Wildlife Compensation Schemes From Around the World: An Annotated Bibliography

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Abstract

This bibliography synthesizes selected literature (abstracts, reports, theses, peer-reviewed journal, and magazine articles) relevant to scaling both theoretical and practical applications of compensation programs in the context of wildlife conservation, economics, and public policy. Each citation is accompanied by a brief description of the major findings or interpretations. Coverage of this bibliography emphasizes two broad subject areas: 1) compensation programs that reimburse private interests for damages caused by wildlife herbivores and carnivores, and 2) quantitative analyses or other descriptions of the types of damages, including the species involved, number of attacks, scale and costs of damages, and public opinions about wildlife damages. At the end of the bibliography, I present a short list of the major categories of wildlife damages, and a partial list of the global wildlife species for which damages have been documented and/or for which compensation has been paid.

Literature available

African Elephant Specialist Group. 2002. Review of compensation schemes for agricultural and other damage caused by elephants. Technical brief, Human-Elephant Conflict Working Group, African Elephant Specialist Group, IUCN, Gland, Switzerland. -- Without rejecting compensation outright in all circumstances, this report argues against monetary reimbursement for elephant damages on grounds that symptoms not causes of the inherent conflict are addressed. Elephant compensation schemes in Kenya, Gabon, Ghana, Malawi, Zimbabwe, and Botswana were also described with details as: 1) cumbersome, expensive, and slow to administer; 2) open to abuse, fraud, and corruption; 3) subject to insufficient funds for covering claims; 4) causing disputes and social problems; and 5) unable to keep pace with changing economic or policy circumstances.

Andersone, Ž, and J Ozolinš. 2004. Public perception of large carnivores in Latvia. *Ursus* 15: 181–187. -- Attitudes against large carnivores (brown bear, lynx, wolf) stemmed mostly from real or perceived effects on livestock husbandry and game management.

De Azevedo, F.C.C., and D.L. Murray. 2007. Evaluation of potential factors predisposing livestock to predation by jaguars. *Journal of Wildlife Management* 71: 2379–2386. -- Mortality rates of livestock killed by jaguars and puma in western Brazil represented a mere 0.2–0.3% of total livestock holdings on the ranch studied. Predation risk increased as distance to forest cover declined. For ranchers in the Pantanal region, greater reductions in cattle losses could be obtained by concentrating on losses from causes other than predation that could be more easily controlled/

De Azevedo, F.C.C., and D.L. Murray. 2007. Spatial organization and food habits of jaguars (*Panthera onca*) in a floodplain forest. *Biological Conservation* 137: 391–402. -- Livestock comprised 28% of all jaguar kills found in the study areas, and livestock predation was believed overestimated because these prey had higher detectability than native species.

Bagchi, S., and C. Mishra. 2006. Living with large carnivores: predation on livestock by the snow leopard. *Journal of Zoology* 268: 217–224. -- In south and central Asia, 58% vs. 40% of snow leopard diet was on livestock in low vs. high native prey areas, respectively. Despite high losses, the indigenous Buddhist community at the low native

prey area was comparatively tolerant towards the leopard due to a conservation-incentive program and differences in economic importance of livestock at this site. Importantly, and despite cultural similarities, neither local economies nor the ratio of wild prey/livestock alone were able to explain differences in this social tolerance.

Berger, K.M. 2006. Carnivore-livestock conflicts: effects of subsidized predator control and economic correlates on the sheep industry. *Conservation Biology* 20: 751–761. -- Based on a 60-year data set, found that either predator control has been ineffective at reducing predation losses or that factors other than predation account for economic declines in sheep farming. Concludes that government-subsidized predator control has failed to prevent decline in the sheep industry and that alternatives to predator control (*cf.* Musiani et al. 2005) are required if the policy goal is to increase sheep production.

Blanco, J.C. 2003. Wolves in Spain: coping with depredation where wilderness is no more. *International Wolf 11*(3): 6–7. Available at: http://www.lcie.org/Docs/Damage%20prevention/CDPNews6.pdf **(accessed 14-06-07).** -- Annual economic costs of livestock losses to wolves can reach US$825,000-$1,100,000 annually ($1,375/wolf/year). Damages vary by livestock vulnerability, with most occurring in protected areas in the mountains where native prey are abundant but where husbandry is lax; costs in agricultural areas are 1/10 lower because wolves feed mostly on carrion and livestock are better guarded. Up to 12% of livestock farmers are affected each year, with annual average losses of $440/year (4% of average household income). Regional governments (but never non-governmental organizations) pay damage compensation or promote insurance for livestock owners.

Blanco, J.C. 2003. Wolf damage compensation schemes in Spain. (C. Angst, J.-M. Landry, J. Linnell, and U. Breitenmooser, Eds.). Pp. 7-9 *in* Carnivore Prevention News 6. Available at: http://www.lcie.org/Docs/Damage%20prevention/CDPNews6.pdf **(accessed 14-06-07).** -- Spain uses three compensation models: 1) reimburse only wolf damages in protected areas; 2) provide reimbursement throughout the entire regional territory; and 3) reimburse only farmers who have taken out private insurance on their stock. Cultural acceptance of wolf depredation as well as wolf management techniques vary substantially across areas covered by these respective schemes. Eligibility for compensation does not depend on husbandry practices.

Bodenchuk, M., J.R. Mason, and W.C. Pitt. 2000. Economics of predation management in relation to agriculture, wildlife, and human health and safety. (L. Clark, Ed.). Pp. 80-90 *in* Human conflicts with wildlife: economic considerations. Available from: http://www.aphis.usda.gov/ws/nwrc/symposia/economics/ **(accessed 19-06-07).** -- In terms of the costs of predators to agriculture, big game or threatened and endangered species management, this paper concludes from cost:benefit ratios that predator management is an extremely efficient means of protecting livestock and wildlife species of special concern (but see Musiani et al. 2005, Berger 2006). Benefit:cost ratios in terms of human health and safety were more difficult to gauge.

Bulte, E.H., and G.C. van Kooten. 2002. Downward sloping demand for environmental amenities and international compensation: elephant conservation and strategic culling. *Agricultural Economics* 27: 15–22. -- Models and contrasts the international tradeoffs for compensation based on an existing population size and harvest decisions of the range states versus an optimal *in situ* population size for compensation paid per elephant by developed countries. Sovereign nations may be able

frame this management problem as a game where the compensation scheme is subject to negotiation.

Bulte, E.H., and D. Rondeau. 2005. Why compensating wildlife damages may be bad for conservation. *Journal of Wildlife Management* 69: 14–19. -- Questions whether compensating pastoralists and farmers for wildlife damages leads to decreases in damage prevention (i.e., moral hazard) and/or exacerbates human-wildlife conflict. Such subsidies theoretically could increase the rate of crop and livestock production on 'risky lands,' thereby creating a perverse conservation outcome.

Butler, J.R.A. 2000. The economic costs of wildlife predation on livestock in Gokwe communal land, Zimbabwe. *African Journal of Ecology* 38: 23–30. -- Over 2.5 years and a 33-km^2 area of communal land bordering the Sengwa Wildlife Research Area, 241 livestock were killed by wild carnivores, with most kills by chacma baboons (52%), lions (34%), and leopards (12%). In 1995, predators killed 5% of livestock holdings, double the proportion reported up to that date in other African studies. Average annual loss per livestock-owning household was US$13, about 12% of each household's annual income.

Casey, A.L., P.R. Krausman, W.W. Shaw, and H.G. Shaw. 2005. Knowledge of and attitudes toward mountain lions: a public survey of residents adjacent to Saguaro National park, Arizona. *Human Dimensions of Wildlife* 10: 29–38. -- Despite low knowledge of the cat's biology, respondents to a telephone survey of 9 local wildlife managers and a mail survey of 493 suburban residents supported management actions that protected mountain lions in all landscapes and opposed measures that removed protections.

Chavez, A.S., E.M. Gese, and R.S. Krannich. 2005. Attitudes of rural landowners toward wolves in northwestern Minnesota. *Wildlife Society Bulletin* 33: 517–527. -- Landowners perceived that wolves were a threat to their livelihood, but other factors such as market conditions, laws and government, diseases, and weather were ranked as greater threats to the agricultural community. Some results suggested that cultural tolerance of this predator was resistant to change based on proximity to wolves or to the time since wolves were eliminated from respondents' living areas.

Cilliers, D. 2003. South African cheetah compensation fund. (C. Angst, J.-M. Landry, J. Linnell, and U. Breitenmooser, Eds.). Pp. 15-16 *in* Carnivore Prevention News 6. Available at: http://www.lcie.org/Docs/Damage%20prevention/CDPNews6.pdf **(accessed 14-06-07).** -- A novel scheme in which South African farmers receive compensation based on fixed donations (US$1,000) for live cheetah(s) that are captured legally and then relocated to approved conservation areas. In effect, "problem cheetahs" in this scheme pay for their own relocation.

Ciucci, P., and L. Boitani. 2000. Wolves, dogs, livestock depredation and compensation costs: 25 years of Italian experience. [Abstract] Beyond 2000: Realities of Global Wolf Restoration, 23-26 February 2000, Duluth, MN, USA. Available at: http://www.wolf.org/wolves/learn/scientific/symposium/abstracts/008.asp **(accessed 20-06-07).** -- Quantifies compensation costs at the national scale 1991-1995, correlates costs to increasing wolf population, and compares compensation programs adopted by each regional government. Though total compensation costs on the order of US$2,000,000 annually were among the highest of European countries, a large proportion of the predators are still killed each year and the social conflicts do not seem to be tempered by reimbursement.

