (Norwegian Institute for Nature Research), Erlend Birkeland Nilsen (Norwegian University of Science and Technology), Unni Støbet Lande (Norwegian University of Science and Technology), Ivar Herfindal (Norwegian University of Science and Technology), John Odden (Norwegian Institute for Nature Research), Ketil Skogen (Norwegian Institute for Nature Research), Reidar Andersen (Norwegian Institute for Nature Research), Urs Breitenmoser (KORA, Switzerland)

17.00 **Geese and farmers in the United Kingdom**

Juliet Vickery (British Trust for Ornithology, UK), David Cope (The Macaulay Institute, UK) and Marcus Rowcliffe (Institute of Zoology, ZSL, UK)

17.30 **Understanding and addressing the conflict surrounding Black-tailed prairie dog conservation**

Richard P. Reading (Denver Zoo, USA), Tim W. Clark (Northern Rockies Conservation Cooperative, USA), Lauren McCain (Southern Plains Land Trust, USA), Brian J. Miller (Denver Zoological Foundation, USA)

19.15 *DINNER in THE STAMFORD RAFFLES SUITE (tickets booked in advance)*

PROGRAMME: FRIDAY 6 DECEMBER

SESSION 4: CASE STUDIES

Chair: Rosie Woodroffe (UC Davis, USA)

- 9.00 **Raptors and grouse in the UK: conservation science meets realpolitik**
Simon Thirgood (CCS, UK), Stephen Redpath (Centre for Ecology and Hydrology, UK)
- 9.30 **People and elephants in Shimba Hills, Kenya**
Timothy Knickerbocker (U.C. San Diego, USA), John Waithaka (African Conservation Centre, Kenya)
- 10.00 **Socioecological determinants of vulnerability among farmers neighboring Kibale National Park, Uganda**
Lisa Naughton-Treves (University of Wisconsin & CABS, USA), Adrian Treves (CABS, USA)

10.30 *TEA & COFFEE*

Chair: Sarah Durant (ZSL, UK)

- 11.00 **Resolving conflicts between people and jaguars**
Alan Rabinowitz (WCS, USA)
- 11.30 **People and predators in Laikipia District, Kenya**
Laurence Frank (U.C. Berkeley, USA), Rosie Woodroffe (U.C. Davis, USA),
Mordecai Ogada (Mpala Research Centre, Kenya)
- 12.00 **Tigers and people in the Russian Far East**
Dale Miquelle (WCS, Russia)
- 12.30 **A tale of two countries: large carnivore depredations and compensation schemes in Sweden and Norway**
Jon Swenson (Agricultural University of Norway), Henrik Andrén (Swedish University of Agricultural Sciences)

13.00 *LUNCH*

Chair: Nigel Leader-Williams (DICE, UK)

- 14.30 **Management of wolf–human conflict in the northwestern United States**
Ed Bangs, John Oakleaf, Liz Bradley (U.S. Fish & Wildlife Service, USA)
- 15.00 **Policy for reducing human–wildlife conflict: a Kenya case study**
David Western (WCS, Kenya), John Waithaka (African Conservation Centre, Kenya)
- 15.30 **An ecological framework for managing human–tiger conflict in India**
Ullas Karanth (WCS, India), Rajesh Gopal (Tiger Project – Government of India)

16.00 *TEA & COFFEE*

SESSION 5: THE FUTURE OF CO-EXISTENCE

Chair: Simon Thirgood (CCS, UK)

- 16.30 **Risk assessment and human–wildlife conflict**
John Harwood (CCS, UK), Christian Asseburg (CCS, UK), Sophie Smout (CCS, UK), Stephen Redpath (CEH, Banchory, UK), Simon Thirgood (CCS, UK)
- 17.00 **The future of co-existence**
Rosie Woodroffe (U.C. Davis, USA), Simon Thirgood (CCS, UK), Alan Rabinowitz (WCS, USA)
- 17.30 **Closing Remarks - John Robinson (WCS, USA)**

Organisers

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Alan Rabinowitz	Wildlife Conservation Society, Bronx Zoo, 185th St. and Southern Blvd., Bronx, New York 10460, USA. Email: ARABINOWITZ/0007174173@MCIMAIL.COM

ABSTRACTS

How conflict with people affects wildlife populations

Rosie Woodroffe¹, Simon Thirgood² and Alan Rabinowitz³

¹Department of Wildlife, Fish & Conservation Biology, University of California, 1 Shields Avenue, Davis CA 95616, USA

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Conflict between people and wildlife is a major extinction risk for some wild species. At its most extreme, lethal control has led to the extinction of at least two species (the Guadalupe caracara, *Caracara lutosus*, and the Falkland Island wolf, *Dusicyon australis*). Outside protected areas, lethal control – some of it highly organized and government-funded – has led to the deliberate eradication of some species from large tracts of their former geographic ranges (e.g. grey wolf, *Canis lupus*, black-tailed prairie dog, *Cynomys ludovicianus*, hen harrier, *Circus cyaneus*). Even where lethal control occurs in just part of a landscape, mortality may be high enough to reduce the viability of regional populations. For example, conflict with landowners may make moorlands managed for grouse (*Lagopus lagopus*), and commercial sheep farms in African rangelands, into ‘sinks’ for regional populations of hen harriers and lions (*Panthera leo*) respectively. Conflicts between people and wildlife in the border areas of national parks can become sinks in a similar way, and may be severe enough to cause extinction of nominally protected populations where reserves are small in comparison with the home ranges of the species that inhabit them. Conflict may also have a more insidious effect on wildlife populations since, where conflicts are severe, economics may favour alternative land uses that exclude wildlife altogether. This capacity for conflict to drive habitat destruction is particular cause for concern, since its effects are often irreversible.

The impact of threatened species on human lives and livelihoods

Simon Thirgood¹, Rosie Woodroffe² and Alan Rabinowitz³

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Intrusive techniques are often used by government agencies, wildlife managers and local communities to reduce the impact of wildlife on human lives and livelihoods. But do the real costs of wildlife damage actually match the perceptions of local communities and other stakeholders? In this second scene-setting presentation, we evaluate the need for active intervention in conflict situations by quantifying the impact of threatened species on human lives and livelihoods. Focusing on mammalian and avian predators and crop raiders, we assess the economic costs to stakeholders of living with wildlife in both the developed and developing world. We also consider the ecological characteristics of species that come into conflict with humans and discuss whether particular problem individuals cause most wildlife damage. We conclude that threatened species may, in certain circumstances, have a significant impact on stakeholder lives and livelihoods. We note, however, that in many, if not most cases, data do not exist to rigorously quantify the real costs of wildlife damage.

