

Wildlife-Human Interactions: From Conflict to Coexistence in Sustainable Landscapes

Final report from a joint Indo-Norwegian project 2007-2011

Jørn Thomassen
John Linnell
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Jørn Thomassen
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Thomassen, J., Linnell, J. & Skogen, K. 2011. Wildlife-Human Interactions: From Conflict to Coexistence in Sustainable Landscapes. Final report from a joint Indo-Norwegian project 2007-2011. - NINA Report 736. 83 pp.

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Indian and Norwegian conflict species, photos: Ashok Captain, Kartik Shanker, Nature Conservation Foundation, John Linnell, Jørn Thomassen, Espen Lie Dahl, Raman Sukumar

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Abstract

Thomassen, J., Linnell, J. & Skogen, K. 2011. Wildlife-Human Interactions: From Conflict to Coexistence in Sustainable Landscapes. Final report from a joint Indo-Norwegian project 2007-2011. - NINA Report 736. 83 pp.

The last three decades of the 20th century were witness to a dramatic turn around in policy towards the environment and conservation of biodiversity and many international conventions were ratified by most of the world countries. Recent paradigms have attempted to make connections between biodiversity conservation and human well-being. However, not all biodiversity is associated with human well-being and many species can create direct and severe conflicts with human interests. As a consequence, wildlife-human conflicts are currently recognized as a serious impediment to the implementation of conservation plans for species recovery and the establishment or management of protected areas in many developing countries such as India and even in parts of Norway.

This background was important in 2007 when the Norwegian Institute for Nature Research (NINA) and the Centre for Ecological Science (CES) of the Indian Institute of Science (IISc), together with the Royal Norwegian Embassy (New Delhi) initiated a collaborative research project on Human – Wildlife conflicts. Several other institutions in India and Norway were sub-contracted as collaborators.

The overall goal of the project has been to understand the dynamics of wildlife human interactions in India and Norway (in a sample of multiple landscapes) and develop mechanisms of coexistence suitable to the countries. From the outset it was recognized as being important to include both natural science and social science perspectives into the project. The main focus in the project was put on a few species such as elephant, blackbuck and other herbivores, leopard, wolf, turtles – all species that regularly come into conflict with humans, but which reflect the diversity of forms these conflicts can take. A large part of India was covered in the various studies on these species and in the social science research component of the project. The various project activities included:

All India survey of Human Wildlife Conflicts: questionnaire survey delivered to all Forestry Department Divisions in India (chapter 3.2.1).

Elephants in Orissa: state wide mapping of spatial distribution of elephants in conflicts (chapter 3.2.2).

Elephants in west Bengal: identification of conflict around migration corridors between fragmented forest patches (chapter 3.2.3).

Nilgiri hills: a broad study of human-wildlife conflicts in one of the largest and most intact forested areas in India (chapter 3.2.4).

Leopards in Akole: a study of leopards living in croplands and their interactions with local people (chapter 3.2.5).

Wolves, dogs and rabies in Nannaj: a survey of the extent of rabies infection in wild canids and level of transmission to humans (chapter 3.2.6).

Blackbuck in Nannaj: a study of the patterns of crop damage around the Great Indian Bustard Wildlife Sanctuary (chapter 3.2.7).

Crop-raiding around Tadoba-Andhari tiger reserve: an exploration of how different herbivores raid crops with increasing distance from the protected area border (chapter 3.2.8).

Sea turtles on the Lakshadweep Islands and Orissa coast: a study of conflicts between local fishers and turtles concerning resource access (chapter 3.2.9 and 3.2.10).

Human Wildlife conflicts across different landscapes: a framework for examining social, political and economic issues and a preliminary comparison between sites (chapter 3.2.11)

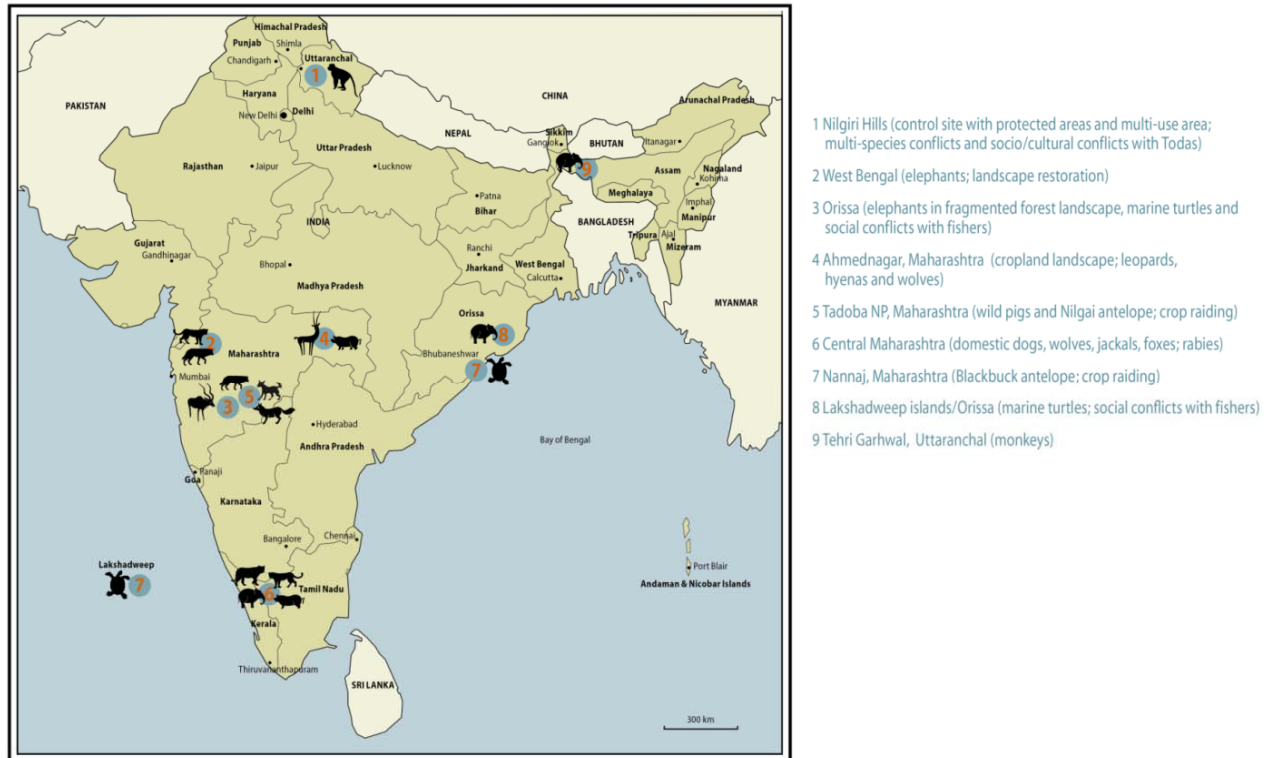
Monkeys in Terhi Garhwal: study of crop raiding by monkeys (chapter 3.2.12).