Cope, D.R., R.A. Pettifor, L.R. Griffin, and J.M. Rowcliffe. 2003. Integrating farming and wildlife conservation: the Barnacle Goose Management Scheme. *Biological*

***Conservation* 110: 113–122.** -- Among the first evaluations of biological effectiveness for a compensation scheme. Density of barnacle geese (*Branta leucopsis*) approximately doubled on non-reserve lands where farmers were awarded payments for reducing the level of disturbances on geese. The scheme employed two tiers of payment levels corresponding to feeding (FZ) and intermediate zones (IZ). Farmers volunteer their fields in the payment levels, and receive a higher payment per unit area for fields within the FZ tier. The arrangement also allowed targeted the consolidation of geese in the ideal configuration of fields for which the aggregate management goals were aimed.

Cozza, K., R. Fico and M.-L. Battistini. 1996. The damage-conservation interface illustrated by predation on domestic livestock in central Italy. *Biological Conservation* 78: 329–336. -- Describes weak reliability of evaluation methods for damages such that blame for most predation was misdirected at wolves instead of domestic dogs in Abruzzo region. Only 4.1% of 563 claimants considered chronically afflicted by losses, with a majority claiming less than one attack per year. Recommends compensation or other economic incentives be directed primarily at those owners mostly likely to experience conflicts with wildlife.

Ericsson, G., and T.A. Heberlein. 2003. Attitudes of hunters, locals, and the general public in Sweden now that the wolves are back. *Biological Conservation* 111: 149–159. -- Swedes living in areas with restored wolves have more negative attitudes than the general public. Attitudes in the latter group were not strong, and more knowledge about wolves tended to increase tolerance within all groups, thereby suggesting that attitudes could be modified within some stakeholder groups. Hunters in areas with restored wolves reported the least tolerance. Predicts that net demographic trends should increase tolerance for wolves in the future.

Fritts, S.H. 1982. Wolf depredation on livestock in Minnesota. Res. Publ. 145. Patuxent, MD: U.S. Department of the Interior, Fish & Wildlife Service. 11 p. -- Summary of wolf depredation patterns by year, number of farms affected, and number of livestock taken. Number of livestock killed remained fairly stable over a period in which lethal control declined. Notes a recurring problem of claims that are exaggerated or misattributed to the wrong predator.

Gilady, P. 2000. Wolf predation damages to livestock, the Golan, Israel. [Abstract] Beyond 2000: Realities of Global Wolf Restoration, 23-26 February 2000, Duluth, MN, USA. Available at: http://www.wolf.org/wolves/learn/scientific/symposium/abstracts/009.asp **(accessed 19-06-07).** -- Out of 150-200 individuals country-wide, about depredations by 100 wolves in the Golan led to approximately US$280,000 in livestock losses as estimated by ranchers during 1998-1999. At least seven techniques were employed to minimize wolf depredations, including guard dogs, fencing, controlled hunting, marking livestock birthing enclosures with dog urine, using foot traps only where wolf damage occurred, wolf removal, and a government compensation fund.

Haney, J.C., G. Schrader, T. Kroeger, S. Stone, F. Casey, and A. Quarforth. 2006. Wilderness discount on livestock compensation costs for imperiled gray wolf *Canis lupus*. (A. Watson, L. Dean, and J. Sproull, Eds.). Pp. xxx-xxx *in* Science and stewardship to protect and sustain wilderness values: 8th World Wilderness Congress symposium. Proc. RMRS-P-000, Fort Collins, CO. U. S. Dept. Agriculture, Forest Service, Rocky Mountain Research Station. -- Despite often lax husbandry practices in remote areas, costs for compensating livestock losses to

reintroduced wolves was demonstrably lower on wilder lands where livestock and the predators occurred in close proximity. This 'wilderness discount' was detected for wolf depredations in the western Great Lakes region and on public grazing allotments in the northern Rockies, U.S.A. Authors suggest that livestock depredations (and thus compensation costs) remained comparatively low because native ungulate prey of wolves were abundant in each of the two landscapes studied.

Hill, T., and R. Bonham. 2005. Living on borrowed time. *Swara* 28: 34–39. -- A community-based program providing reimbursement for livestock losses in return for agreed changes in behavior. This stakeholder program, conducted on the Maasai's community Mbirikani Group Ranch in Kenya, used a system of penalties and compensation rewards that were culturally acceptable in order to demonstrably reduce (to near zero) retaliatory killing of a highly-threatened local population of African lion. The compensation fund is a business contract forged between conservation and community interests, with non-governmental enforcement that withholds compensation for clans or kin groups that kill lions. Compensation payouts occur only after a suitable period elapses without lion killing *after* the livestock loss.

Holmern, T., J. Nyahongo, and E. Røskaft. 2007. Livestock loss caused by predators outside the Serengeti National Park, Tanzania. *Biological Conservation* 135: 518–526. -- In a survey of 481 households in 7 villages bordering the park, 27.4% reported losses of a total of 4.5% of their livestock lost to wild predators over 12 months, an average financial loss of 19.2% of cash income. Most of these substantial economic losses were attributed to spotted hyena. Depredation by felids occurred only in a narrow zone along the protected area whereas hyenas killed livestock in households located as far away as 30 km. Statistical modeling indicated that education improved tolerance, while for livestock owners higher depredations were associated with approval of lethal control and effective protection measures were linked to less desire for retaliation.

Hötte, M., and S. Bereznuk. 2001. Compensation for livestock kills by tigers and leopards in Russia. (C. Angst, J.-M. Landry, J. Linnell, and U. Breitenmooser, Eds.). Pp. 6-7 *in* Carnivore Prevention News 3. Available at: http://www.lcie.org/Docs/Damage%20prevention/CDPNews3.pdf **(accessed 20-06-07).** -- Compensation takes three forms in this project: 1) farms receive direct compensation for livestock kills, 2) deer farms receive additional compensation for presence of tigers and leopards on or near the farm, and 3) deer farms receive practical assistance such as supplemental forage, equipment repair, and fuel for these proactive measures. Compensation could be as high as US$80/month/leopard. Notably, prevention of all livestock losses was not a goal because of dependency by the highly-endangered Amur leopard on domestic deer prey. Authors conclude that "we are convinced that compensation helps to prevent retaliations by the farm staff when tigers or leopards kill livestock."

Hussain, S. 2003. Snow leopards and local livelihoods: managing the emerging conflicts through an insurance scheme. (C. Angst, J.-M. Landry, J. Linnell, and U. Breitenmooser, Eds.). Pp. 9-11 *in* Carnivore Prevention News 6. Available at: http://www.lcie.org/Docs/Damage%20prevention/CDPNews6.pdf **(accessed 14-06-07).** -- Describes structure for a two-fund compensation scheme that involves combining premiums based on number of livestock and paid by potential claimants in one fund, and proceeds from ecotourism ventures into the second. Due to community participation and new, positive incentives for conservation, the asymmetric information, moral hazard, fraudulent claims and other deficiencies of some compensation programs

were overcome. Unless the entire village colludes, and keeps this fact from all stakeholders, it is very difficult to "cheat" the scheme. Early indications are that snow leopard population in area is stable and perhaps increasing.

Karlsson, J., M. Sjöström. 2007. Human attitudes towards wolves, a matter of distance. *Biological Conservation* 137: 610–616. -- People living inside wolf territories had a more negative attitude towards wolf conservation than people living just outside. Distance to nearest wolf territory had a greater influence on attitudes towards this predator than did membership in a conservation organization, being a hunter, owning livestock, or owning a hunting dog. Suggest that attitudes more likely to be result of indirect than direct experience of predator presence.

Khuukhenduu, T., and E. Bidbayasakh. 2001. Wolves in Mongolia: wolf depredation in Mongolian park is a fact of live. *International Wolf* 11(3): 10. Available at: http://www.wolf.org/wolves/news/iwmag/2001/fall/fall2001.asp **(accessed 20-06-07).** -- A random sample of 150 households (out of 1,100 herding households near Gobi Gurvan Saikhan National Park revealed that wolf kills amount to about 2.3% of total livestock holdings. This figure was high relative to certain other northern Asian regions: Kazakhstan (1.5%), Siberia (1.6%), and Volga (2.2%). Total cost of livestock lost to wolves was estimated at US$27,455 for interviewed families, a high proportion, $183, of annual family income. At least at the time of the study, Mongolia did not pay compensation.

Kloskowski, J. 2005. Otter *Lutra lutra* damage at farmed fisheries in southeastern Poland, I: an interview survey. *Wildlife Biology* 11: 201–206. -- Most frequently listed type of otter damage was killing or serious injury of commercially valuable brood fish and surplus killing of cultured carp. Non-destructive attempts to protect stocks from otters were rare, and 17% of respondents admitted illegal killing of otters. Otters occurred at 91% of 114 surveyed carp fisheries in 1994-1995 and 2001, with 62% perceiving otter predation over the previous decade. Private pond owners perceived losses to otters higher than did managers of state-owned fisheries. Similar proportions of carp by weight in otter diet were found in fish farms with and without perceived serious economic losses.

Kumar, S. 2001. Wolves in India: compensation policies complicate wolf depredation conflicts. *International Wolf* 11(3): 8–9. Available at: http://www.wolf.org/wolves/news/iwmag/2001/fall/fall2001.asp **(accessed 20-06-07).** -- Conflicts with wolves were exacerbated because, unlike for Indian tiger and Asiatic lion, farmers were not paid for their livestock losses to that predator. Between 1991 and 1995, farmers and shepherds lost US$3,246 of livestock in the region of the Great Indian Bustard Sanctuary in Maharashtra State, a potentially large proportion of average annual income of less than $300 per household. Individual families were compensated only for $110 for the loss of a child to wolf depredation. Between 65-70 children were attacked or killed by wolves in Uttar Pradesh, northern India, between 1996 and 1999. Native, natural prey for wolves in these areas was greatly depleted, and livestock were a major dietary component.