Non-lethal techniques for reducing predation

Urs Breitenmoser¹, Christoph Angst¹, Jean-Marc Weber¹, Jean-Marc Landry¹, John Linnell² and Christine Breitenmoser-Würsten¹

¹*KORA, Thunstrasse 31, CH-3074 Muri, Switzerland*

²*Norwegian Institute for Nature Research, Tungasletta 2, N-7485 Trondheim, Norway*

All medium-sized to large mammalian predators from boreal to tropical zones are sharing their living space with domestic animals and do occasionally or frequently kill stock. Retaliation killing from herders is one of the major threats to the predators living outside strictly protected areas. Killing stock raiders was the most usual practice to avoid or reduce depredation in all cultures throughout the world. However, non-lethal methods to protect livestock, such as guarding or fencing, were traditionally applied because the retaliation killing of predators was not efficient enough to protect livestock herds. Today, additional to economic incentives, we must consider ethical and conservation aspects. For many of the larger carnivores, strictly protected areas are too small to maintain viable populations, and they need to expand into the cultivated landscape where they have to co-exist with humans. Here, the application of non-lethal preventive methods for the protection of livestock herds may be crucial for the survival of a carnivore population. We review the traditional herding techniques (shepherd, guarding animals, corrals) and modern systems (electric and electronic device) and practices (translocations, aversive conditioning) with respect to the conservation of populations. Then, we discuss non-lethal preventive measures in the context of a broader conservation approach. In many situations, domestic prey form a significant part of a predator's diet, and even non-lethal preventive methods may harm the carnivore population. In such situations, a compensation scheme aimed to increase the herders' tolerance to losses through predators will be more appropriate. Under such circumstances, only the recovery of the natural prey base may help to preserve the carnivores in the long term.

Techniques to reduce crop loss to elephants and primates in Africa: the human and technical dimension

F.V. Osborn

Mid Zambezi Elephant Project, 37 Lewisam Avenue, Chisipite, Harare, Zimbabwe

Human-wildlife conflict and specifically crop loss to wildlife, is a significant constraint on rural development and conservation. Most large mammals in the forests and savannas cause crop destruction to some degree and efforts to control crop loss have generally been ineffective. This talk focuses on the reasons underlying this conflict, outlines current and experimental non-lethal methods to reduce the loss and examines the implications of this conflict on the farmers and conservation agencies. Elephants and primates are used as examples because they exemplify the complexities of managing intelligent and potentially dangerous crop pests.

Characterisation and prevention of attacks on humans

Howard Quigley¹ and Stephen Herrero²

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²*Professor Emeritus of Environmental Sciences, Faculty of Environmental Design, University of Calgary, Calgary, Alberta, T2T 2Y2, Canada*

Attacks on humans are one of the most perplexing and dramatic categories of interactions between wildlife and humans. Although these attacks have always been part of human existence, an expanding human population and increased human–wildlife interactions drive an increasing need to reduce these attacks through measures other than the wildlife population control methods of the past. In an attempt to better understand these attacks and develop approaches for reduction, we examined the characteristics of these attacks as they relate to large terrestrial carnivores. Attacks can be characterized into one of three categories: defensive, provoked, or offensive. We define these categories and describe the threatening behaviors often displayed prior to attack or potential attack. These categories appear across all of the species we examined, canid, ursid, and felid. Subsequently, we describe the variety of tools available to reduce, repel, and prevent attacks. Finally, we examine the environmental factors that predispose animals to attack humans, or increase the potential for attacks, and suggest steps needed to further reduce the potential for attacks and contribute to the future existence of large carnivores as integral and important components of natural vertebrate communities around the globe.

Safari hunting and conservation on communal land

Dale Lewis¹ and John Jackson III²

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²*Chairman, Conservation Force, 1Lakeway Center, Suite 1045, 3900 N, Causeway Blvd., Metairie, LA 70002, USA*

Under the right policies and investment strategies, safari hunting on communal land can greatly mitigate human costs of living with wildlife and can also contribute to improved wildlife conservation. An important aspect of these policies is the need to bind community/private sector stakeholders together as an effective force in reducing human-related threats to wildlife. Lacking but greatly needed in the safari hunting industry are trade conventions that enhance conservation standards in the industry. A variety of problems typically limit the conservation value of safari hunting on communal land, including the imposition of subsidized license fees for utilizing wildlife and unfair trade practices that place the community as a disadvantaged partner to the private sector. Under more equitable arrangements, investments in improved livelihoods can sustain a rationale for the community to produce wildlife and support the marketing needs of safari hunting.

Can hunters and wildlife co-exist in the humid tropics?

Elizabeth L. Bennett and John G. Robinson

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In high-rainfall tropical forests, productivity of large mammals is extremely low, and hunting offtake rates must be low if they are to be sustainable. With expanding human populations and increasing colonization of forest areas, such low offtake rates are insufficient even to support the subsistence needs of rural hunting communities, let alone a commercial trade. Unsustainably high hunting levels in tropical forests are causing local declines and extirpations of many species across the globe, with resulting implications for forest ecology and rural peoples. The balance between wildlife and people is lost, and both suffer. Moving from high-rainfall tall forests into forest fallows/savannah mosaics, the natural standing biomass of large mammals increases, and certain r-selected species occur at high densities. Hunting offtakes in these mixed ecosystems could be higher while still being sustainable. This could have the dual benefit of providing protein and possibly

income for local peoples, and controlling crop pests, and the potential for co-existence between humans and wildlife is greater. A major management challenge is to ensure that hunting and possible trade of animals from these mosaics do not undermine efforts to conserve populations of species in adjacent tall forests through the mosaics acting as unsustainable sinks, or through rendering enforcement of regulations in tall forests impossible. It is clear that we must strive to achieve this balance.

Increasing the value of wildlife through non-consumptive use?

M.J. Walpole¹ and C.R. Thouless²

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²*PO Box 209, Timau, Kenya, AFRICA*

It has long been recognised that the costs of living with wildlife for poor, rural communities are rarely offset by any material benefits, and this may threaten species survival. Non-consumptive use of wildlife, principally through tourism, offers an opportunity for people to benefit from wildlife in the hope that they will value, and therefore tolerate, coexistence. As a result, wildlife-based tourism has been widely promoted in and around protected areas throughout the world. However, the utility of tourism as a tool for the alleviation of human–wildlife conflict rests on a series of conditions common to most, if not all, indirect incentives schemes that attempt to integrate economic development and conservation. These include (1) the generation of a net benefit for individuals, (2) local understanding of the linkages between tourism benefits and wildlife conservation, and (3) mechanisms to prevent the system being subverted. In practice these conditions are rarely met, for a variety of economic, socio-political and ecological reasons. These include an adherence to socialist economic principles, an assumption that poverty alleviation will inevitably lead to good conservation and a lack of knowledge about the workings of the tourism industry amongst promoters of community-based tourism. Whilst tourism may generate non-consumptive benefits from wildlife, its conservation legacy is likely to be greatest where those benefits are deployed as part of a battery of conflict mitigation methods that includes direct incentives, compensation, consumptive use and conflict avoidance strategies.

Zoning as a means of mitigating conflicts with large carnivores

John D. C. Linnell¹, Erlend Birkeland Nilsen², Unni Støbet Lande², Ivar Herfindal², John Odden³, Ketil Skogen⁴, Reidar Andersen^{2,3} and Urs Breitenmoser⁵

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Zoning of land-use is a common means of reconciling the competing demands of multiple users on limited land, and has been widely used in wildlife conservation, for example, in the case of establishing protected areas. However, large carnivores require such massive home ranges that only a few of the very largest protected areas are able to embrace sizeable populations. In addition, long dispersal distances result in a wide zone of influence surrounding any protected area. The result is that large carnivore conservation must occur partially or entirely within multi-use landscapes outside protected areas.