Todas and sacred buffalos: a study of conflicts associated with tiger predation on sacred buffalos and transformation of culturally valued grassland habitats to forest (chapter 3.2.13).

Human - large carnivore interactions in Akole, north-western Maharashtra: how people and wildlife, specifically large carnivores, coexist in a human-dominated rural landscape in western India, which is outside the protected area network (chapter 3.2.14)

Human-Wildlife Conflict in the Biligiri Rangaswamy Temple Wildlife Sanctuary: understanding and mitigating conflicts in the Context of the Forest Rights Act (chapter 3.2.15)

International biodiversity conventions: Interpreting project results in the context of implementing international biodiversity conventions (chapter 15).



This report does not intend to go into depths in the individual projects' technical results, rather it is intended as a summary of the project's overall activities and an evaluation of the main outcomes. Technical reports from each of the activities have been produced, see annex 1 for an overview.

This project's cooperation has provided many mutual insights. The Indian partners were able to benefit from the Norwegians' experience at conducting interdisciplinary conflict research in human-dominated landscapes, while the Norwegians were able to gain critical insights into the unique levels of tolerance often displayed by the rural Indians. Moreover, while the Norwegian researchers contributed some degree of technical knowledge in all fields, especially social science methods, GPS-telemetry and genetic analysis of non-invasively collected biological samples (scats), the Indian partners with whom they interacted were able to reciprocate with their own experiences and skills such that both partners learnt a great deal from each other. As well as the technical cooperation, exposure to the radically different wildlife management systems and philosophies in the two countries has provided a much needed perspective on their own domestic situations

The project has produced articles in peer review scientific journals (and more will come), written several research reports, produced conflict management guidelines that have been adopted by Indian authorities, written numerous popular articles in newspapers and journals, given several interviews on radio and TV, given public and scientific presentations and even produced and performed a theatre production on leopard – human conflicts! The media has covered a lot of the issues that we have been studying and many journalists have interviewed project scientists or based their reports on project results. Several of the project's scientists

have been very active in writing their own popular science articles and initiating the production of a wide range of communication packages ranging from TV documentaries to training courses and handbooks to popular books and, as mentioned, theatre productions – in all cases trying to use the most appropriate media to reach the desired stakeholder group. Top-up funding for communication activity was obtained from the Research Council of Norway and its activities will peak during the coming months. The various dissemination activities are summarized in chapter 9.

Much engagement has occurred through the informal contacts that emerge when conducting ecological research in rural areas or interviewing people during social science studies. All these interactions involved a two-way transfer of knowledge and experience. In addition, to these informal engagements, most projects have had extensive contact with the forestry department and local village councils. Chapter 12 lists the wide range of stakeholder engagement which has occurred in most of the activities.

Important outcomes from the project are numerous recommendations and policy implications, and the future challenge for stakeholders and decision makers will be to assess and implement actions to achieve a better coexistence between humans and wildlife. Policy implications and recommendations are listed in chapter 13 and 14, respectively.

The goal of this project has been to exchange experience and jointly conduct research on human-wildlife conflicts to such a level that we have equivalent data on ecological, economic, social and political aspects of the conflicts from both India and Norway. Interdisciplinary research that collects scientific and local knowledge is crucial to turn conservation conflicts into opportunities for coexistence which again strikes to the core of the Convention of Biological Diversity (CBD) and its guiding principles (the Malawi- and the Addis Ababa principles). Overall, we believe that the project has been very successful at conducting cooperative research and improving the knowledge base which is necessary to reach these goals. However, we should not underestimate the magnitude of the task required to reach these goals in practice.

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Sammendrag

Thomassen, J., Linnell, J. & Skogen, K. 2011. Menneske-dyr interaksjoner: Fra konflikt til sameksistens. Sluttrapport fra et felles indisk-norsk samarbeidsprosjekt 2007-2011. - NINA Rapport 736. 83 s.