Latini, R., C. Sulla, L. Gentile, and A. di Benedetto. 2005. The conflict between humans and large carnivores at the Abruzzo, Lazio and Molise National Park (central Italy): assessment, experiences and management perspectives. *Biologia e Conservazione della Fauna* 115: 151–159. [in Italian, with English abstract] -- Analysis of 1996 claims of carnivore damage 1998-2003. Wolves were responsible for 61% of claims, bears for 31%. A small fraction of total livestock were taken (1.6%);

neither surplus killing (defined as >20 animals killed/attached) nor chronic events (>6 attacks/farm/year) were common. Compensation was judged to be ineffective unless adequate damage prevention and public outreach is conducted.

Lindsey, P.A., J. T. du Toit, and M.G.L. Mills. 2005. Attitudes of ranchers towards African wild dogs *Lycaon pictus*: conservation implications on private land. *Biological Conservation* 125: 113–121. -- Attitudes were most negative where ranches were game-fenced and where cattle or consumptive wildlife utilization dominated the land use.

Lindsey, P.A., R. Alexander, J.T. du Toit, and M.G.L. Mills. 2005. The cost efficiency of wild dog conservation in South Africa. *Conservation Biology* 19: 1205–1214. -- Novel study in which a substantial fraction of all damage and transaction costs (*sensu* Schwerdtner and Gruber 2007) were computed in a cost metric for measuring efficiency of wild dog (*Lycaon pictus*) conservation strategies on South African large protected areas (449 packs/US$100,000 expenditure), private reserves (3-13 packs/$100,000), and private ranch lands (14-27 packs/$100,000). Authors recommend that expansion of this wild dog metapopulation be limited to state-owned nature reserves willing to bear predation costs without compensation.

Linkie, M., Y. Dinata, A. Nofrianto, and N. Leader-Williams. 2007. Patterns and perceptions of wildlife crop raiding in and around Seblat National Park, Sumatra. *Animal Conservation* 10: 127–135. -- Describes extent and seasonal pattern of crop-raiding damage by wild boar, pig-tailed macaque, and other species in Kerinci Seblat National Park, Sumatra. Article also includes some socioeconomic backgrounds on the farmers affected, and contrasts farmer perceptions versus observed crop pest species.

Linnell, J., and H. Brøseth. 2003. Compensation for large carnivore depredation of domestic sheep 1994-2001. (C. Angst, J.-M. Landry, J. Linnell, and U. Breitenmooser, Eds.). Pp. 11-13 *in* Carnivore Prevention News 6. Available at: http://www.lcie.org/Docs/Damage%20prevention/CDPNews6.pdf **(accessed 14-06-07).** -- In a single year (2001), Norway paid out about 5 million euros for compensation of sheep losses from brown bear, gray wolf, Eurasian lynx and other large predators. There is no requirement that all predator-killed sheep be found and their cause of death confirmed in order for compensation to be paid; thus, compensation has not prompted farmers to adopt better husbandry practices. In addition to direct costs, compensation also covers some of the lost production of ewes and extra work caused by damages. High livestock losses originate from unherded, unguarded and unsupervised husbandry which developed during an era in which most large predators were close to extermination in Norway.

Ludwig, G.X., V. Hokka, R. Sulkava, and H. Ylönen. 2002. Otter *Lutra lutra* predation on farmed and free-living salmonids in boreal freshwater habitats. *Wildlife Biology* 8: 193–199. -- Otters switched to salmonids where these fish were more abundant, especially during winter. The dietary increase in salmonids occurred mostly due to the presence of fish farms rather than trout streams.

Lukarevsky, V. 2003. Saving the Central Asian leopard in Turkmenistan. (C. Angst, J.-M. Landry, J. Linnell, and U. Breitenmooser, Eds.). Pp. 13-15 *in* Carnivore Prevention News 6. Available at: http://www.lcie.org/Docs/Damage%20prevention/CDPNews6.pdf **(accessed 14-06-07).** -- A community-level compensation program in which local ranchers are compensated with live animals drawn from a sustainable sheep operation purchased with capital provided by WWF. Livestock losses were verified by expert investigators, ranches were given a

fixed time limit to report losses, and herds left unattended or grazing in remote natural areas might not receive compensation.

Madhusudan, M.D. 2003. Living amidst large wildlife: livestock and crop depredation by large mammals in the interior villages of Bhadra Tiger Reserve, South India. *Environmental Management* 31: 466–475. -- Material and monetary loss estimates for resident villagers between 1996 and 1999. Each household lost 12% of total livestock holdings to tiger, and about 11% of annual grain production (0.8 tonnes per family) to elephants. Compensation only offset 5% and 14% of livestock and crop losses, respectively. Improvements and/or changes (e.g., insurance) were suggested as alternatives to a scheme characterized by protracted delays in claims processing and a failure to achieve full reimbursement.

Maikhuri, R.K., S. Nautiyal, K.S. Rao, and K.G. Saxena. 2001. Conservation policy-people conflicts: a case study from Nanda Devi biodiversity reserve (a World Heritage Site), India. *Forest Policy Economics* 2: 355–365. -- Reserve authorities granted compensation for livestock killed by wildlife, but only 5% of the market value as perceived by the claimants. As a result of participatory discussions with 419 households in 10 villages in the buffer zone around the reserve, traditional uncodified rights of local people were described as substantially reduced through several policy interventions implemented since the 1860s. More than 90% of respondents perceived that the rural economy had deteriorated due to crop damages, livestock lost to wildlife, termination of opportunities to harvest medicinal plants, and tourism in the core zone of the reserve. Mean economic loss was estimated at 1285 rupees, 1195 rupees, and 156 rupees from wildlife damage to food crops, fruit trees, and beehives, respectively.

Maroney, R. L. 2005. Conservation of argali *Ovis ammon* in western Mongolia and the Altai-Sayan. *Biological Conservation* 121: 231–241. -- Interviews in Siilkhemiin Naruu National Park in western Mongolia revealed that pastoralists revered the arguli wild sheep and supported government protection. However, these pastoralists were not included to reduce their herd sizes or discontinue grazing certain pastures for the sheep's benefit without compensation.

Mech, L. D. 1999. Estimated costs of maintaining a recovered wolf population in agricultural regions of Minnesota. *Wildlife Society Bulletin* 26: 817–822. -- Contrasts costs for maintaining wolves in primarily wilderness (US$86/wolf/year) versus primarily outside wilderness areas ($197/wolf/year), lists by the number of farms affected, types and number of livestock taken, compensation paid, and cost of control program. This study thus included some of both the damage and transaction costs for compensation (*sensu* Schwerdtner and Gruber 2007).

Mishra, C. 1997. Livestock depredation by large carnivores in the Indian trans-Himalaya: conflict perceptions and conservation prospects. *Environmental Conservation* 24: 338–343. -- Over the course of an 18-month period, eighty households in three villages lost 189 livestock, with most retaliatory killing directed at wolf rather than snow leopard. Expressed per household, this equated to half the average annual per capita income. Financial compensation from the national government amounted to 3% of the perceived annual loss. Intensification of conflict appeared related to a 37.7% increase in livestock holdings over the previous 10 years (*cf.* Bulte and Rondeau 2005, Rondeau and Bulte 2007). Author proposed a self-financed compensation scheme coupled with modification of livestock pens as a short-term measure to reduce the conflict.

Mishra, C., P. Allen, T. McCarthy, M.D. Madhusudan, A. Bayarjargal, and H.H.T. Prins. 2003. The role of incentive programs in conserving snow leopard. ***Conservation Biology*** **17: 1512–1520.** -- Describes a pilot incentive program in India in which losses due to livestock predation are offset by creating livestock-free zones to enhance wild prey density on common land. Also described is a separate program in Mongolia in which income from handicrafts helps curtail poaching and retaliatory killing. Notes that these types of programs tend to be small, isolated, and heavily-subsidized.

Millar, H. 2007. Insuring the survival of the snow leopard. EnvironmentYALE Spring 2007: 34–37, 41. -- Locally supported insurance-type plan overseen by Shafqat Hussein which uses combination of annual premiums plus NGO funds from Project Snow Leopard. With villagers' input, the scheme was linked to an ecotourism venture and designed with clever checks and balances to discourage cheating and encourage cooperation (e.g., committee membership with limited, fixed terms; self-monitoring; two separate funds to prevent fraudulent claims).

Moa, P.F., I. Herfindal, J.D.C. Linnell, K. Overskaug, T. Kvam, and R. Andersen. 2006. Does the spatiotemporal distribution of livestock influence forage patch selection in Eurasian lynx ***Lynx lynx*****? *Wildlife Biology* 12: 63–70.** -- Contrary to expectations, lynx did not select for livestock-rich patches in any season. Rather, the cat showed clear preference for patches rich in the most prevalent native ungulate, roe deer. Thus, livestock depredations were primarily the result of chance encounters rather than active selection.

Moberly, R.L., P.C.L. White, C.C. Webbon, P.J Baker, and S. Harris. 2004. Modelling the costs of fox predation and preventive measures on sheep farms in Britain. ***Journal of Environmental Management*** **70: 129–143.** -- An analysis that provides a framework for future evaluations of wildlife impacts and cost-effective management of these certain damages. Simulations indicated that efficient fox predation management does not necessarily mean that lamb losses should be reduced to zero, and additional fox control is not worthwhile on the majority of farms.

Montag, J. 2003. Compensation and predator conservation: limitations of compensation. (C. Angst, J.-M. Landry, J. Linnell, and U. Breitenmooser, Eds.). Pp. 2-6 ***in*** **Carnivore Prevention News 6. Available at:** http://www.lcie.org/Docs/Damage%20prevention/CDPNews6.pdf **(accessed 14-06-07).** -- Questions the premise that the social opposition stemming from livestock depredation is primarily an economic issue, and that paying for losses to predators will alleviate the challenge of achieving coexistence between carnivores and humans. Notes that the most damaging species (e.g., domestic dogs and coyotes) are not always the species targeted with compensation schemes (e.g., wolves).