Zoning, or geographically differentiated management, of large carnivores has been used widely in such landscapes in various forms. These include different degrees of protection, different thresholds for initiation of control actions, different hunting regimes, different implementation of compensation and different economic incentives to mitigate conflicts in different zones. From some points of view zoning is effective in that it allows a concentration of conservation effort and creates a degree of predictability for user groups that can potentially be effected by large carnivores. However, there are a number of sociological, political and ethical disadvantages to zoning that must be considered. Furthermore, the absolute scales at which zoning must be applied to be of relevance to large carnivores will often require transboundary co-operation, creating challenges for management agencies. The ultimate decision of if zoning should be utilised, in what form, and on what scale will be highly context specific.

Geese and farmers in the United Kingdom

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Nine distinct populations of geese are found in Scotland, most of which are increasing in number due to greater legislative protection from shooting. They are concentrated in time and space, and increasingly feed on agricultural land, reducing yields in grass and cereal crops. Whilst geese are economically valuable for their recreational amenity, farmers suffer yield losses and rarely share in these benefits. The resulting conflict between geese and farmers threatens to destabilise the balance between the need to conserve Scotland's fauna and the needs of farmers to run economically viable businesses. Options such as culling or scaring geese or the provision of alternative feeding areas or compensatory payments are unlikely to solve this conflict in isolation. In the 1990s a co-ordinated, stakeholder-driven approach to solve this conflict was initiated. This approach used payments to encourage farmers adversely affected by the presence of geese to redistribute geese into areas designated as undisturbed feeding refuges. Payments were directed towards farmers for positively managing the land for the benefit of geese, ensuring that Scotland met its international conservation obligations. At the same time, these payments offset the economic losses incurred by these farmers as a result of the geese grazing in their fields. In this talk, we discuss the factors that have led to the successful reduction of goose–farmer conflict in Scotland: the participatory approach adopted, the land-management techniques, the payment structures and the mix of top-down and bottom-up administrative structures deployed.

Understanding and addressing the conflict surrounding black-tailed prairie dog conservation

Richard P. Reading^{1,2,3}, Tim W. Clark^{2,4}, Lauren McCain^{3,5}, and Brian J. Miller¹

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In 1999 the U.S. Fish and Wildlife Service declared that the black-tailed prairie dog (*Cynomys ludovicianus*) was warranted for listing as threatened under the U.S. Endangered Species Act, but precluded from such listing by other, higher priority species. This designation flamed a management controversy that had been brewing for years and instigated a flurry of activity by agricultural interests, government land and wildlife management agencies, non-governmental conservation organizations, scientists, and others. Today, conflict surrounds black-tailed prairie dog conservation. Ecologists consider prairie dogs ‘keystone species.’ Ranchers and farmers, however, who perceive the animals as ‘pests’ that compete with livestock, damage crops, and pose a threat to their livelihood, elicited government support to eliminate prairie dogs. Yet, research has shown that claims of prairie dog–livestock competition have been greatly exaggerated, that the activities of prairie dogs benefit more species than previously thought, and that the species has been declining precariously. Partially as a result of this work, conservation and animal rights groups have begun promoting prairie dog conservation. In this paper we use a social sciences approach of the policy sciences to describe and analyze the controversy surrounding prairie dog conservation and management by examining the context of the issue, the key stakeholders, and the social and decision processes being used to understand and address the problem. We address both content (e.g., biology) and procedural (e.g., interaction) issues, and we finish with recommendations to improve the prospects for black-tailed prairie dog conservation.

Raptors and grouse in the UK: conservation science meets realpolitik

Simon Thirgood¹ & Steve Redpath²

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²*Centre for Ecology and Hydrology, Banchory, Kincardineshire, AB31 4BW, UK*

The current conflict in the UK between the management of red grouse for commercial hunting and the conservation of endangered raptors that kill grouse is a classic example of the problems caused by the recovery of predator populations in human-dominated landscapes. Here we present ten years of research that has: (1) quantified the numerical and functional response of moorland raptors to their prey and examined the circumstances in which raptor predation can limit grouse populations and reduce hunting bags; (2) explored alternative methods of reducing conflicts between raptor conservation and grouse management through habitat management, diversionary feeding, raptor translocation and lethal control; (3) explored uncertainties in both ecological understanding and stakeholder acceptance of management options through a variety of modelling techniques. Finally we (4) make a realistic assessment of whether this research programme has improved either the conservation status of moorland raptors or increased the commercial returns from harvesting red grouse. We conclude that management decisions from either side of the conservationist/hunter divide are driven more by realpolitik than conservation science.

People and elephants in Shimba Hills, Kenya

Timothy J. Knickerbocker¹ and John Waithaka²

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This case study explores issues related to fencing as a strategy for reducing human–animal conflicts. It explains consequences of the Shimba Hills fence on biodiversity, and the cultural ramifications it has for an indigenous group (the Digo). The 253 km² Shimba Hills National Reserve conservation area in the Coast Province of Kenya serves as a powerful example of both the value of protected areas for conserving Africa’s elephants and the complexities of human–animal conflicts inherent in such an approach. Boasting one of the richest forests in terms of biodiversity in Kenya, containing endemic, threatened, and endangered flora and fauna, and serving as the primary water source in the area, Shimba Hills is one of the most important representatives of the remnant humid tropical forests in the East African coastal region. The Shimba Hills ecosystem, however, is impoverished, and the 600 plus elephants currently confined to the reserve contribute to its deteriorating condition. Soaring human populations and the need to cultivate more land, have restricted elephant migrations and increased the frequency of human–elephant conflicts. The completion of a high-tension electric fence, and the annexation of a 36 km² community-owned elephant sanctuary have reduced the number of human–elephant conflicts; however, the importance of the cultural context to the long-term effectiveness of the fence was underestimated. Changing Digo expectations challenge the framework for community involvement in maintaining the fence, and perhaps more importantly, increase resource exploitation strategies among individual Digo. The fence is merely buying time. Other solutions must include direct economic incentives for Digo.