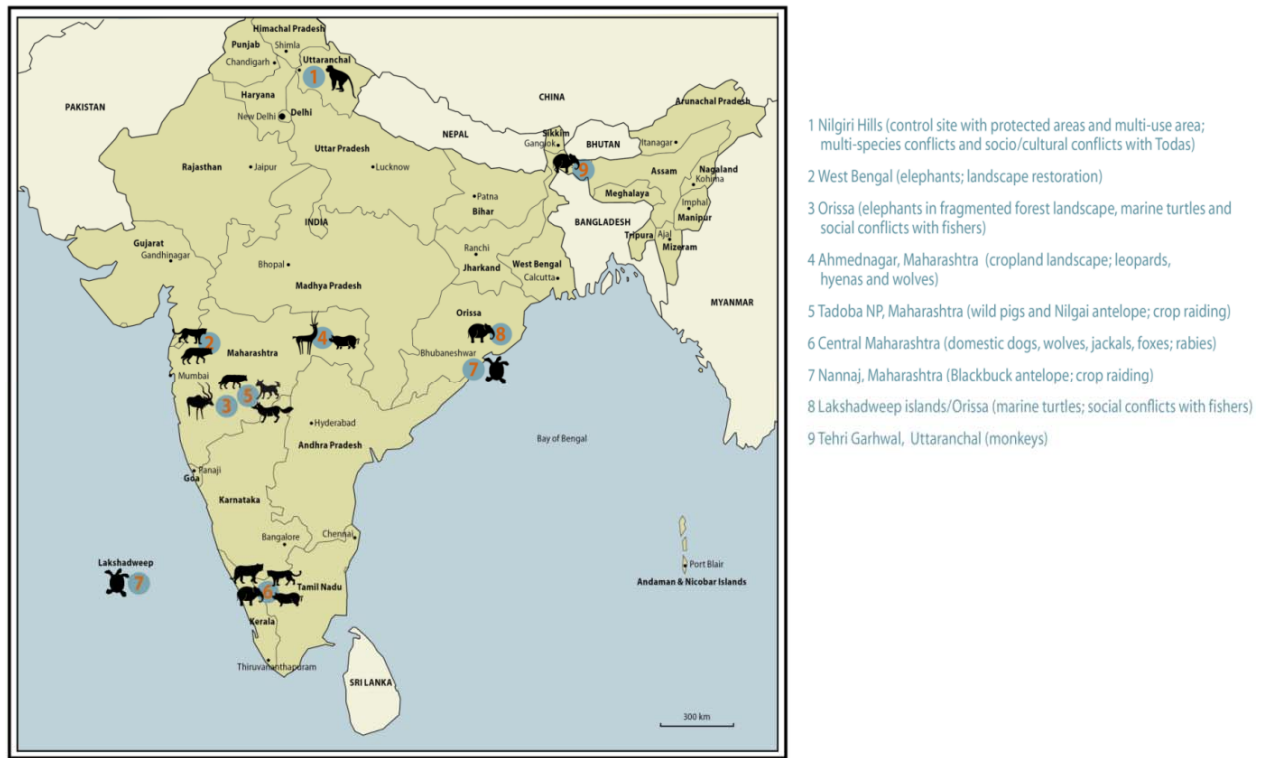
På slutten av forrige århundre ble mye fokus rettet mot miljø og bevaring av biologisk mangfold, og mange internasjonale konvensjoner ble ratifisert av de fleste land i verden. Det ble dessuten gjort forsøk på å koble biodiversitet med folks levkår og velvære. Bevaring av en del arter fører i midlertid til konflikter med mennesker. Dette kan igjen være en trussel mot bevaringen av de samme artene og mot forvaltningen av verneområder i mange u-land og for så vidt også i deler av Norge.

Dette var bakgrunnen for at den norske ambassaden i India (Delhi) i 2007 initierte et samarbeidsprosjekt på menneske-dyr-konflikter mellom Norsk institutt for naturforskning (NINA) og Centre for Ecological Science (CES), Indian Institute of Science (IISc). Flere andre institusjoner i India og Norge har også deltatt i prosjektet.

Hovedmålet i prosjektet har vært å forstå dynamikken mellom mennesker og dyr i India og Norge og utvikle mekanismer for en bedre sameksistens i landene. Både naturvitenskapelig og samfunnsvitenskapelig forskning har vært nødvendig i prosjektet. Hovedfokus ble lagt til noen få arter som elefant, blackbuck og andre gressetere, samt leopard, ulv og havskilpadder – alle arter som stadig kommer i konflikt med menneskets interesser, men som også reflekterer variasjonen i konfliktene. Prosjektområdene dekket en stor del av India og inkluderte:

- **Kartlegging av menneske-dyr-konflikter over hele India:** Spørreundersøkelse sendt til alle lokalavdelinger i Skogdepartementet i India (kap. 3.2.1).
- **Elefanter i Orissa:** Kartlegging av konfliktelefanter i staten Orissa (kap. 3.2.2).
- **Elefanter i Vest-Bengal:** Identifisering av elefantkonflikter i forbindelse med trekkveier mellom fragmenterte skogområder (kap. 3.2.3).
- **Nilgiri-fjellene:** En bred studie av menneske-dyr-konflikter i et av de største uberørte skogområdene i India (kap. 3.2.4).
- **Leoparder i Akole:** En studie av leoparder og sameksistensen med mennesker i kulturlandskap (kap. 3.2.5).
- **Ulver, hunder og rabies i Nannaj:** Kartlegging av omfanget av rabiesinfeksjoner hos ville hundedyr og graden av overføring til mennesker (kap. 3.2.6).
- **Blackbuck i Nannaj:** En studie av beiteskademønsteret omkring Great Indian Bustard Wildlife-reservatet (kap. 3.2.7).
- **Ødelagte avlinger rundt Tadoba-Andhari tigerreservat:** En undersøkelse av hvordan ulike gressetere ødelegger avlinger ved økende avstand fra grensene til reservatet (kap. 3.2.8).
- **Havskilpadder på Lakshadweep-øyene og lengst Orissa-kysten:** En studie av konflikter omkring ressurstilgang mellom lokale fiskere og havskilpadder (kap. 3.2.9 og 3.2.10).
- **Menneske-dyr-konflikter i flere landskapstyper:** Et rammeverk for å undersøke politiske og økonomiske forhold, og en foreløpig sammenlikning mellom områder (kap. 3.2.11).
- **Apekatter i Terhi Garhwal:** En studie av apekatters plyndring av avlinger (kap. 3.2.12).
- **Toda og hellige bøfler:** En studie av konflikter som følge av tiger-predasjon på hellige bøfler, og omgjøring av kulturelt verdsett beiteområder til skog (kap. 3.2.13).
- **Interaksjoner mellom mennesker og store rovdyr i Akole, nordvest i Maharashtra:** Hvordan sameksistensen mellom mennesker og vilt, spesielt store rovdyr, er i et menneskedominert jordbrukslandskap utenfor mange verneområder (kap. 3.2.14).

- **Menneske-dyr-konflikter i Biligiri Rangaswamy Temple Wildlife-reservatet:** Forstå og avbøte konflikter i sammenheng med Forest Rights Act (kap. 3.2.15).
- **Internasjonale biodiversitetskonvensjoner:** Tolke prosjektresultatene i lys av internasjonale biodiversitetskonvensjoner (kap. 15).