Morzillo, A.T., A.G. Mertig, N. Garner, and J. Liu. 2007. Spatial distribution of attitudes toward proposed management strategies for a wildlife recovery. ***Human Dimensions of Wildlife*** **12: 15–29.** -- Statistical analysis of black bear recovery in southeastern Texas revealed that respondents closer to a potential release site in a preserve were more likely to support exclusion than other categories of respondents (cf. Karlsson and Sjöström 2007). Clustering for two other attitudes was detected: 1) non-support for a natural (non-human assisted) increase in bear population, and 2) strong disagreement toward total exclusion of bears from southeastern Texas within a relatively urban county.

Musiani, M., T. Muhly, C.C. Gates, C. Callaghan, M.E. Smith, and E. Tosoni. 2005. Seasonality and reoccurrence of depredation and wolf control in western North

America. *Wildlife Society Bulletin* 33: 876–887. -- Limited wolf control was rapidly employed as a short-term response to depredation, and was not designed to decrease wolf depredation and thus livestock loss damage at a regional scale or in the long-term.

Naughton-Treves, L. 1998. Predicting patterns of crop damage by wildlife around Kibale National Park, Uganda. *Conservation Biology* 12: 156–168. -- Despite crop damages documented from 13 species being mostly confined to farms at forest edges, and equal or greater damage from domestic livestock, farmers perceived a heightened economic risk to their interests due to legal prohibitions on killing the wild species.

Naughton-Treves, L., R. Grossberg, and A. Treves. 2003. Paying for tolerance: rural citizens' attitudes toward wolf depredation and compensation. *Conservation Biology* 17: 1500–1511. --Using a mail-back survey of 535 rural residents, assessed tolerance and preferences for wolf management. Despite all respondents approving of compensation as a management strategy, livestock producers and bear hunters who had been compensated for their losses were not more tolerant than their counterparts who alleged a loss but received no compensation. Authors suggest that tolerance depended more on deep-rooted social identity and occupation than individual encounters with this carnivore.

Nemtzov, S.C. 2003. A short-lived wolf depredation compensation program in Israel. (C. Angst, J.-M. Landry, J. Linnell, and U. Breitenmooser, Eds.). Pp. 16-17 *in* Carnivore Prevention News 6. Available at: http://www.lcie.org/Docs/Damage%20prevention/CDPNews6.pdf **(accessed 14-06-07).** -- Run for only one year, this program was discontinued because no sponsor could be found to underwrite the payments. Ranchers perceived that the compensation was too low, but better than no payment at all. Subsidies for fences and livestock guarding dogs are now employed.

Nelson, A., P. Bidwell, and C. Sillero-Zubiri. 2003. A review of humane elephant conflict management strategies. People and Wildlife Initiative. Wildlife Conservation Research Unit, Oxford University. Available at: http://www.peopleandwildlife.org.uk **(accessed 19-06-07)** -- Offers reasons for lack of success in wildlife compensation schemes; only advantage mentioned is that compensation helps identify serious human-elephant conflict zones.

Nyhus, P.J., H. Fischer, F. Madden, and S. Osofsky. 2003. Taking the bite out of wildlife damage: the challenges of wildlife compensation schemes. *Conservation-in-Practice* 4: 37–40. -- General overview, with some examples, of opportunities and challenges faced by implementing compensation schemes. Notes that studies of cost-effectiveness and comparative assessment of putative benefits on wildlife populations are scarce.

Nyhus, P.J., S.A. Osofsky, P. Ferraro, F. Madden, and H. Fischer. 2003. Bearing the costs of human-wildlife conflict: the challenges of compensation schemes. (R. Woodroffe, S. Thirgood, A. Rabinowitz, Eds.). Pp. 107-121 *in* People and Wildlife, Conflict or Coexistence?, Cambridge University Press, Cambridge. -- Identifies six "key determinants of success" for compensation schemes: 1) rapid and accurate identification of damage, 2) prompt and fair payment, 3) long-term source of funding, 4) clear rules and guidelines linking payment to sound management practices, 5) adaptation to cultural and socio-economic context, and 6) ability to monitor the wildlife population for which the compensation is directed. Suggests performance payments as an alternative to compensation in some circumstances.

Ogada, M.O., R. Woodroffe, N.O. Oguge, and L.G. Frank. 2003. Limiting depredation by African carnivores: the role of livestock husbandry. *Conservation Biology* 17: 1521–1530. -- Retaliatory killing by farmers on lions, leopards, and spotted hyenas scaled to the number of livestock that these predators killed in the Laikipia District, Kenya. Husbandry practices had a substantial influence on the number of livestock lost.

Ogutu, J.O., N. Bhola, and R. Reid. 2005. The effects of pastoralism and protection on the density and distribution of carnivores and their prey in the Mara ecosystem of Kenya. *Journal of Zoology* 265: 281–293. -- Estimates of wild prey biomass density were 2.6 times higher in ranches than on reserves. Due to a heightened risk of conflict, recommends economic intervention to prevent local lion extinctions from retaliatory killings.

Okello, M.M. 2005. Land use changes and human-wildlife conflicts in the Amboseli area, Kenya. *Human Dimensions of Wildlife* 10: 19–28. -- Interviews of residents showed more support for the profitability of agricultural expansion (*cf*. Bulte and Rondeau 2005, Rondeau and Bulte 2007) than for either pastoralism or conservation. Although a majority of residents still favored wildlife conservation, they were opposed to free wildlife use of their land. Thus, support for wildlife conservation was contingent on benefits received and influenced by lack of compensation for losses from problem animals.

Patterson, B.D., S.M. Kasiki, E. Selempo, and R.W. Kays. 2004. Livestock predation by lions (*Panthera leo*) and other carnivores on ranches neighboring Tsavo National Park, Kenya. *Biological Conservation* 119: 507–516. -- Analysis of attacks on livestock show mainly predation on cattle at night; daytime attacks on smaller sheep and goats mostly by cheetahs. Lion and other wildlife attacks claimed 2.4% of range stock annually, with livestock representing ~5.8% of the diet of ranch-dwelling lions, about 2.6% of the herd's economic value, and costing the ranch studied here US$8,749 per annum. These losses came to about half of what ranchers perceived as sustainable from a business standpoint.

Polisar, J., I. Maxit, D. Scognamillo, L. Farrell, M.E. Sunquist, and J.F. Eisenberg. 2003. Jaguars, pumas, their prey base, and cattle ranching: ecological interpretations of a management problem. *Biological Conservation* 109: 297–310. -- Biomass calculations indicated that natural prey were adequate in the study area to support the resident large cats without augmentation by livestock depredation. Puma (cougar) were more responsible for livestock attacks than jaguar. Eleven recommendations are provided for ranchers to mitigate livestock losses to the large cats.

Promberger, C., and A. Mertens. 2001. Wolf-livestock conflicts in Romania. *International Wolf* 11(3): 7-8. Available at: http://www.wolf.org/wolves/news/iwmag/2001/fall/fall2001.asp (accessed 20-06-07). -- More than five million sheep share their grazing habitat with 3,000 wolves and 5,000 brown bears in the Carpathian Mountains, making this region unique as the only in Europe where both predators and livestock occupy the same habitats at high densities. Because flocks are extensively protected by guard dogs and shepherds, neither subsidies nor compensation are administered for the losses.

Rasmussen, G.S.A. 1999. Livestock predation by the painted hunting dog *Lycaon pictus* in a cattle ranching region of Zimbabwe: a case study. *Biological Conservation* 88: 133–139. -- Indications suggested that some losses attributed to wild dogs were in fact due to cattle rustling and poaching. Authentic cattle losses in a cattle

herd averaging 3,132 amounted to ≤26 animals out of a total of 268 losses detected during a peak calving season.

Reiter, D.K., M.W. Brunson, and R.H. Schmidt. 1999. Public attitudes toward wildlife damage management and policy. *Wildlife Society Bulletin 27*: 746–758. -- A mail survey of selected U.S.A. households indicated that respondents were generally opposed to the federal government paying financial compensation for losses from wildlife damages.

Richer, M.-C., J.-P. Ouellet, L. Lapointe, M. Crête, and J. Huot. 2005. Impacts of white-tailed deer grazing in hay fields of southern Québec. *Wildlife Society Bulletin* 33: 1274–1281. -- Deer grazing caused losses of 12-14% of subsequent annual yields in legume and alfalfa crops; loss rates varied considerably across individual farms.

Rollins, K., and H. C. Briggs. 1996. Moral hazard, externalities and compensation for crop damages from wildlife. *Journal of Environmental Economics and Management* 42: 156–182. -- Largely mathematical treatment of whether contracts that involve transfers of severe hunting regulations (a public good that disperses wildlife – in this study, geese) and monetary payments from hunting licenses can be deployed to overcome the moral hazard problem in wildlife compensation schemes. Importantly, this study also identifies smaller-scale predation and compensation settings as less costly to implement.

Rondeau, D., and E. Bulte. 2007. Wildlife damage and agriculture: a dynamic analysis of compensation schemes. *American Journal of Agricultural Economics* 89: 490–507. -- Sets up a highly-stylized dynamic model with assumptions for testing whether damage compensation schemes achieve conservation objectives when reimbursements create perverse incentives for more farming or ranching. The framework for this analysis seems reasonable only for less developed countries that might have "open access to both land for agriculture and wildlife for animal products." The model identifies certain conditions where compensation could lead to a reduction in wildlife stock.