Socioecological determinants of vulnerability among farmers neighboring Kibale National Park, Uganda

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We monitored crop damage by wildlife and livestock in 91 farms bordering Kibale Forest during 29 months. Variation between farms was high. Livestock caused roughly two-thirds of all damage. Among the wildlife, primates and bushpigs were the most frequent raiders and affected the most people. Elephants caused rare, but catastrophic damage to a few farms. Farmers lost 4–7% of planted fields to wildlife each year, worth ~ US\$60–100 per km of park border. We also assessed farmers' coping strategies and perceived vulnerability to wildlife. Farmers abandoned fields because of baboons (36%), bushpigs (24%), banana weevils (15%), and depleted soil (5%). Only elephants caused people to abandon entire farms. We tested socioecological factors shaping coping capacity and found only farm size proved significant; i.e., farmers with large farms were less likely to abandon their land after an elephant raid. This accords with environmental hazards theory. As risk is ‘individualized’, wealth plays a more powerful role in shaping local coping capacity. Individuals with small farms may suffer compounding vulnerability (i.e., they live in risky areas and cannot cope with losses). They may also be politically marginalized, and less able to capture benefits from wildlife (e.g. tourism revenue). To ameliorate the incidence and impact of wildlife raids (especially elephants), smallholders ought to make collective land use decisions (e.g. plant continuous buffer strips), and employ collective systems of insurance. Such collective strategies are often difficult, given the trend toward individualized land management in Africa. Ultimately,

conservationists must lobby against national policies that create high conflict situations, e.g. resettling smallholders or refugees on park boundaries.

Resolving conflicts between people and jaguars

Alan Rabinowitz

Wildlife Conservation Society, Bronx Zoo, 185th St. and Southern Blvd., Bronx, New York 10460, USA

Humans and jaguars have always lived in close proximity throughout jaguar range. Yet conflicts between these two species have increased markedly in recent years due to human land use patterns that have destroyed and fragmented jaguar habitat and led to increased contact between jaguars and domestic livestock. Jaguar depredation on domestic livestock is now the major conflict between people and jaguars. Since many jaguars occupy or use private lands, the resolution of this conflict is essential for any long-term jaguar conservation strategy. While the hunting of jaguars and their prey continues unabated, most people living within jaguar range want jaguars controlled but not extirpated. Furthermore, research indicates that most jaguar–livestock conflicts can be avoided, mitigated, or resolved through the modification of hunting and husbandry practices at little or no additional cost to the landowner. The reason we have made little progress resolving jaguar–livestock issues is two-fold: first, the difficulty with changing traditional views and practices of ranchers and, second, the often antagonistic and divisive relationship existing between ranchers, government agencies, and conservation groups. Through financial assistance programs to implement practices known to reduce jaguar conflict, government agencies and conservation organizations must work together in engaging and supporting the ranching community. Such activities should be strategically initiated in regions where mitigation of jaguar/livestock conflict will also serve landscape issues of connectivity and overall biodiversity conservation.

People and predators in Laikipia District, Kenya

Laurence Frank¹, Rosie Woodroffe² and Mordecai Ogada³

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Although Africa is the last continent on which significant populations of large predators have persisted alongside man, most species are disappearing rapidly from non-protected areas. The primary cause of decline is direct killing by humans, in response to depredation on domestic animals. Few national parks are large enough to ensure survival of viable populations, so conservation of predators critically depends on finding ways to alleviate depredation through better protection of livestock. Laikipia District in Kenya comprises 10,000 km² of semiarid rangeland owned by commercial ranches and communities of Laikipiak Masai pastoralists. Both types of properties use traditional African practices for raising cattle, goats, and sheep. Stock are closely herded by day, and confined in thornbush enclosures ('bomas') at night. Although some depredation may be unavoidable, these methods can be quite effective at preventing losses to predators. Significant lion populations persist primarily on commercial ranches, in part because these can build more effective bomas, and in part because income derived from ecotourism offsets livestock losses. However, lion home ranges encompass many properties, and a minority of ranches with inadequate livestock husbandry and low tolerance for losses can act as predator sinks for much larger areas. Communal areas are less tolerant and have

lower numbers of wild prey, so lion populations are small. However, communities that are beginning to see profits from wildlife appear to be more tolerant of predators than those which do not. The majority of landowners, both commercial and pastoral, are strongly interested in improving husbandry to reduce losses; conservationists face the challenge of devising methods that are both practical and affordable.

Amur tigers and people in the Russian Far East: searching for co-existence

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Presently, only 7% of the remaining habitat for Amur tigers (*Panthera tigris altaica*) in the Russian Far East is protected. Survival of Amur tigers will therefore depend largely on whether local people tolerate their presence in unprotected, multiple use forest lands. From 1970-1989, only 0.1 people/year were killed by tigers in Russia, but during the 1990s this rate increased to 1.2/year, suggesting a dramatic rise in tiger-human conflicts. Over the past decade, human-caused mortality is probably largely responsible for regulating tiger numbers, suggesting that intervention is likely to be critical to long-term survival of this population. In this case study we focus on direct impacts of tigers and humans on each other, and efforts to mitigate those impacts. The dual goals of any intervention program should be to reduce levels of human-caused mortality of carnivores, and to reduce/eliminate the threat posed by carnivores to people. Intervention programs in the Russian Far East include anti-poaching teams, a specially trained Tiger Response Team, an experimental insurance program for livestock depredation, a cooperative program with hunting clubs, and environmental education projects. Success of these programs varies, and likely is dependent as much on program design and implementation as need or theoretical construct of the program. A monitoring program suggests that the population of Amur tigers has stabilized since the introduction of these interventions, but it is impossible to assess the effectiveness of individual programs. We suggest that more rigorous attention to program implementation and employment of an adaptive management approach will allow more effective review of successes and failures.

A tale of two countries: large carnivore depredations and compensation schemes in Sweden and Norway

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Sweden and Norway share the Scandinavian Peninsula and populations of four large carnivores, the brown bear (*Ursus arctos*), wolf (*Canis lupus*), lynx (*Lynx lynx*) and wolverine (*Gulo gulo*). However, the two countries have different rural policies, sheep husbandry methods, and compensation schemes. The husbandry systems for semi-

domestic reindeer are more similar, however. Norway has about 2.5 million sheep that graze unattended on open range and Sweden has about 400,000 sheep that graze mostly within electric fences where large carnivores occur. Farmers in Norway are not required to implement effective preventative measures against depredations to receive compensation, but they are in Sweden. Sheep losses per individual predator are very high in Norway and low in Sweden. Compensation for sheep losses is based on 'probable losses' to predators in Norway and documented losses in Sweden. On the other hand, per carnivore individual losses for free-ranging semi-domesticated reindeer are similar in Norway and Sweden. There are about 195,000 in Norway and 250,000 in Sweden. However, the compensation schemes in the reindeer husbandry area are very different. In Norway, compensation is paid based on documented losses, whereas in Sweden, it is paid based on the occurrence of large carnivore reproductions, disregarding losses. The opposition to large carnivores is greater in Norway, where losses are greater. This is reflected in higher harvest rates of large carnivores and lower national population goals than in Sweden. However, the illegal killing of large carnivores is a problem in both countries.