Denne rapporten har ikke som mål å gå faglig i dybden på de enkelte prosjektene, men derimot gi en oversikt over prosjektet og en vurdering av resultatene. Det er utarbeidet egne rapporter fra hvert delprosjekt, se vedlegg 1 for en oversikt.

Indiske og norske samarbeidspartnere har dratt god nytte av hverandres erfaring. Indiske partnere har hatt nytte av norsk tverrfaglig forskningserfaring i konfliktfylte menneske-dominerte landskaper, mens norske partnere har fått verdifullt innblikk i et unikt toleransenivå som finnes på den indiske landsbygda. Videre har norske forskere bidratt med viktig kunnskap innenfor samfunnsforskningsmetoder, GPS-telemetri og genetiske analyser av biologisk materiale samlet i felt (ekskrementer), mens samarbeidende indiske forskere har overført sin erfaring og kunnskap til felles gjensidig læring. Samarbeidet og innsynet i landenes totalt forskjellige forvaltningssystemer og -filosofier har bidratt til nye perspektiver i landene.

Prosjektet har publisert artikler i vitenskapelige fagfelleverderte tidsskrifter (og flere vil komme), skrevet mange forskningsrapporter, bidratt til forvaltningsveiledere omkring konflikter, skrevet en rekke populærvitenskapelige artikler i magasiner og aviser, blitt intervjuet i radio og TV, presentert prosjektresultatene til andre forskere og til publikum for øvrig, og til og med satt opp en egen teaterforestilling med tema menneske-leopardkonflikter (se kap. 9 for en liste over formidlinger). Forskningsformidlingen har vært målrettet for å nå rette publikum. Toppfinansiering spesielt rettet mot formidling har vært bevilget av Norges Forskningsrådet.

Det er også viktig å trekke fram verdien av all uformell kontakt som har skjedd, både ved det samfunnsvitenskapelige forskningsarbeidet og det økologiske. All denne kontakten har medført viktig toveis utveksling av kunnskap og erfaring. I tillegg til uformelle kontakter har prosjektet hatt utstrakt kontakt mot Skogdepartementet i India og med lokale landsbyråd. I kapittel 12 er

det satt opp en oversikt over det breie kontaktnettet som har vært en del av de fleste aktivitetene i prosjektet.

Prosjektet har også kommet opp med viktige anbefalinger, mulige implikasjoner for politikere og andre beslutningstakere og hvilke utfordringer som må vurderes og implementeres for å få til en bedre sameksistens mellom mennesker og dyr (se kap. 13 og 14).

Et viktig mål i prosjektet har vært å utveksle erfaring og gjennomføre forskning omkring menneske-dyr-konflikter slik at vi kan få gode data på økologiske, økonomiske, sosiale og politiske forhold både fra India og Norge. Tverrfaglig forskning, som samler både vitenskapelig og lokal kunnskap, er viktig for å kunne snu forvaltningskonflikter til muligheter for en bedre sameksistens. Dette er også en del av kjerneprioritetene i biomangfoldkonvensjonen og de styrende prinsippene som er utarbeidet (Malawi- og Addis Abeba-prinsippene).

Samlet sett mener vi dette prosjektet har vært vellykket. Vi har gjennomført et samarbeidende forskningsprosjekt mellom India og Norge, og i vesentlig grad økt kunnskapsbasen som er nødvendig for å nå målene nevnt over. Vi skal likevel ikke underverdige de store oppgavene og utfordringene som fortsatt finnes.

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Abbreviations

AERCC	Asian Elephant Research and Conservation Centre
ANCF	Asian Nature Conservation Foundation
ATREE	Ashoka Trust for Research in Ecology and the Environment
CBD	Convention on Biological Diversity
CCET	Centre for Conservation Education and Technology
CCF	Chief Conservator of Forests
CDM	Clean Development Mechanisms
CES	Centre for Ecological Sciences
CESD	Centre for Environment and Sustainable Development
CF Con	Conservator of Forests
CTBC	Centre for Tropical Biodiversity Conservation
DFO	Divisional Forest Officer
EPT	Elephant Proof Trench
EU Europ	European Union
FD Fore	Forest Department
FPC	Forest Protection Committee
FRA	Forest Rights Act
GPS	Global Positioning System
HiHM	Hedmark University College
HP FD	Himachal Pradesh Forest Department
HWC	Human Wildlife Conflict
IFS	Indian Forest Service
IGNFA	Indira Gandhi National Forest Academy
IPBES Intergovernm	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IISc	Indian Institute of Science
IISER	Indian Institute of Science Education and Research
MPA	Marine Protected Area
NCF	Nature Conservation Foundation
NGO	Non Governmental Organisation
NINA	Norwegian Institute for Nature Research
NOK Norwe	Norwegian krone (NOK)
NREG	National Rural Employment Guarantee Scheme
NRK	Norwegian Broadcasting Corporation
NTCA	National Tiger Conservation Authority
NTCA	National Tiger Conservation Authority
OMRCC	Orissa Marine Resources Conservation Consortium
OMRCC	Orissa Marine Resources Conservation Consortium
OTFWU	Orissa Traditional Fishworkers Union
PA Protec	Protected Area
PCCF	Principal Chief Conservator of Forests
STR	'Some' Tiger Reserve
TATR	Tadoba Andhari Tiger Resrve
TEEB	The Economics of Ecosystems and Biodiversity
UMB	Norwegian University of Life Sciences
VSS	Vana Samrakshana Samiti
WL Wild	Wildlife

English and scientific names of species in the report

English name	Scientific name
Asiatic lion	<i>Panthera leo persica</i>
Black bear (asian)	<i>Ursus thibetanus</i>
Blackbuck antelope	<i>Antilope cervicapra</i>
Brown bear	<i>Ursus arctos</i>
Elephant (asian)	<i>Elephas maximus</i>
Eurasian lynx	<i>Lynx lynx</i>
Gaur	<i>Bos gaurus</i>
Green turtle	<i>Chelonia mydas</i>
Langur	Genus <i>Semnopithecus</i>
Leopard	<i>Panthera pardus</i>
Lion	<i>Panthera leo persica</i>
Moose	<i>Alces alces</i>
Nilgai antelope	<i>Boselaphus tragocamelus</i>
Olive Ridley turtle	<i>Lepidochelys olivacea</i>
Otter	<i>Lutra lutra</i>
Rhesus Macaque	<i>Macaca mulatta</i>
Rhino	<i>Rhinoceros unicornis</i>
Sloth bear	<i>Melursus ursinus</i>
Tiger	<i>Panthera tigris</i>
Wild boar	<i>Sus scrofa</i>
Wolf	<i>Canis lupus</i>
Wolverine	<i>Gulo gulo</i>

Foreword

The Royal Norwegian Embassy (New Delhi), together with the Norwegian Institute for Nature Research (NINA) and the Centre for Ecological Science (CES) of the Indian Institute of Science (IISc) initiated in 2007 a collaborative research project on Human – Wildlife conflicts.