Schiess-Meier, M., S. Ramsauer, T. Gabanapelo, B. König. 2007. Livestock predation – insights from Problem Animal Control Registers in Botswana. *Journal of Wildlife Management* 71: 1267–1274. -- Farmers report livestock losses due to carnivores as a prerequisite for receiving financial compensation, thus enabling more rigorous quantification of human-predator conflicts. Five carnivore species (but mostly lions and leopards) took 2,272 head of livestock over 3 years; in the year with highest impact (2002) this depredation represented 0.34% of livestock across the entire district. However, within farmers and herders within 30 km of game reserves, livestock losses to predators amounted to 2.2% annually. Predation on livestock in the Kweneng District of Botswana was relative low compared to similar studies elsewhere around the globe.

Schwerdtner, K., and B. Gruber. 2007. A conceptual framework for damage compensation schemes. *Biological Conservation* 134: 354–360. -- Provides a theoretical framework for distinguishing damage costs (both direct and indirect) and transaction costs (both search/information and decision-making) in compensation schemes. Based on the power to reach a certain goal at the least possible cost, also recommends compensation-in-advance versus ex-post compensation as preferred for European otter in Germany.

Sidorovich, V.E., L.L. Tikhomirova, and B. Jedrzejewska. 2003. Wolf *Canis lupus* numbers, diet and damage to livestock in relation to hunting and ungulate abundance in northeastern Belarus during 1990-2000. *Wildlife Biology* 9: 103–111. -

- During a decade of substantial political and economic transformation in eastern Europe, density of wild ungulates declined 5- to 6-fold, probably due to uncontrolled harvest. Wolves responded to the shortage of wild ungulates by taking more domestic animals, mostly cattle. The proportion of livestock depredated rose from 4-6% to 38% of the biomass consumed by this predator.

Spitz, F., and S. Lek. 1999. Environmental impact prediction using neural network modeling: an example in wildlife damage. *Journal of Applied Ecology* 36: 317–326. -- Uses artificial neural network (ARN) modeling to produce relevant predictions that could help managers allocate their decisions among prevention, protection, and compensation of wildlife damages.

Stahl, P., J.M. Vandel, V. Herrenschmidt, and P. Migot. 2001. Predation on livestock by an expanding reintroduced lynx population: long-term trend and spatial variability. *Journal of Applied Ecology* 38: 674–687. -- Lynx attacks on sheep in the French Jura region between 1984 and 1998 were clustered within a very few small 'hotspots' that covered 0.3-4.5% of total study area (1,835-4,061 km^2). Each year, two to six of these hotspots were responsible for 33-66% of sheep depredations. 'Hotspots' also tended to have very high roe deer abundance, indicating that lynx depredation was mostly incidental to their foraging on native prey. Recommends compensation as one approach to minimize conflict, especially when proactive measures would not be effective due to the highly-localized and random nature of predator damages.

Stone, S.A. 2006. Wolf conservation and conflicts in the USA northern Rockies. Masters thesis, Prescott College, Prescott, Arizona, USA. 66 pp. -- Effectiveness of an NGO-sponsored compensation program as a conservation method was assessed through survey sent to all livestock owners who received reimbursements for documented losses from 2002 to 2004. Respondents represented more than 60% of total livestock owners compensated for losses to wolves since 1987. Although nearly all (80%) respondents still objected to wolves in their area, but most (59%) also reported that their tolerance toward wolves would be lower if they hadn't received compensation.

Swarner, M. 2004. Human-carnivore conflict over livestock: the African wild dog in central Botswana. Breslauer Symposium on Natural Resource Issues in Africa, University of California, Berkeley. Available from: http://repositories.cdlib.org/cas/breslauer/swarner2004a **(accessed 15-06-07)** -- A Kalahari farm experienced as much as US$6,250 in livestock losses during eight months when wild dogs denned nearby.

Swenson, J.E., and H. Andrén. 2003. A tale of two countries: large depredation and compensation schemes in Sweden and Norway. (R. Woodroffe, S. Thirgood, A. Rabinowitz, Eds.). Pp. 323-339 *in* People and Wildlife, Conflict or Coexistence?, Cambridge University Press, Cambridge. -- Contrasts relative impacts, husbandry practices, carnivore species, and costs between Norway and Sweden for compensating for livestock lost to wolverine, brown bear, lynx, and gray wolf. Also describes how compensation to reindeer owners in Sweden is based on number of carnivores living within their grazing area, not on number of reindeer killed. Reindeer owners and county employees survey lynx, wolverine, and wolf cooperatively each year.

Tchamba, M.N. 1996. History and present status of the human/elephant conflict in the Waza-Logone region, Cameroon, west Africa. *Biological Conservation* 75: 35–41. -- Damage to crops (mostly dry-season millet, rainy-season sorghum, cotton, corn, peanuts, and vegetables) doubled between 1992 and 1993, and caused increasing loss of human life. Browsing, trampling, and uprooting represented 52%, 38%, and 10% of crop

damage, respectively. Mostly ineffective prevention measures included prayer, burning sheep dung, and other magical practices, beating drums or empty barrels, lighting fires at night, and sleep-guarding in fields. Over half of the 427 randomly-selected households viewed elephants as having no utilitarian benefits, a considerable proportion (73%) though more elephants should be culled, and nearly 75% considered personal danger and crop loss a major problem. Also, a majority (87%) indicated that protected areas and the wildlife department were ineffective at mitigating conflicts. Paying compensation with assistance of international organizations was recommended as one means to increase tolerance of local farmers towards elephants.

Treves, A., R. R. Jurewicz, L. Naughton-Treves, R.A. Rose, R.C. Willging, and A.P. Wydeven. 2002. Wolf depredation on domestic animals in Wisconsin, 1976-2000. *Wildlife Society Bulletin* 30: 231–241. --Compensation for lost livestock averaged US$96/wolf/year and reimbursements were distributed to 66 property owners. Two/thirds of the 71 wolf packs were never suspected of causing depredations, although 4 packs were involved in multiple incidents.

Verdade, L.M., and C.B. Campos. 2004. How much is a puma worth? Economic compensation as an alternative for the conflict between wildlife conservation and livestock production in Brazil. *Biota Neotropica* v4(n2) – http://www.biotaneotropica.org.br/v4n2/en/toc **(accessed 20-06-07).** -- Illustrates 'value' of individual pumas through prorating the US$3,600 in livestock losses to 7 puma killed ($514/puma/year). Three steps were recommended before implementing a Brazilian compensation scheme for puma: 1) changes to wildlife law, 2) train and deploy wildlife biologists as wildlife managers, and 3) use an existing infrastructure of the Agriculture Extension Service.

The Wildlife Conservation Research Unit, Oxford University, Panthera Foundation. 2007. Felid Biology and Conservation, IUCN/SSC Cat Specialist Group, 17–20 September. -- This conference consisted of thirty-two (32) oral and poster presentations devoted to conservation biology and management of wild cats. Full abstracts for those presentations most relevant to wildlife compensation and to wildlife damage assessment are reproduced below:

> **Jaguar depredation in the llanos: an ecological and socio-cultural approach to coexistence**
> Esteban Payan, Sarah Durant, Katherine Homewood, and Chris Carbone, Wildlife Conservation Society, New York, USA. Contact e-mail: c.payan@ucl.ac.uk
> Jaguar distribution in the Colombian Llanos is largely unknown and uncertain with constant persecution by cattle ranchers. We evaluated presence, studied the spatial, ecological and sociocultural aspects of jaguar-livestock conflict in this Neotropical savannah habitat (100,242 km^2). Some 1,800 jaguars are estimated present; all associated to major rivers and riparian forests, but never far from cattle pastures. Free roaming pigs were most predated by jaguars (91%), followed by cattle (21%), goats, horses and dogs. For cattle, jaguar depredation never exceeded 5% of the standing stock. Small and poor cattle ranches are more vulnerable to jaguar depredation and than larger ones, since they suffer higher depredation impact and are less tolerant. They run an unprofitable production system mainly due to poor acidic soils, lack of technology, extreme drought and flood dynamics and lack of connectivity to markets; resulting in extensive area grazing and to rear stock in a semi-wild manner – which in turn increases depredation risk and decreases the viability of implementing anti-predatory management strategies. Approximately, 0.4 jaguars are hunted annually per 100 km^2. Linear trends show that attack numbers decrease as distance of attack site to water, forest edge and homestead increases. Cheap and easy anti-predator management techniques are suggested.

Community based livestock insurance scheme; a solution to resolve human-leopard conflict in northern Pakistan

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Part of the moist temperate forest in the NWFP province of Pakistan that hosts a total of 5 common leopards (*Panthera purdus*), has seen an escalation in human-leopard conflict. The available data (since June, 2005) on livestock predation reveals that a total of 413 goats, 10 cows, seven oxen, two buffalos and one horse have been killed in 115 km^2 of study area. In spite of damages to livestock, and retaliatory killings the overall situation of leopard conservation stayed reasonably good till a leopard turned man-eater (June, 2005). Since June, 2005 a total of nine leopards have been killed in retaliation from the area. Keeping in view the gravity of the situation, and magnitude of problem, WWF-Pakistan launched a "Community Based Livestock Insurance Scheme" to overcome the economic losses of farmers. In this regard communities were mobilized to generate a fund, managed and administered by community. Considering the success of the scheme, its membership is increasing steadily and the government and other organizations have shown their interest to support the initiative and replicate in other places. This innovative scheme launched for the first time in Pakistan and provides a tangible incentive to local communities to support conservation and find ways to live in harmony with leopards.