Management of wolf–human conflict in the northwestern United States

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Gray wolf (*Canis lupus*) populations were eliminated from the western United States by 1930. Naturally-dispersing wolves from Canada first denned in Montana in 1986. In 1995 and 1996 wolves from western Canada were reintroduced to central Idaho and Yellowstone National Park, Wyoming. By December 2002 nearly 700 wolves were being managed in those three states under the federal Endangered Species Act. Wolf restoration has proceeded more quickly, with more benefits (public viewing and restoration of ecological processes), and fewer problems (livestock and pets depredations) than predicted. However, between 1987 and December 2001, a minimum of 188 cattle, 494 sheep, 43 dogs, and 5 llamas were killed by wolves and nearly \$250,000 was paid from a private damage compensation fund. The U.S. Fish and Wildlife Service relocated 117 wolves and killed 103. Management also includes: preventative and non-lethal tools such as: injurious [i.e., rubber bullets] and non-injurious [i.e., light and siren devices] harassment; barriers [i.e., fencing, fladry, scents, herders, guard animals]; altering wolf activity patterns [i.e., supplemental feeding, moving dens and rendezvous sites away from livestock]; livestock management [i.e., confinement, alternative pasture, later turn-out, closer surveillance]; and practical research [i.e., livestock death and movement caused by wolves, aversive conditioning]. Livestock losses by wolves remain rare compared to other causes of livestock death but are inordinately controversial. Because over 85% of adult wolf mortality is human-caused, the inter-agency recovery program focuses its efforts on addressing the concerns of people.

Policy for reducing human–wildlife conflict: a Kenya case study

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Rising human population and intensifying land use has caused conflict with large mammals to rise steeply in Kenya over the last half century. Long-term records are used to trace the intensifying and changing nature of conflict between human activity and large mammals. These records are used to explore the effectiveness of existing conflict mitigation policies and practices. Despite many proven methods for minimizing conflict, a lack of coherent policies for addressing human–wildlife conflict within a larger national policy framework for biodiversity conservation is causing heavy losses to wildlife and humans alike. In 1994 Kenya conducted a national investigation and debate on human–wildlife conflict. The aim was to draw up an integrated policy for biodiversity conservation in which broader valuation and conflict-mitigation were treated as interlinked goals. In this article we describe the process of formulating national policy, creating a favourable environment for reducing conflict and putting policy into practice. Drawing on the Kenya case study, we explore a set of principles that apply broadly to conflict mitigation for a range of species and variety of interactions between people and wildlife.

An ecology-based policy framework for managing human–tiger conflicts in India

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India has a billion-strong human population that competes fiercely with the country's remaining wildlife over the use of scarce land as well as plant and animal biomass resources. Human–tiger conflicts arise because of tiger predation on livestock and humans, and from human persecution of tigers, their prey and encroachments of habitat. Although over 300,000 km² of potential tiger habitat still exists, most of this area cannot support breeding populations of tigers because of over-hunting of prey and other adverse human impacts. During the past 30 years, the policy to manage human–tiger conflict has shifted from large-scale tiger hunting to a preservation and reserve-centered approach. Despite some shortcomings in its implementation, the Indian policy has been more successful than the conflict-reduction strategies pursued in other parts of tiger's range. Currently, densities of wild tiger populations vary between 0.5- to 20-tigers/100 km², depending primarily on prey abundance. Tiger conservation essentially involves trying to maintain clusters of breeding female territories of 6–30 breeding tigresses in prey-rich reserves that range from 300–3000 km² in size, and, occupy less than 2% of India's land. Management of conflict essentially involves isolating these clusters of breeding tigresses from incompatible human uses of their habitat. Comparatively, the most effective strategy to attain this goal appears to lie in ensuring the spatial separation of humans from tigers through voluntary resettlement projects, supplemented by the social tactic of engendering public support for tigers as significant cultural icons. Preliminary results from several ongoing efforts in this direction are presented and discussed.

Risk assessment and human–wildlife conflict

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Environmental risk assessment takes explicit account of the uncertainties associated with the scientific information available on a particular issue. This information is used to calculate the probability that a management action will result in a particular desirable, or undesirable, outcome. If there is no uncertainty there is no risk. We will outline the basic principles of environmental risk assessment and apply this approach to a specific human–wildlife conflict: the impact of predation by hen harriers (*Circus cyaneus*) on the density of red grouse (*Lagopus lagopus scoticus*) on moorland that is managed for grouse shooting. Although a number of different management actions can have similar effects on the number of grouse available for shooting in a particular season, greater uncertainty is associated with the outcomes of some actions.

The future of coexistence

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Lethal control – both legal and illegal – is a major threat to the persistence of many populations outside and inside protected areas. In trying to alleviate this threat, we need to accept that some species of conservation concern can and do cause serious damage to people’s livelihoods and lives. In many areas, ‘conflict’ species have been eradicated because this makes economic sense. Creating impermeable barriers by fencing may alleviate the damage caused by wildlife, but it can also reduce the viability of wildlife populations restricted to small areas. If we are therefore to try to foster coexistence of people with wildlife that are often difficult neighbours, we need to create economic circumstances that favour tolerance. When people have the option to “shoot, shovel and shut up” legislation alone will not solve the problem, especially where a small number of people have the capacity to influence populations across a large area. Various technical approaches can reduce wildlife impact on human livelihoods and hence reduce the need for lethal control. Such techniques may come at a cost, however. These costs may be met by local communities, perhaps using revenues from ecotourism or hunting, or they may be met by outside bodies such as government or conservation NGOs. It will usually be necessary to retain some level of lethal control to maintain the support of local people for conservation activities. Coexistence may be difficult, however, the fact that it is possible is demonstrated by the recent recovery of several ‘conflict’ species in regions where they had been extirpated. Perhaps the one hopeful thing about lethal control is that, even where populations have been locally extirpated, suitable habitat often remains, meaning that restoration could be possible if conflicts can be resolved.

POSTER ABSTRACTS

Farming and wildlife: the Barnacle Goose Management Scheme

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Since 1994 the Barnacle Goose Management Scheme (BGMS) has integrated conservation and agricultural aims on the Scottish side of the Solway Firth. In the four years before the introduction of the BGMS, the density of barnacle geese (*Branta leucopsis*) on the Wildfowl & Wetlands Trust Reserve at Caerlaverock was four times higher than on the non-Reserve area. In the six years following establishment of the BGMS, the density of geese on non-Reserve fields rose so that the Reserve had twice the density of the non-Reserve area. No difference in density was found between fields in the Feeding Zone and Intermediate Zone of the BGMS. The density of barnacle geese around the study area appears to be at a maximum under current management regimes. The remaining geese from this increasing population are using other feeding areas. This may lead to further conservation-agriculture conflict in the future, but could be mitigated through expanding the range and quality of the BGMS, through increasing the dedicated reserve network, or through a combination of the two.

Mitigating human-elephant conflict in the Mara ecosystem, Kenya

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Human–elephant conflict (HEC) in Africa occurs wherever the two species coincide, and poses serious challenges to wildlife managers, local communities and elephants alike. Efforts to mitigate the problem rely on a detailed understanding of underlying patterns and processes, and the IUCN Human–Elephant Conflict Working Group has recommended widespread comparative monitoring and analysis of both HEC and its mitigation. This study in Transmara District, Kenya, is the first of its kind to integrate community-based HEC monitoring with GIS and multivariate statistical analyses to build predictive models of the occurrence of different types of HEC. Using a 25 km² grid system and logistic regression, it was found that the occurrence and intensity of both crop raiding and human deaths and injuries were accurately predicted using underlying spatial variables, for both male elephants and elephant family groups. Furthermore, a comparative survey of raided and non-raided farms revealed that active defence, in terms of patrol effort and the use of noise and light, helped to prevent crop raiding whilst non-electrified barriers did not. However, once elephants had entered a field, traditional mitigation methods were ineffective at reducing the amount of damage caused. These methods provide a simple suite of comparative tools for measuring and analysing HEC that could be employed across Africa to aid the development of mitigation strategies at both landscape and local scales. Further work in this study site is focusing on implementing and monitoring the success of traditional and novel mitigation methods, and on the feasibility of tourism for conflict alleviation.