The background for this initiative was the increasing focus on the environment and biodiversity over the last three decades, resulting in a number of international treaties and agreements. The Convention of Biological Diversity (CBD) stands out as the first global agreement on conservation and sustainable use of biological diversity. Wildlife conservation will, however, in many instances generate conflicts with humans, which also is the instance in India as well as in Norway.

The overall goal of the project has been to understand the dynamics of wildlife human interactions in India and Norway (in a sample of multiple landscapes) and develop mechanisms of coexistence suitable to the countries. From the outset it was recognized as being important to include both natural science and social science perspectives into the project.

This report is a summary of the various project activities conducted in the project period 2007-2011, as also reported to the main funding agency, the Royal Norwegian Embassy in Delhi. This report does not intend to go into depths in the individual projects' technical results, rather it is intended as a summary of the project's overall activities and an evaluation of the main outcomes. An overview of the Technical reports from each activity are provided in annex 1.

This report summarizes the main outputs from the various activities and list up the project dissemination spanning from scientific publications, popular science, technical reports and media coverage. Stakeholder meetings, policy implications and recommendations are also listed in the report. This has been a complex and diverse project with numerous stakeholder meetings, important to understand the core of human-wildlife conflicts. All sort of knowledge must be taken into consideration when assessing outcomes on policy implications and giving recommendations for a better coexistence in the future.

We hope the project results will be important input in the future efforts to help solving conflicts, find strategies for further solutions and help decision makers to understand what sort of knowledge is needed.

Trondheim/Oslo, July 2011

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Ketil Skogen

1 Introduction

The last three decades of the 20th century were witness to a dramatic turn around in policy towards the environment and biodiversity. A wide range of national and international legislation has been passed which has committed most countries to conserving the environment and its associated biodiversity. This rapid process culminated in the Convention on Biological Diversity (CBD) (Rio Convention) in 1992 – which has underlined the principle commitment of >190 countries to the cause of biodiversity conservation. The CBD outlines concrete approaches on how to achieve conservation, primarily through its “*Ecosystem Approach*” and its guiding “*Malawi principles*”. These principles were further developed in the “*Millennium Ecosystem Assessment*” and the recent “*Addis Ababa principles and guidelines for the sustainable use of biodiversity*”. Despite a focus on linking biodiversity conservation to human well being, many countries are struggling to implement these conventions. While the reasons for this are diverse, at least one aspect that is often ignored is the fact that not all biodiversity is associated with human well being. In fact, many species can create direct and severe conflicts with human interests.

As a result wildlife-human conflicts are today recognized as a serious impediment to the implementation of conservation plans for species recovery and establishment or management of protected areas in many developing countries such as India or even parts of the developed world such as Norway. Conflict occurs in a variety of contexts, when wildlife species raid agricultural crops, damage property, kill people or livestock or spread diseases. Such wildlife species include mammals such as elephant, wild pig, porcupine, deer, antelope, tiger, leopard, lion, wolf and monkeys, many birds and reptiles. For the purposes of this project we confine ourselves to the larger mammalian species.

The elephant is perhaps the most potent agent of crop damage among wildlife species in India. Damage runs into millions of dollars each year, though compensation paid by the state to farmers is only a fraction of the losses. In addition, an average of 200 people is killed each year by elephants, with the majority of incidents occurring in the context of crop raiding when elephants enter agricultural fields and settlements at night. Wild pigs are another common agent of crop losses, and though the damage inflicted may not be as spectacular, it is nevertheless a much more widespread phenomenon. In recent years, two antelopes that were once considered endangered, the nilgai and the blackbuck, have increased enormously in numbers thanks to effective protection, and have become serious pests of agriculture in many parts of the country, including Rajasthan, Madhya Pradesh and Andhra Pradesh.



About 75 people are presently killed by tigers each year in India. Photo: Espen Lie Dahl.

Conflict between the larger carnivores and people is even more contentious. Much has been written about man-eating by tigers. Presently about 75 people are killed each year by tigers in

India, a figure that is much lower than the 1000+ people killed each year a century ago. Nevertheless, even this level of human predation is not acceptable in a modern society and solutions have to be found to reduce this further. Predation on humans, usually children, by leopard seems to have risen, on the other hand. The problem is most acute in states such as Uttaranchal, Himachal and Maharashtra. Although precise statistics are hard to come by, it is clear that the problem of human killing by leopards is more widespread and much more frequent than by tigers in the country. Predation of children by wolf has been sporadic but can strike terror locally for months or years; in recent years this problem has surfaced in Uttar Pradesh and Karnataka. Finally, the Asiatic lion that is confined to the Gir National Park in Gujarat has been in conflict with the *maldharis* or buffalo keepers. The present emphasis on conflict mitigation and reduction includes payment of compensation for livestock death or crop damage, capture and relocation of offending animals, and the use of barriers such as electric fences and ditches. These measures have had only limited success in conflict reduction. The recommendations to India's Planning Commission of the working group on wildlife conservation of the Ministry of Environment and Forests, explicitly recognizes the resolution of wildlife-human conflicts as a thrust area for the 11th Plan Period (2007-12).