Human-felid conflicts and perspectives on large felid management in Chitwan, Nepal

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The increasing encounter between felid, livestock, and humans raises concerns about the large felid management. I assessed causes of livestock depredation by large felids (tiger and leopard); spatial and temporal distribution of depredation; and effectiveness of the conflict mitigation programs in the Chitwan National Park (CNP) through literature review, field study and participatory appraisals. Over 800 cases of depredation by large cats occurred between 2000 and 2003 showed depredation patterns are varied geographically, seasonally, and in relation to type/size of livestock and proximity to forests. Habitat encroachment, proximity to livestock, behavior of particular predator and intra specific competition are factors forcing felids to kill livestock. In spite of damage, the local people still had a positive attitude towards the felid, because of tangible benefits derived from the park management. Economic compensation, capacity building and local development through the strategy of participatory conservation are considered to be successful to some extent in reducing conflicts and developing local guardianship in conservation. This study clearly indicated that a shift in attitude of people towards wider recognition of felid for ecosystem function and adaptive management.

Human-predator conflict and livestock protection methods in Botswana

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Large carnivores come into frequent conflict with farmers when caught raiding livestock. This study sought to understand and reduce the predator-livestock conflict in Khutse Game Reserve and the surrounding farmland of Kweneng District, Botswana. From 2000 to 2006, we computerized reports of livestock killed by predators, which are kept by the Botswana Department of Wildlife and National Parks, conducted interviews with local farmers and started to survey locations of kills. Preliminary results indicate that leopards and lions were the primary source of the predator livestock conflict. Between 2000 and 2004, the number of annual losses attributed to leopards almost doubled, increasing from 276 to 450, and annual losses attributed to lions increased by a factor of almost 5, from 119 to 561. Local farmers reacted to this situation by killing 18 lions near the reserve in 2005 and 2006. Predator attacks occur manly at night and outside of kraals, suggesting that improvements in kraaling and herding techniques will effectively reduce losses. These results, along with our ongoing research, will be used to develop effective livestock protection methods to contribute to the long-term viability of carnivore populations in Africa.

Investigating key determinants of human-large cat conflict around Ruaha National Park in Tanzania

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Human-wildlife conflict is an issue of pressing conservation concern, particularly when it involves threatened species, and accurately identifying the causes of conflict is fundamental to developing effective resolution strategies. This study investigated pastoralists' attitudes towards wildlife, particularly large felids, in the area around Ruaha National Park in Tanzania, which is a globally important area for biodiversity. Pastoralists reported intense conflict with wildlife, especially big cats, and were largely hostile towards the nearby Park, as wild animals cross the boundary and cause problems on village land. Although the level of retaliatory wildlife killing was low, this was mainly due to circumstantial constraints rather than innate tolerance, highlighting a likely conservation concern for the future. A range of factors affected the severity of respondents' conflict with large cats, including ethnic group, wealth, income sources, social status and levels of livestock loss experienced. Successful conflict mitigation will depend upon reducing depredation through better husbandry, and upon improving the cost-benefit ratio of wildlife presence to ensure that local people receive direct, relevant benefits from conservation. Identifying the main factors influencing conflict, and therefore developing the most appropriate mitigation schemes, should have significant benefits both for human and wild cat populations in this important area.

Cougar (*Puma concolor*) impacts on livestock ranches in the Santa Elena Canyon, Chihuahua, Mexico

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Few studies try to clarify the different sources of livestock loses to large felids. This is critical information needed to evaluate the effect of a predator. We investigated livestock losses by cougars in the Santa Elena Canyon, a northern Mexican protected area were ranchers reported cougar predation claims. Our objectives were to determine the impact of cougars on the livestock industry and to identify the factors associated with livestock kills. We used interviews with rancher owners to document the number of livestock lost/yr for 2001-2003. We identified three groups of livestock loses: by cougars, 8% of total economic loss, by other animals (25%) and by others factors (67%). We found a positive relationship between cougar predation on livestock and the amount of mountain terrain, forest vegetation and relative abundance of cougar in each ranch. Apparently, there is no relationship between livestock husbandry and predation rate, although we discuss the role of other variables. We concluded that current cougar impact on livestock ranches in the Santa Elena Canyon is very low. However, we recognize the need to improve livestock husbandry in the area in order to avoid livestock mortality and further reduce the impact of cougars on this human activity.

Human lion conflict in West and Central Africa

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The lion is threatened in West and Central Africa; livestock encroachment and indiscriminate killing of lions are main threats. Human lion conflict mitigation is therefore key to persistence; several experiments were carried out within the region. In Pendjari NP (Benin), enclosures of clay instead of traditional thorny shrub cut depredation figures by more than half. Around the Niger side of 'W' NP, depredation was estimated at US$ 138 per household per year, more than half caused while grazing; people identified improved herding as the most appropriate measure here (effectiveness not yet measured). A livestock corridor through a chain of protected areas has helped reduce conflict in Benoue NP, while close monitoring reduced depredation from 9 to 0 attacks in enclosures and from 60 to 18 on the pastures of 6 pilot villages around Waza NP (both in Cameroon). Cases in Tchad and Guinea identified yet other mitigation measures, including the use of dogs, sensitisation over rural radio and using relevant Sourats from the Koran; data on effectiveness are lacking, however. These projects demonstrate that mitigation can be effective

provided judicious choice from a varied suite of mitigation options is made, adapted to local circumstances.

The ecology of Eurasian lynx depredation on domestic sheep in Norway: are sheep prey, or just something that gets in the way?
John Odden, John D.C. Linnell1, Ivar Herfindal, and Reidar Andersen, Norwegian Institute for Nature Research, Trondheim, and Norwegian University of Science and Technology, Biology Department, Trondheim, Norway. Contact e-mail: john.odden@nina.no
Livestock depredation is a major source of conflict with large carnivores. In Norway, compensation is paid for between 5000 and 10000 sheep each year following lynx depredation. In this study we aimed to understand the ecology of lynx depredation on sheep in a boreal forest habitat where sheep were grazed in the forest without any form of protection. The study involved the radio-collaring and intensive tracking of 42 Eurasian lynx in Hedmark county, SE Norway from 1995-2000. Our results included the following (1) Despite a very low density of alternative prey sheep did not constitute a major source of food, (2) Most sheep were killed as a form of surplus killing, and were not consumed to the same extent as wild prey, (3) Male lynx killed more sheep than any other age class of lynx, (4) Lynx did not select sheep grazing areas – their movements selected for areas of high wild prey density, (5) Shooting lynx only a minimal losses on subsequent depredation except in cases where the population was reduced. All in all the results allowed us to reject the claims that sheep were regarded as a normal prey. It appears that sheep are simply killed when they are encountered by lynx when they are searching for wild prey. However, the results are likely to be highly context dependent.

A study of livestock depredation by tigers in and around buffer zone of Corbett Tiger Reserve
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We studied livestock depredation by large carnivores in and around buffer zone of the Corbett Tiger Reserve, India in 2002 and 2003. Blocks in south and south east of buffer zone had highest abundance of tigers accounting for 36.5%, 43.5% and 44.7% of tiger population in 1999, 2001 and 2003 censuses. A total of 311 livestock kills and injuries were recorded out of which 61% livestock kills and 18.6% injuries were by tigers. A total of 30.5% and 69.5% of livestock kills were recorded inside and out side of buffer zone respectively. Majority of the livestock kills were recorded on south and southeast portion of buffers zone also having highest tiger abundances in three censuses. Livestock depredation increased significantly in rainy season. Tigers killed significantly higher number of cows than buffalo in buffer zone. The distribution of livestock kills showed significant differences in terms of sex of prey species, weight categories, vegetation types, topography, tree and shrub cover, distance to water and human settlements. Analysis of 38 tiger scats collected from buffer zone showed chital (47.9%) and sambar (14.6%) as dominant prey species with very low contribution of livestock to tiger diet which is in contrast to the observed pattern of livestock depredation.

The Wildlife Society. 2006. Multi-dimensional evaluation of wildlife compensation schemes, Special Symposium, Session 39, 13th Annual Meeting, Anchorage, AK, 23–27 September. -- This special symposium consisted of ten presentations devoted to an initial exploration of how to determine whether wildlife compensation programs are effective. Full abstracts for each presentation are reproduced below:

Compensation schemes for wildlife: How do we measure their conservation effectiveness?
J. Christopher Haney, Defenders of Wildlife, Washington, DC, USA. Contact e-mail: Chaney@defenders.org

Reimbursing private interests for the damages to crops and livestock caused by wildlife is the central tenet of compensation programs. Economic compensation can facilitate wildlife conservation in some instances, yet the record of success with this management tool has been mixed. At times compensation may lead to unintended consequences that can erode protection for wildlife populations or habitats. Yet compensation enhances scientific knowledge of depredation biology if reliable data are acquired through a rigorous claims verification process. This symposium has two aims. First, we seek to synthesize and reconcile the cause(s) behind compensation's mixed record across a variety of species, habitats, and human environments. Second, we will explore reasonable metrics that can gauge when, where, and how compensation schemes meet conservation objectives. To introduce this symposium, I contend that effectiveness of compensation is best understood to be graduated, scale-dependent, and multi-dimensional. Effectiveness is greater, for example, when realized unit costs per animal compensated are low, giving more conservation bang for the dollar spent. Effectiveness is multi-dimensional in that no fewer than six broad elements for success can be recognized: 1) biological compatibility, 2) economic feasibility, 3) transfer of social equity, 4) influence on public opinion, 5) legal and regulatory facilitation, and 6) administrative practicality. Compensation success is scale dependent if confined to a narrow range of ecological, economic, or socio-cultural settings; in such situations, compensation programs must be adaptable. Certain dimensions of compensation success necessarily assume primacy placed within a strict context of wildlife conservation. Unless wildlife populations and habitat are ultimately enhanced, or unless threats to either are mitigated, compensation programs cannot be deemed truly successful.