Coexisting with coyotes in North America: community-based approaches to conflicts

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Coyotes (*Canis latrans*) have expanded their range in the United States threefold since the 1850s, largely in response to human alterations to the environment and the eradication of larger predators such as wolves, cougars and grizzly bears. Opportunistic, resilient, and intelligent predators, coyotes have proven highly successful in their ability to adapt to changing landscapes, particularly in the urban/suburban wildland fringe. As a result, conflicts between coyotes and humans have dramatically increased over the last decade.

Historically, the U.S. Department of Agriculture's Wildlife Services program has been responsible for the management of predators. Efforts to manage coyote populations have relied primarily on lethal methods, including traps, poisons, and aerial gunning — methods increasingly criticized as unethical and/or indiscriminate. Public opposition to lethal control, along with biologists' increased understanding of the ecological importance of coyotes and other native carnivores has led to greater demand for humane, socially acceptable, and ecologically sound management methods.

The author discusses: (1) the history of coyote management in the United States; (2) why lethal control of coyotes has been ineffective in reducing conflicts and coyote populations; (3) the ecological role of coyotes in maintaining healthy ecosystems and species diversity; (4) examples of effective, cost-efficient, and ecologically sound alternatives for reducing conflict between humans and coyotes; (5) the importance of cooperative efforts between stakeholder groups and public and private agencies; (6) the need for increased public education and outreach efforts that address coexistence and nonlethal management practices.

The use of livestock guarding dogs to protect sheep from bears and wolves in Slovakia

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Livestock guarding dogs have been used in Eurasia for millennia to guard domesticated animals against wild predators, stray/feral dogs and human thieves. The tradition was abandoned in Slovakia due to socio-economic changes during Communism and/or low levels of losses after large carnivores were virtually extirpated. By the late 20th century wolf, bear and lynx populations had recovered and predation on livestock increased. The overall level of losses is, however, still low: wolves and lynx reportedly killed 353 head of livestock in 1999, causing c.£6700 worth of damage; compensation paid for sheep, goats and cattle “damaged” by bears totalled c.£6000 in 2000. Nevertheless livestock depredation is frequently given as justification for killing large carnivores. The Protection of Livestock and Conservation of Large Carnivores project, launched in spring 2000, aims to reintroduce the traditional system of raising livestock guarding dogs. Fourteen pups were bought in 2001 and raised with sheep. Behavioural observations are testing whether two selected breeds (Slovensky cuvac and Caucasian ovciak) retain the key traits of trustworthiness, attentiveness and protectiveness; Scat analyses will estimate the proportion of livestock in the diet of wolves and bears in the Western Carpathians.

The study and management of human–elephant conflict in Africa

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The IUCN African Elephant Specialist Group (AfESG) has had a Human–Elephant Conflict Working Group (HECWG) since 1996. Initially, carefully specified topics were studied to begin investigating HEC; thereafter management-related outputs were produced in the form of guides to help mitigate the problem, culminating in the production in 2001 of a "Decision Support System" for HEC management, available in both English and French (see www.iucn.org/ssc/sgs/afesg). A network of AfESG collaborators working on conservation projects in Africa and Asia continues to contribute to a growing understanding of the HEC phenomenon. HEC displays complex social and spatial dynamics across many bio-geographical landscapes in Africa but common characteristics and themes allow certain management principles to be recommended to address it. These ideas are often transferable to human–wildlife conflicts involving other species e.g. carnivores, crocodiles, hippopotamus and primates. Frequently, elephants are simultaneously the 'flagship' of both the problem side and the charismatic side of the large fauna in Africa. As such, HEC has increasingly become not a problem in isolation but a topic strongly linked to many fundamental conservation issues, especially in community conservation initiatives. Co-existence between elephants and humans is possible but requires solid policy support from wildlife authorities, strong commitment from conservation interests and a climate of trust between the diversity of negotiating parties on the ground.

Human mountain gorilla conflict in Uganda, Congo and Rwanda

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Mountain gorillas foraging for food outside the protected areas of Uganda, Congo and Rwanda often cause damage in the form of crop raiding, human injury and the impeding of human movement. The gorillas risk death or injury by angry villagers and face the constant health risk associated with exposure to human diseases to which gorillas have low or no immunity. In 1998 the author developed an innovative adaptive management project to address human–gorilla conflict in this region. The goal of this project was to reduce the level of conflict between humans and gorillas and to improve capacity within the parks to reduce the incidences of gorillas leaving the protected areas and entering the villages. To achieve this goal, the project design contains a multifaceted scheme that addresses the numerous factors causing this conflict, including scientific, political, behavioral, educational, managerial, psychological, geographical, and structural conditions. Here we highlight the problem and detail its rigorous analysis, including addressing behavioral changes as a result of gorilla habituation for tourism, human population issues, disease transmission, geographic considerations, and management inadequacies, as well as the project design, which includes the development of community and institutional communication and monitoring networks, land use and management changes, educational strategies to address conflict mitigation and health risks, policy recommendations, and the establishment of a 'toolbox' of deterrents to keep gorillas within the protected area.

Keeping wild animals wild: managing artificial food sources amidst emboldened canids

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Arctic foxes (*Alopex lagopus pribilofensis*) inhabiting St Paul Island, Pribilofs, Alaska, are typically distributed around the island's perimeter near natural food resources. Beginning in 1993, construction of a breakwater and fishery processing facility in the harbor created artificial habitat and food sources adjacent to town. Numbers of foxes residing in town increased rapidly, attributable mainly to increased survivorship among juveniles. In 2000, following escalation of interspecific territorial behavior by foxes and resultant rise in human–fox conflict, a comprehensive garbage management program focusing on containment was implemented. Improved garbage containment offered an affordable, low-tech solution to resource availability. Predictably, however, the sudden elimination of resources initially exacerbated human–wildlife conflicts. Foxes habituated to artificial foods became increasingly desperate and aggressive towards townspeople, and were often killed. Animals that persisted in town expanded their territories in response to the decrease in resource availability. Among townspeople, peer-pressure among neighbors has successfully reduced artificial foods, however, deliberate feeding (often by visitors) continues to attract foxes. The Pribilof fox situation is complex: this subspecies' welfare is often overlooked due, in part, to well-publicised eradication efforts of introduced *A.l. pribilofensis*. Island ownership (natives, state, and federal agencies) adds complexity onto any conservation efforts. Although the situation of artificial foods is improving, continued disregard (e.g., deliberate feeding) undermines permanent solutions. Broader public education spotlighting wildlife–human conflict cause and effect is needed. Additionally, promotion of eco-tourism may be instrumental in generating local support of wildlife conservation.