In Norway, the most important conflict is between recovering populations of large carnivores (brown bears, Eurasian lynx, wolverines and wolves) and livestock (mainly sheep and semi-domestic reindeer). The conflict is far larger than any similar conflict (about 50% of the depredation on livestock in Europe occurs in Norway which has <5% of the carnivores) because the form of husbandry was developed in years when these species were absent.



The wolf is one of four large carnivores causing conflict with livestock in Norway. Photo: John Linnell.

Some conflicts also occur between wild herbivores and forestry, between otters and fish-farming, and between seals and fisheries. Conflicts involving geese (agriculture) and cormorants (fish farming and angling) are emerging. Furthermore, the process of conserving conflict species can unleash a range of social conflicts between different sections of society that have different values towards wildlife, and the wildlife conflicts can come to represent potent symbols for a wide range of other underlying conflicts. The present emphasis on conflict reduction

focuses heavily on lethal control of carnivores and payment of large amounts of compensation, neither of which is desirable as a long term “solution”.



The moose creates conflicts with forestry and is involved in collisions with vehicles. Photo: Erling Solberg.

Wildlife-human conflict is one aspect, perhaps one of the most important, in the overall conflict between “people and parks” or between human interests and conservation in general. Historically, there was a certain level of coexistence between local communities and wildlife, but this was possible in a different socio-economic milieu than what we are experiencing today. The rapid economic growth in countries such as India, accompanied by changes in value systems, means that attitudes to wildlife are also changing quickly in the direction of antagonism – not only between people and wildlife, but also between “traditional” and “modern” views of nature. Also in Norway these conflicts are polarizing the existing separation between urban and rural communities and hindering the attainment of conservation goals. It is thus imperative that practical solutions are found to minimise or eliminate such conflicts if conservation is to succeed in the long term.

In Norway, considerable effort has been expended in studying these conflicts from both the point of view of ecology and from social science. We are therefore in a situation where knowledge about the nature and form of conflict is not the limiting factor in seeking coexistence. Rather, we lack knowledge about how to finance and achieve the necessary changes to agriculture within the existing political landscape, and about how best to reduce the social conflicts, potentially through various forms of delegated management or power sharing. At a more philosophical level there is also a lack of a vision for how conflicts (both material and social) and conflict causing species should be integrated into the present day physical and political landscapes.

In India, there is relatively good ecological knowledge about conflicts associated with large carnivores and elephants associated with protected areas. There is relatively less knowledge about these conflicts in multi-use landscapes outside protected areas (e.g. man-eating leopards) and on the conflicts associated with wild pigs and antelopes. Furthermore, relatively little social science research has been focused on this topic. India can potentially gain much from Norway’s experience at working with social science and local peoples in the investigation of conflict issues. However, India seems to have a far greater cultural acceptance of conflict and the presence of conflict-causing species in the landscape.

2 Objectives and Scope of the Cooperation Project

2.1 Objectives

A main objective of this project has been to bring the level of human-wildlife conflict research in India to such a level that we have equivalent data on ecological, economic, social and political aspects from both India and Norway.

The broad goal of the project has been to understand the wild life human interactions in India and Norway (in a sample of multiuse landscapes) and develop mechanisms of coexistence suitable to the countries. To achieve the broad goal the project identified several subgoals:

- a) Map the spatial and temporal distribution of material conflicts between people and wildlife.
- b) Conduct targeted ecological research where necessary to better understand the mechanisms of conflict for selected species.
- c) Evaluate the utility of a range of mitigation measures (both those that are already in use and those which could be introduced) designed to promote coexistence.
- d) Promotion of mutual experience sharing among equal partners concerning the integration of wildlife into human-dominated landscapes.
- e) Explore attitudes to human-wildlife relationships, and analyze [HWC] in the light of relevant social structures and culture patterns.
- f) Explore the challenges and opportunities of resolving wildlife-human conflicts through several means including establishing socially equitable and environmentally responsible, income-generating activity for villagers.

2.2 Cooperating institutions

2.2.1 Norwegian Partners

Norwegian Institute for Nature Research (NINA) is Norway's leading institution for applied ecological research. NINA is responsible for long-term strategic research and commissioned applied research to facilitate the implementation of international conventions, decision-support systems and management tools, as well as to enhance public awareness and promote conflict resolution. NINA is organized as non-profit foundation and is placed among the Norwegian Environmental Institutes which receive some basic state-funding but mainly operate on competitive contracts.

Norwegian University of Life Sciences (UMB) comprises 8 departments. High professional quality, a high degree of teacher-student interaction and a pleasant social and physical environment characterize education at UMB. UMB collaborates with independent institutions established at Aas, as well as through national and international alliances with other institutions.

Hedmark University College (HiHM) is located in the south-eastern part of Norway. With more than 5000 students it is one of the largest university colleges in Norway. The college provides high standards and modern research-based teaching. HiHM's Campus Evenstad became involved in the project as a consequence of one of the key co-operators from UMB moving to HiHM towards the end of the project's life.

2.2.2 Indian Partners

Centre for Ecological Sciences (CES) at the Indian Institute of Science offers exciting opportunities for research in a variety of areas in ecology. These include animal behaviour, evolutionary biology and socio-biology, community and habitat ecology, molecular genetics and conservation biology, large mammal and forest ecology, and climate change. Research is being carried out on a number of taxa, ranging from ants to elephants, and including wasps, crickets, spiders, herpetofauna, birds and mammals. The projects range from theoretical to laboratory to field-based research with the different approaches being used in a complementary manner.

Ashoka Trust for Research in Ecology and the Environment (ATREE) is a not for profit organization with a mission to promote socially just environmental conservation and sustainable development by generating rigorous interdisciplinary knowledge that engages actively with academia, policy makers, practitioners, activists, students and wider public audiences. ATREE envisions a society committed to environmental conservation and sustainable and socially just development, in which ATREE plays the role of a model knowledge-generating organization for catalyzing the transition to such a society.