A multi-species view of wildlife compensation schemes in Norway: is there a consistent philosophy?

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Conserving wildlife can often lead to costly conflicts with human interests. The costs and benefits tend to fall on different spatial scales, with costs being felt locally, and benefits being held nationally or globally. Economic compensation is a widely applied instrument to redistribute the costs to the larger scale where the benefits are found. However, there is growing concern about the utility of compensation systems - making it an appropriate time to take stock of present practices. In this paper we review the range of conflicts that occur between people and wildlife in Norway with a focus on carnivores, ungulates and birds. Each conflict will be examined in terms of the spatial distribution of costs and benefits, the scale of the conflict, and the ease with which it can be mitigated. We will focus on both those conflicts where some resource valuable to people are actually damaged, and those conflicts where conservation interests incur opportunity costs - where some potential development or land-use must be avoided. For each conflict we present a brief overview of the compensation systems that exist, as well as focusing on those conflicts for which compensation is not paid. By comparing the different case studies we will examine if there is actually a consistent philosophy behind the application of compensation or not. Our intention is to go back to the basics, and ask if present practice is the best way of using economic incentives to achieve conservation goals.

Investing in a sustainable future: an economics-based approach to human-wildlife conflict resolution in pastoralist East Africa.

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Mbirikani Group Ranch (MGR) is a 300,000-acre semi-arid grazing land and wilderness habitat in southeastern Kenya owned communally by 9,000 Maasai pastoralists. In late 2001 resident members of MGR and their Maasai neighbors began killing lions at a far higher rate than previously - twenty-two in eighteen months on MGR alone -- using spears and a new, far more lethal weapon, poison. In response, Ol Donyo Wuas Trust (ODWT) launched the Mbirikani Predator Compensation Fund. PCF provides significant benefits: compensation equal to full replacement value for all species of domestic livestock killed by all major carnivores, not just lions. It also contains harsh penalties: fines of cattle or their cash equivalent and possible arrest and jail terms for killing lions; cash fines and reduced amounts of compensation for lesser offenses; and, most critically, the invalidation of otherwise valid compensation claims for entire

local communities for failure to enforce agreed-upon self-regulation (i.e., failure to *prevent* the killing of lions). Since PCF was introduced in April, 2003 lion killing on neighboring group ranches (by spearing and poisoning) has continued at or near pre-PCF levels while on MGR lion killing has diminished substantially; only three lions killed, none by poisoning, in three years. Given the average annual population of livestock on MGR, PCF costs approx. $.50/head of livestock per year to operate. Data collected during the history of PCF on the cost of carnivore depredation -- when combined with all other costs of living with wildlife -- provides clear evidence the Maasai of the Amboseli-Tsavo ecosystem are paying an unacceptable economic price for tolerance toward any and all wildlife. Yet the success of PCF suggests a hopeful way forward, very possibly a breakthrough, for conservationists - using an economics-based approach -- to not only protect lions but also to help conserve and sustain long term the Amboseli-Tsavo ecosystem itself before it collapses.

Wisconsin wolf depredation compensation program: 1985-2005.

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The Wisconsin Department of Natural Resources (WDNR) is responsible for gray wolf (*Canis lupus*) management in the state of Wisconsin. An important part of wolf management is dealing with human-wolf interactions; especially depredation to domestic animals. As the wolf population has grown depredations on livestock, hunting dogs and pets have increased dramatically. The WDNR wolf damage reimbursement program paid 232 claims between 1985 and 2005, totaling $469,431. During this same time the wolf population increased from 15 to 425. During 1985-1995 there were 18 wolf depredation claims paid (average 1.6 /year), the number of wolves varied from15 to 83 (average 37); depredation payments averaged $1,505/year ($41.00 per wolf in the population). From 1996-2000 there were 60 wolf depredation claims paid (average 12.0/year), the wolf population varied from 99 to 248 (average 176); payments averaged $27,204/year ($ 148.00 per wolf). From 2001-2005 there were 154 cases of wolf depredation (average 30.8 /year) the wolf population varied from 257 to 425(average 343); payments averaged $63,371/year ($183.00 per wolf). The WI program is unique because it pays for "missing" livestock and hunting hounds. From 1985 to 2005 reimbursement for hounds killed by wolves accounted for 35% of all payments, calves 32%, farm raised deer 18%, cows 5%, horses 4%, pet dogs 2%, veterinary bills 2%, sheep 1%, and poultry 1%. Some social scientists estimate the success of depredation payment programs by asking questions about the preferred wolf population size or about the likelihood people would illegally shoot a wolf. I assess the success of the WI program on what people are actually doing not on what people say they would do. Survival data from radiocollared wolves between 1979 and 2005 shows that the percent of illegal human caused mortality is decreasing despite the increase in the number of wolf-human conflicts.

Evaluating the importance of compensation payments for wolf recovery in Wisconsin

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Analysis of 537 mailback surveys of residents of human-wolf conflict zones in WI suggests that compensation payments do not improve individual citizens' tolerance for wolves. Yet during personal interviews, livestock producers and hunters stress that compensation is essential to wolf recovery. These seemingly contradictory results highlight the challenges of measuring the impact of compensation programs. Compensation may not change individual attitudes toward wolves, but it can improve wolves' political viability at a broader level. Results of a second survey in WI (n = 1,545) reveal general public opinion on compensation. The majority of respondents favored compensation for livestock losses provided there was evidence of wolf culpability and the livestock producer was following best management practices. Fewer respondents supported compensation for hunting dogs killed by wolves on public land.

As wolf numbers and conflicts increase, managers face serious dilemmas regarding funding compensation. Livestock producers and hunters have successfully lobbied for increases in compensation, even as wolves are removed from the ESA. But the individuals who have voluntarily paid for compensation thus far (mainly city dwellers) have markedly different views on managing wolves than do livestock producers and bear hunters, particularly with regard to

lethal control and public hunts. Will these contributors continue to pay for compensation programs even though 'problem wolves' are being shot? Or should wolves be reclassified as a game species such that the burden of funding compensation shifts to hunters themselves? The WI case reveals the promises and pitfalls of compensation, including the difficulty of reducing or eliminating compensation payments once a species has recovered.

Conserving snow leopards in Asia through community-based incentive programs.
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Livestock depredation by snow leopards *Uncia uncia* causes substantial financial loss to indigenous herders and resultant retaliatory persecution is a primary threat to this endangered carnivore throughout its range in South and Central Asia. Livestock, which outnumbers wild ungulate prey in much of the region, make up as much as 50% of the snow leopard's diet. The Snow Leopard Trust has employed several community-based conservation programs across the region, using economic incentives to reduce retribution killing of the cats. In northern India we initiated a community-based conflict resolution program that involves establishment of small livestock-free wildlife reserves on village land to promote wild ungulate populations, and a livestock insurance program that promotes better herding practices and off-sets economic losses due to depredation. The insurance program off-sets up to 100 % of the losses, while prohibiting meat/carcass collection and persecution of wildlife. Starting with a single site in Spiti in 2002, as a village-run insurance model, the program is currently benefiting over 116 herder families in five villages (66 % participation). The program has recently been expanded to Ladakh where four villages are participating. This model has not resulted in increased livestock herd size, which would be counter-productive. It has, however, significantly improved peoples' tolerance towards wild carnivores and has diminished the persecution of wildlife. We compare these results with those of community-based incentive models from two distinctly different parts of the region; Mongolia and Pakistan. In these countries the Snow Leopard Trust uses small handicraft development and livestock vaccination/husbandry programs to reduce retribution killing of snow leopards and alter human attitudes. We demonstrate that it is essential for each program to be grounded in science while having a strong understanding of local conditions, human desires and existing community capabilities in order to design and implement successful incentive-based predator conservation programs.

Large carnivore depredation and compensation schemes in Sweden and Norway – different schemes and different effects.
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The parliaments in both Sweden and Norway have accepted maintaining viable populations of the four species of large carnivores (wolf, wolverine, brown bear and Eurasian lynx). Both countries have stated that predator-killed livestock (primarily sheep and semi-domesticated reindeer) should be fully compensated. However, Norway and Sweden represents the two ends of a spectrum in relation to sheep depredation. In Norway 2 million sheep graze on open ranges in mountain and forested habitats. Whereas, in Sweden 450 000 sheep are almost all kept within fenced pastures on farmsteads. This results in tremendous differences in depredation rates on sheep by large carnivores and consequently large differences in compensation costs, both total costs and cost per predator. The compensation costs for losses of semi-domesticate reindeer to large carnivores are about the same in both countries. However, the compensation schemes differ. In Norway the compensation is based on the number of reindeer killed by large carnivores, whereas in Sweden it is based on the number of carnivores within the area. This Swedish compensation system gives an incentive for better protection of the reindeer. If the losses decrease due to better protection, but the number of large carnivores remains the same, the compensation remains the same. However, both Eurasian lynx and wolverine depend on reindeer for their survival. To conclude, sheep and carnivores can only co-exist if effective mitigation measures are used and are required for payment of compensation. The reindeer and large carnivore conflict can probably be solved if there are defined population goals for the large carnivores and defined acceptable losses of reindeer to large carnivores.

Incentive strategies for carnivore conservation in the western United States.
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Restoration of large, wide-ranging carnivores is often controversial and wrought with emotion due to occasional human-carnivore conflicts. Conservation measures in the United States to assist grizzly bear (*Ursus arctos*) and gray wolf (*Canis lupus*) populations have been no exception. To facilitate good will towards predators and thus aide in their recovery, Defenders of Wildlife established two programs that incorporate market-based incentives for carnivore restoration. The Bailey Wildlife Foundation Wolf and Grizzly Compensation Trusts were established in 1987 and 1997, respectively, to reimburse ranchers for livestock lost to predation by these species. The goals of these programs are to spread the cost and responsibility for maintaining healthy carnivore populations, rather than have the burden fall on individual ranchers, and to establish an economic mechanism to correct for a market failure associated with providing a public good. To date, the programs have paid out more than $600,000 and have helped facilitate the growth of wolf and grizzly populations. This talk will compare and contrast management of compensation programs for two different carnivore species in the northern Rockies, and examine the logistical and administrative challenges of these programs under changing federal and state regulatory protections. Regardless of the obstacles, we believe these programs have gone a long way toward building tolerance for predators throughout the United States.