Why wildlife compensation schemes succeed or fail: a global perspective

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Human–wildlife conflict is a significant—and growing—conservation and management problem everywhere people and animals co-exist. We describe results of a unique global survey of individuals and organizations that have used compensation schemes as a strategy to minimize the negative consequences of human–wildlife conflict. We identify six core elements that help to differentiate successful and less successful programs irrespective of where they were located or what species they were developed to protect. Our analysis suggests that compensation programs can be an initial step in building local tolerance and support for endangered wildlife. To effectively resolve human–wildlife conflicts, however, they need to be part of a comprehensive program that includes control, proactive mitigation measures, and in some cases, economic incentives for changes in agricultural practices. The ultimate measure of a compensation scheme's effectiveness, at least when used as part of a conservation program for endangered species, is whether it keeps fewer tigers, wolves, elephants, or gorillas etc. from being killed. Compensation programs, under certain circumstances, may provide one component of an effective response to

human–wildlife conflict, particularly when endangered species are the main ‘offender’ and lethal control is not a desirable option. Similarly, if carried out inadequately or incorrectly or without proper attention to certain factors, these schemes can be a waste of resources destined to do more harm than good.

Predation of domestic livestock in the border of Iguazu National Park, Brazil – An analysis of perception of farmers and management practices.

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The perceptions of farmers towards wild mammals depredating domestic livestock and crops were evaluated by surveying 60 properties bordering Iguazu National Park, Parana State, Brazil, between 1998 and 1999. Approximately 80% of farmers reported losses of domestic livestock on 66 occasions. Jaguar (*Panthera onca*) and puma (*Puma concolor*) accounted for 62% of these cases reaching a maximum value of US\$ 17,000. Thirty-one farmers had their crops damaged on 42 occasions with five species causing damages to 86% of all situations: white-lipped- peccary (*Tayassu pecari*), capybara (*Hydrochoerus hydrochaeris*), coati (*Nasua nasua*), peccari (*Tayassu tajacu*) and armadillo (*Dasypus novemcinctus*). In general, losses caused by damage to crops were considered irrelevant, estimated to be up to US\$ 1,750. Farmers showed basic knowledge on most wildlife species involved in this study as well as a positive attitude. However there was a tendency for the farmers to develop negative attitudes toward big cats, since their behaviour produced losses to source of investments and income. Conservation of wild mammals on private properties bordering Iguazu National Park depends on support of farmers in solving conflicts over the cases of predation.

Mapping probability of carnivore–livestock conflicts in the Romanian Carpathian Mountains

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The importance of conserving wild populations of carnivores in balance with local human interests has been widely recognised. However, diverse human activities are in potential conflict with the conservation of carnivore species. Particularly so when the carnivore species are large predators that compete with hunters for prey and affect the husbandry economy in rural areas. In the Romanian Carpathians large carnivores, such as brown bear (*Ursus arctos*), Eurasian lynx (*Lynx lynx*) and gray wolf (*Canis lupus*), are present at high population densities for European standards. They represent a threat to the rural economy that is the only source of income for the majority of families in some mountain localities. The magnitude of conflicts represented by predation on livestock by the carnivores may depend on a multitude of factors, such as the landscape structure and easy access to livestock. We have mapped the probability of large carnivore–livestock conflicts in an area of the Romanian Carpathians using satellite imagery as a proxy for landscape characteristics. The sites where damage to livestock was inflicted by large carnivores were used as reference points for the establishment of a 100% probability of conflicts. Outputs were compared with a map where measures for preventing carnivore damage were put in place. The results suggest that preventive measures can significantly lower the probability

of conflicts. However, the paucity of data do not allow any generalisation and further application of preventive measures are planned for the future.

Community conservation of California mountain lions: a collaborative method

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California is home to 33 million people, a number expected to nearly double within the next 50 years. More than 20 percent of California's remaining native species were classified as endangered, threatened, or of 'special concern' with 140 of the animal species listed in danger of extinction. The mountain lion, the State's last great keystone predator, has a crucial role to play in maintaining California's biological heritage and as an indicator of the loss of wilderness. According to the California Department of Fish and Game, and in contrast to media portrayals, mountain lion populations are stable or declining in most of the State, and the habitat necessary for the mountain lion's survival is disappearing at an alarming rate. What little remains is fragmented by roads and other hazards. Since 1972, when the legislature stopped the trophy hunting of mountain lions, more than 1,600 lions have been killed under depredation permits. The number of lions killed annually has increased, with a peak of 149 lions killed in 2000. Although a few permits are issued for losses incurred by traditional open range livestock operations, most are issued for incidents on ranchettes and 'hobby farms'. A substantial policy shift regarding mountain lions is needed to ensure that they do not become threatened in California. The Mountain Lion Foundation elaborates new approaches to mountain lion conservation that stress science to establish a factual basis for dialogue, community involvement to identify shared goals, and developing partnerships with diverse organizations and professions to broaden conservation efforts.

The conservation of African wild dogs in South Africa: can economic benefits promote coexistence between wild dogs and landowners?

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In South Africa wild dogs inhabit a fraction of their former range. Their current distribution consists of a single viable population in the Kruger National Park (KNP), a meta-population reintroduced into six isolated reserves, and a number of wild dogs occurring outside protected areas. We determined the distribution and status of wild dogs outside protected areas through collecting sighting records ($n=507$). We found low numbers of wild dogs in a highly fragmented range and high levels of persecution. We surveyed attitudes of ranchers ($n=219$) towards wild dogs in rangeland in South Africa and Zimbabwe and found that wild dogs are the least popular of all predator species for reasons rooted in perceived or real economic costs associated with the species. The economic costs associated with conserving a pack of wild dogs within the three sectors of the South African wild dog population (KNP population, meta-population, and wild dogs outside state protected areas) were estimated. Estimated costs are high and provide some justification for the concerns of landowners. The potential for deriving economic benefits through wild dog-based ecotourism was estimated via surveys of willingness of tourists to pay to see wild dogs ($n=596$). The potential benefits are sufficient to offset the costs and promote coexistence between landowners and wild dogs outside protected areas and encourage the reintroduction of wild dogs into private reserves. The potential benefits of

wild dog-based ecotourism in KNP alone are sufficient to potentially subsidise conservation efforts of the species outside protected areas throughout South Africa.

Attitudes towards wildlife in Botswana

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Many conservation schemes have sought both to protect wildlife and to provide benefits to local people. Until recently, very little attention has been devoted to measuring how benefit programmes do alter local people's perception of wildlife areas and wildlife institutions. It was expected that re-enfranchising indigenous people would result in increased support for wildlife. It was hoped that both wildlife and local people would benefit from this relationship. However, on both scores, many programmes have fallen short. In some cases, poaching and illegal offtake by local people proceeded unabated and expectations of local villagers have been unfulfilled or unsustainable. Botswana is home to substantial populations of African wildlife. Much of this wildlife persists outside of protected areas. Botswana has an innovative Community Based Natural Resource Management (CBNRM) programme that may come to serve as a model for other management plans. However, success has not yet been measured in terms of the attitudes of participants, nor in terms of unintended effects on people not included in CBNRM communities. Results are presented here from two regions in Botswana. The research presented here is unique in that it includes communities receiving tangible benefits from wildlife and also communities not receiving any formalized benefit yet suffering similar wildlife conflict. Interview responses are examined to assess the influence of benefit system, land use, land tenure, wealth, education level, exposure to wildlife, and strength of tradition on attitudes towards wildlife.