Asian Nature Conservation Foundation (ANCF) is a non-profit public charitable trust, was set up in November 1997 at Bangalore, India, to meet the need for a well informed decision-making framework to stem the rapidly declining natural landscape and biological diversity of India and other countries in tropical Asia. ANCF undertakes all conservation efforts through its many specialist divisions such as:

- Asian Elephant Research and Conservation Centre (AERCC)
- Centre for Tropical Biodiversity Conservation (CTBC)
- Centre for Environment and Sustainable Development (CESD)
- Centre for Conservation Education and Technology (CCET)

Indian Institute of Science Education and Research (IISER), Pune is a premier institute dedicated to research and teaching in the basic sciences. Established in 2006, the institute falls under the purview of the Ministry of Human Resource Development (vide communication F.No. 22-8/2006-TS.1). As a unique initiative in science education in India, IISER aims to be a Science University of the highest calibre devoted to both teaching and research in a totally integrated manner, with state-of-the-art research and high quality education, thus nurturing both curiosity and creativity.

Nature Conservation Foundation (NCF)

The Nature Conservation Foundation is a non-governmental wildlife conservation and research organization based in Mysore, India. They promote the use of science for wildlife conservation in India. The organization was founded in 1996. Their mission is to carry out "science-based and socially responsible conservation".

Kalpavriksh is a non-profit organization working on environmental and social issues. The group began in 1979 with a campaign led by students to save Delhi's Ridge Forest. Kalpavriksh believes that a country can develop meaningfully only when ecological sustainability and social equity are guaranteed, and a sense of respect for, and oneness with nature and fellow humans is achieved.

In addition, a number of individuals in other Indian institutions have provided support and assistance in various ways, including scientific cooperation, that have not been formally linked through contracts. Most importantly are the **National Centre for Biological Sciences** and the **Centre for Wildlife Studies**, both in Bangalore.

3 Outputs

3.1 Activities taken up and completed

The project has had social science and natural science activities all over India focussing on a number conflict species ranging from sea turtles to elephants (figure 1).

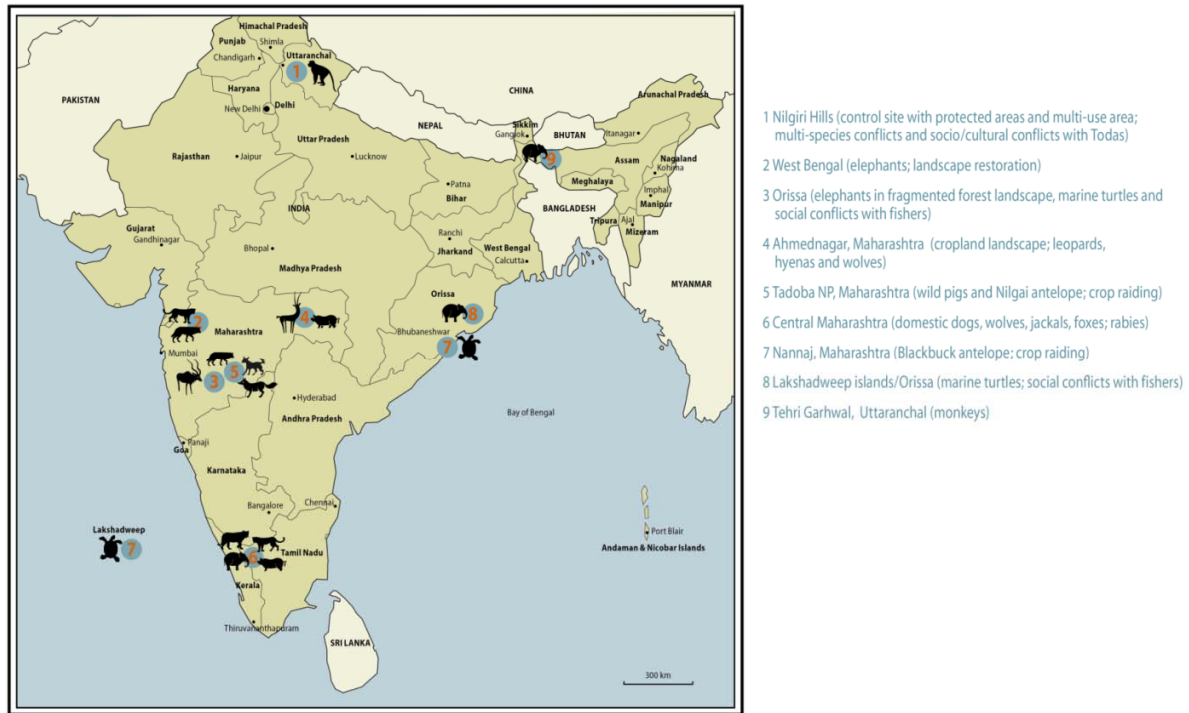


Figure 1. Project sites in India.

Several activities were planned for to fulfil the project objectives and goals. Almost all planned activities have been completed with written technical reports submitted (table 1).

Table 1. Status on activities taken up.

Activities	Investigator(s)	Project period	Status	Report
Main project lead	Jørn Thomassen (NINA)	2007-2011	Completed	Final report to RNE (this)
Project lead, India	Raman Sukumar (CES)	2007-2011	Completed	Final report to RNE (this)
Activity 1. Kick off workshop	Project members	2007	Completed	N.A.
Activity 2. All India Forest Division level questionnaire survey of Human - Wildlife conflict	Jayant Kulkarni (CES, IISc)	January 2009 to March 2011	Completed T	Technical report submitted
Activity 3. Attitudes of local people towards wildlife-human conflicts	Included in activity 4.10	N.A. N.A		N.A.
Activity 4.1a-1. Elephant-Human Interactions in Eastern India- Orissa	C. K. Sar (ANCF)	2007 - 2011	Completed	Technical report submitted
Activity 4.1a-2. Elephant-Human Interactions in Eastern India- West Bengal	Mukti Roy (CES, IISc)	2007 - 2011	Completed	Technical report submitted
Activity 4.1b. Wildlife-Human conflict in the Nilgiris Eastern Ghats landscape	G. Kannan (CES, IISc)	December 2007-March 2009	Completed T	Technical report submitted