Wildlife damage compensation models: an overview of strengths, weaknesses, and effectiveness.
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Livestock and crop depredations by endangered/threatened wildlife are a common problem worldwide. Conservation status of these species leaves the people living amongst them few options for protecting their livelihoods and preventing future incidents. Compensation programs are a controversial option that has been widely used to mitigate the effects of economic losses and provide positive incentive for coexisting with wildlife. This study provides baseline understanding of how compensation is applied by examining the basic forms of wildlife damage compensation programs in use today, including government, non-government, and privately managed schemes. Different schemes are described, qualitatively analyzed, and evaluated for their viability and effectiveness. Features of these schemes include insurance, full/partial reimbursement, improved animal husbandry practice requirements, monetary/livestock reimbursement, and compensation for capture of problem animals. Three case studies are examined: a program that failed (Israel), one that has persisted but has many problems (India), and a program that is an overall success (Pakistan). Results showed that social factors contribute most to a successful wildlife compensation program, including involvement of the affected community in the decision-making process throughout the duration of the program; a thorough understanding by all participants of the problem, responsibilities, and expectations involved with a compensation program; and a transparent method of assessing and fulfilling claims on losses.

Wildlife damage compensation: Economic incentives can bite too
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In an effort to attenuate human-wildlife conflict and promote conservation of charismatic megafauna, compensation programs for wildlife damages have been implemented in many countries. Compensating pastoralists and farmers for damage caused by wildlife reduces hunting pressure on wild animal populations. However, it can also lead to a decrease in efforts to prevent damage and exacerbate conflicts with wildlife. Furthermore, compensation programs increase the return to agriculture and can therefore be viewed as a subsidy toward crop and livestock production. Such subsidies can trigger agricultural expansion (and habitat conversion), an inflow of agriculture producers and intensification of agricultural production. Each of these impacts is shown to have potentially adverse effects on the wildlife population that compensation intends to favor. In some circumstances, the net effect on the wildlife stock could be negative. This calls for a careful assessment of local ecological and economic conditions before compensation is implemented. Incentive mechanisms that are directly tied to conservation outcomes (e.g.

payments to locals based on the size of the wildlife population) should be considered instead of compensation programs.

The Wolf Trust. 2004. Wolf management: non-lethal control 6. compensation. Available from: http://www.wolftrust.org.uk/a-mgm-non-lethal6-compensation.html **(accessed 20-06-07).** -- Overview of the definitions, rationale, general structure, and advantages and disadvantages for wolf compensation programs.

Wang, S.W., and D.W. Macdonald. 2006. Livestock depredation by carnivores in Jigme Singye Wangchuck National Park, Bhutan. *Biological Conservation* 129: 558–565. -- Based on household surveys, reports the number and financial value of domestic animals lost to at least 4 species of wild predators. Annual mean livestock loss per household equated to more than two-thirds of annual cash income (US$250). Lax herding, inadequate guarding practices, and overgrazing may have contributed to the high loss rate. Financial compensation is proposed as one means to reduce short-term conflict, with an insurance scheme recommended over the long term.

Wang, S.W., P.D. Curtis, and J.P. Lassoie. 2006. Farmer perceptions of crop damage by wildlife in Jigme Singye Wanchuck National Park, Bhutan. *Wildlife Society Bulletin* 34: 359–365. -- Farmers blamed park's conservation policies for high level of reported (and apparently real) losses that occurred after park establishment and implementation of new environmental statutes. Because hunting and other lethal control of wild species was limited as a management option due to cultural reasons, i.e., Buddhist philosophy, farmers tended to rely upon non-lethal methods for crop protection.

Woodroffe, R., P. Lindsey, S. Romañach, A. Stein, and S.M.K. ole Ranah. 2005. Livestock predation by endangered African wild dogs. *Biological Conservation* 124: 225–234. -- Farmer reports of wild dog take of Kenyan livestock gave a "fairly reliable index of the true depredation rate." Despite livestock being quite abundant in study area, depredation was rather uncommon, with costs amounting to only US$3.40/wild dog/year if wild prey were abundant. However, where wild prey had been depleted, damage costs rose to US$389/wild dog/year, with some farmers experiencing disproportionately high losses.

Yoder, J.K. 2000. Damage abatement and compensation programs as incentives for wildlife management on private lands. (L. Clark, Ed.). Pp. 17-28 *in* Human conflicts with wildlife: economic considerations. Available from: http://www.aphis.usda.gov/ws/nwrc/symposia/economics/ **(accessed 19-06-07).** -- Models the logic behind common characteristics of public wildlife damage programs. The model is supported through examining a broad cross-section of wildlife agency law and policy in the U.S.A., and offers policy makers a conceptual framework for understanding incentive effects.

Yom-Tov, Y., S. Ashkenazi, and O. Viner. 1995. Cattle predation by the golden jackal *Canis aureus* in the Golan Heights, Israel. *Biological Conservation* 73: 19-22. -- Jackals take 1.5-1.9% of calves, resulting in total damages of US$42,000 as measured during 1993. These damages were estimated to have been much higher (closer to $80,000) if no control measures had been taken.

Zhang, L., and N. Wang. 2003. An initial study on habitat conservation of Asian elephant (*Elephas maximus*), with a focus on human elephant conflict in Simao, China. *Biological Conservation* 112: 453–459. -- Investigated total economic damages of US$314,600 on the rural agricultural economies in Yunnan Province from 1996 to 2000. Wheat, rice, and corn main crops in open fields; maize and banana most affected

on hill slopes. With an annual compensation budget of only $2,420 in the Simao Forestry Bureau, and damages from a single township reaching $78,650 each year, compensation to farmers covered less than 1/10 of the elephant damages in many villages.

Ziegltrum, G. J. 2006. Cost-effectiveness of the black bear supplemental feeding program in western Washington. *Wildlife Society Bulletin* 34: 375–379. -- "Compensation" for black bear damage to tree plantations based on a supplemental feeding program. Costs ranged from US$0.75 - $5.10/ha, averaging $2.70/ha for the forest products industry in general. Because costs of feeding bears for 2.5 months each year was always lower than the costs of tree damage, this compensation program was judged to be an effective, damage control tool.

Major economic categories of wildlife damages

1. Consumption of food and cash crops
2. Damage to water supplies
3. Damage to fencing, buildings, and other structures
4. Injury or killing of livestock
5. Weight loss and other value-related reductions to body condition of livestock
6. Injury or death of people

Wildlife species causing damage; examples of entities administering compensation

African elephant (*Loxodonta africana*); various African national governments
African lion (*Panthera leo*); Mbirikani Predator Compensation Fund (NGO)
African wild dog (*Lycaon pictus*)
American black bear (*Ursus americanus*); Wisconsin DNR; state of Washington, USA;
Asian elephant (*Elephas maximus*); Chinese national government
banded langur (*Presbystis melalophos*)
barnacle goose (*Branta leucopsis*); Scotland (UK) national government
barking deer (*Muntiacus muntjak*)
black-and-white colobus (*Colobus guereza*)
black-backed jackal (*Canis mesomelas*)
brown bear (*Ursus arctos*); Defenders of Wildlife (NGO); Norwegian and Swedish national governments; private insurance companies (Austria)
brown hyena (*Hyaena brunnea*)
bushback (*Tragelaphus scriptus*)
bushpig (*Potamochoerus porcus* and *P. larvatus*)
Canada goose (*Branta canadensis*); Wisconsin DNR
chacma baboon (*Papio ursinus*)
cheetah (*Acinonyx jubatus*);
chimpanzee (*Pan troglodytes*)
crested porcupine (*Hystrix africae-australis*)
dhole (*Cuon alpinus*)
Eurasian lynx (*Lynx lynx*);
European otter (*Lutra lutra*); state of Saxony, Germany
golden jackal (*Canis aureus*)
gray wolf (*Canis lupus*); Defenders of Wildlife (NGO); Spanish regional governments;
Himalayan black bear (*Ursus thibettanus*)
jaguar (*Panthera onca*)
leopard (*Panthera pardus*); World Wildlife Fund (NGO);
long-tailed macaque (*Macaca fascicularis*)

mouse deer (*Tragulus* sp.)
olive baboon (*Papio anubis*)
palm civet (*Nandinia binotata*)
pig-tailed macaque (*Macaca nemestrina*)
porcupine (*Hystrix brachyura*)
puma (*Puma concolor*); U.S. states (Wyoming, Colorado), Canadian province (Alberta)
red duiker (*Cephalophus* spp.)
redtail monkey (*Cercopithecus ascanius*)
rhesus monkey (*Macaca mulatta*)
sambar (*Cervus unicolor*)
snow leopard (*Uncia uncial*); Project Snow Leopard (NGO)
spotted hyena (*Crocuta crocuta*)
striped hyena (*Hyaena hyaena*)
sunbear (*Helarctos malayanus*)
tiger (*Panthera tigris*)
vervet monkey (*Cercopithecus aethiops*)
white-tailed deer (*Odocoileus virginianus*); Wisconsin DNR
wild boar (*Sus scrofa*)
wolverine (*Gulo gulo*); Norwegian and Swedish national governments
yellow baboon (*Papio cynocephalus*)

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