Ecology of cheetahs and other large carnivores in a pastoralist-dominated buffer zone

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The role of protected areas in conservation is undoubted, but their effect is limited by their size and frequently detrimental impacts on local human residents. In contrast, semi- or unprotected areas are not limited by size and provide the potential to reconcile conservation and human requirements. In this study I investigated the success of the cheetah (*Acinonyx jubatus*) and other large carnivores in the north eastern buffer zones to the Serengeti National Park in Tanzania, land dominated by the nomadic Maasai people and their cattle. The large carnivores were expected to represent one of the most sensitive taxa to human influence, yet use of call-in experiments and individual recognition showed that cheetahs, hyaenas and, in particular, lions were all surviving successfully far from the protection of the National Park, including both sexes and breeding females. Furthermore, line transect methodology was used to show the carnivores were supported by herbivore populations equivalent to the National Park. A questionnaire survey amongst the Maasai established that this relationship was far from harmonious, with frequent losses of livestock to carnivores and frequent retributions carried out. Nevertheless, adaptive behaviour displayed by the carnivores coupled with high tolerance and a low impact lifestyle of the pastoralists allowed both to persist in the same areas. Consequently, the Maasai occupation of the buffer zones allows significant numbers of large carnivores to

complement those protected by the National Park whilst there was some evidence that cheetahs and other smaller carnivores were even benefiting from Maasai presence.

Snow Leopard Enterprises: community conservation of snow leopards

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Pastoralists and livestock occur throughout much of snow leopard (*Uncia uncia*) habitat in Central Asia. Livestock depredation by snow leopards is a serious economic hardship for many herders, and retaliatory killing is common. Depletion of wild prey by poaching and out-competition by livestock poses an indirect threat to snow leopards. Conservationists have turned to incentive schemes to motivate local people to protect carnivores. Snow Leopard Enterprises is a community conservation incentive program of the International Snow Leopard Trust. The goal is to provide residents of snow leopard habitat with a sustainable positive incentive to protect the cats and their prey in the form of cash income through handicraft sales. The conservation connection is explicit through a contract that details actions the community must take. A year-end bonus is payable only if conservation conditions have been met.

Successful in Mongolia because it was developed in response to needs expressed by herders, and was based on a sound ecological understanding of the conservation issues, Snow Leopard Enterprises is now expanding to other countries where it will be refined to meet local conditions. In Mongolia the conservation contracts specify no poaching of leopards or prey, and avoidance of key ungulate kidding areas; in Kyrgyzstan participants agree to keep a protected area free of leopard snares; in India, where snow leopard prey is in decline due to overgrazing by livestock, a grazing set-aside constitutes the conservation condition.

Snow Leopard Enterprise is a unique and successful model of integrated conservation and development which provides explicit linkage between conservation actions and positive economic incentives

Grey wolf, brown bear, striped hyaena and people in Turkey

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In Turkey the presence of large carnivores, such as the grey wolf (*Canis lupus*), brown bear (*Ursus arctos*), striped hyaena (*Hyaena hyaena*), Eurasian lynx (*Lynx lynx*) and the critically endangered Anatolian leopard (*Panthera pardus tulliana*), can seriously affect the economy of local communities. Conflicts between large carnivores and people has resulted in their eradication from many sites. Although public attitude towards the wolf is more positive in Turkey than elsewhere in Europe, wolves are threatened in areas where they damage livestock, particularly in Central and Eastern Turkey, where their population is greatest. This has resulted in a declining wolf population across Turkey. The striped hyaena was considered to be extinct in Turkey by local authorities but recent work has revealed it to be present, with most of its population in the south-east. The striped hyaena population sharply declined in Turkey during the last century with animals exterminated not only to prevent livestock damage but also to provide food for local communities. National wildlife legislation considers both the wolf and striped hyaena as pest species and there are no specific hunting limits for either of them. Although the brown bear is a

partially protected species, where it causes damage to livestock and beekeeping, it has come into conflict with local communities. The limited information on the status of large carnivores and the limited capacity of local authorities are major obstacles to the proper management and effective conservation of carnivores in Turkey. This paper summarizes the current problems with selected large carnivores and presents potential solutions for Turkey.

Human–black bear interactions in Yosemite National Park

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Black bears (*Ursus americanus*) in Yosemite National Park have obtained food provided intentionally and unintentionally by humans since the 1920s. This feeding of black bears has led to conflicts between humans and bears. In 1975, the National Park Service (NPS), in an effort to eliminate human-provided food and garbage accessible to bears, initiated the Human–Bear Management Program in Yosemite National Park. Despite these efforts, the annual number of bear incidents and property damage estimates have been documented as high as 1,590 and \$659,000, respectively. Increases in the number of human–bear incidents has highlighted the need to examine and evaluate human–bear interactions in the Park, with the goal of recommending ways to improve bear management and reduce the number of ‘problem’ bear incidents. The Wildlife Conservation Society is using a systems approach to investigate characteristics of the bear as well as human elements of the bear management program. Human–bear incidents of the recent past are being categorized based on the cause of the incident, age class and sex of the bear involved, backcountry or front country location, season, and time of day. Radio telemetry is being used to quantify seasonal and daily activity patterns and movements of black bears in Yosemite Valley. The effectiveness of the content and methods of dissemination of bear-related information to the public are being assessed. Visitor’s salient beliefs about bears and food storage behavior are being evaluated using over 4,000 surveys administered to Park visitors. The documented pattern of human–bear incidents demonstrates that interactions have kept one step ahead of management responses. Increases in incidents began in front country campgrounds, moving to parking lots following the installation of food storage boxes in front country campgrounds, and recently into backcountry campgrounds following regulations prohibiting the storage of food in vehicles. Eighteen bears have been captured and radio collared in order to assess movement and activity patterns relative to anthropogenic activity in Yosemite Valley. Subadult male bears have been found more commonly near anthropogenic activity, followed by adult males, adult females, and subadult females. Collared bears do not exhibit a tendency toward being diurnal or nocturnal and generally travel greater distances during the day than at night. Over 100 unique bear-related messages are distributed to the public in various forms within Yosemite Valley and these tend to have a high level of reading ease and a low level of human interest. Overall, 98% of visitors reported seeing or hearing some type of bear-related information during their visit to Yosemite and 75% retained what they should do relative bears and their own safety. Over 90% of visitors to Yosemite have a positive belief about the presence of bears and their ecological role within the Park. About 60% of visitors involved in a human–bear incident did not report the problem to Park staff, most indicating “because it was so minor”.