Activity 4.2. Understanding human Leopard interactions in the western state of Maharashtra, India	Vidya Athreya (ANCF); John Linnell (NINA); Morten Odden (HiHM)	November 2007 - March 2011	Completed T	Technical report submitted
Activity 4.3. The role of Canine rabies in Human-Wolf conflict: Preliminary investigations in rural Maharashtra, India	Abi Tamin Vanak and Aniruddha Belsare (ANCF)	December 2007-Feb 2009	Completed T	Technical report submitted
Activity 4.4. Crop damage by a wild Indian Ungulate: Investigating ecological causes and developing mitigation measures	Kavita Isvaran (CES, IISc)	January 2008-December 2010	Completed T	Technical report submitted
Activity 4.5. Crop raiding by wild Ungulates in Tadoba-Andhari Tiger Reserve, Maharashtra: A study of ecological patterns and remedial measures	Milind Watve (IISER, Pune)	April 2008-March 2010	Completed T	Technical report submitted
Activity 4.6a. The Trouble with Turtles: Fishers, green turtles, and seagrass meadow dynamics in the Lakshadweep Islands	Rohan Arthur (NCF, Mysore)	March 2008 – December 2010	Completed T	Technical report submitted
Activity 4.6b. The Nature of Conflict - understanding Knowledge and Perceptions of and Attitudes towards Sea Turtle Conservation in Orissa	Kartik Shanker (CES, IISc, ATREE, Bangalore)	March 2008 – December 2010	Completed T	Technical report submitted
Activity 4.7. Comparing human wildlife conflict across different landscapes: a framework for examining social, political and economic issues and a preliminary comparison between sites	Kartik Shanker (CES, IISc, ATREE, Bangalore)	June 2008 – August 2009	Completed T	Technical report submitted
Activity 4.8 has been moved to and merged with activity 8.3	N.A. N.A.		N.A.	N.A.
Activity 4.10. Crop Damage by Wildlife in a Garhwal Himalayan village	Vijay Jardhari, Prabhakar Rao, Ayushman Choudhary (Kalpavriksh, Pune)		Completed	Technical report submitted
Activity 5. Expert and stakeholder involvement	All projects	2007-2011	Completed, see chap.13	N.A., but see chap.13
Activity 6. Conflict mitigation	N.A. Phase	II		N.A.
Activity 7. Convention on Biological Diversity	John Linnell (NINA)	2007-2011	See chap. 15	N.A., but see chap.15
Activity 8.1. What does large carnivore predation of buffalo mean to the Toda? Understanding cultural, politico-legal and ecological contexts and consequences of Toda conflicts with tigers and leopards on the Nilgiri pastures, Southern India.	Siddhartha Krishnan (ATREE)	July 2009 - February 2011.	Completed T	Technical report submitted
Activity 8.2. Human - large carnivore interactions in Akole, north-western Maharashtra	Sunetro Ghosal (ANCF)	June 2008-June 2009	Completed T	Technical report submitted
Activity 8.3. Understanding and Mitigating Human-Wildlife Conflict in the Biligiri Rangaswamy Temple Wildlife Sanctuary in the Context of the Forest Rights Act 2006	Nitin Rai and Siddhartha Krishnan	2009-2011 Completed	Completed	Technical report submitted

3.2 Results

Sections 3.2.1 – 3.2.1 5 are summaries of the various project activities. An overview of the technical reports from each activity are found in appendix 1.

3.2.1 All India Forest Division level questionnaire survey of Human - Wildlife conflict (activity 2)

Principle investigator: Jayant Kulkarni (CES, IISc)

Background / Study area / Study objective / Methods used

There is currently no available overview of human-wildlife conflicts from across India. Therefore, we conducted an all India survey of human-wildlife conflicts in order to fill this gap.

The main component of the study was a postal survey of human-wildlife conflicts sent to all forest divisions in the country, using a standard questionnaire addressed to the Forest Departments of all states. The purpose was to gather data on various aspects of human-wildlife conflicts, including type of conflict, magnitude of conflict and species involved in conflict.

The survey was addressed to 28 Indian states. The species for which the survey would be carried out and the main components of the questionnaire were decided at a workshop at Indian Institute of Sciences in November 2007. Data was collected for 18 species and for 2006, 2007 and 2008.

Data was obtained from 25 states. Because of lack of response, data were not obtained from Meghalaya, Manipur and Simla. Data were received from 622 divisions out of a total of 804. Thus 77.4 % of the divisions from the 25 states are represented.

Main results

Human deaths: The total number of human deaths caused by wildlife in the years of the survey was 888 (figure 2). The total ex-gratia payment for human deaths these two years was INR 57.2 Million.

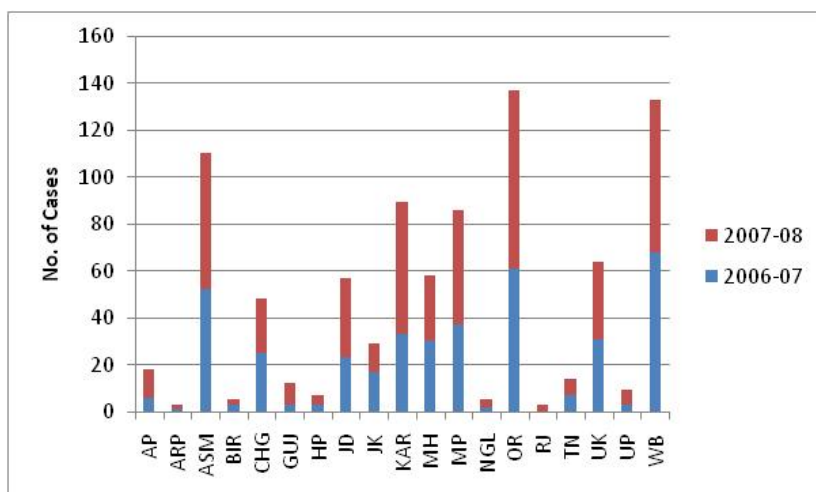


Figure 2. Number of Human Deaths in each state 2006-2008.

Human injuries: The total number of human injury cases due to wildlife was 7381 (figure 3). The total ex-gratia payment for human injury was INR 34 Million. The number of injury cases was very high in Madhya Pradesh.

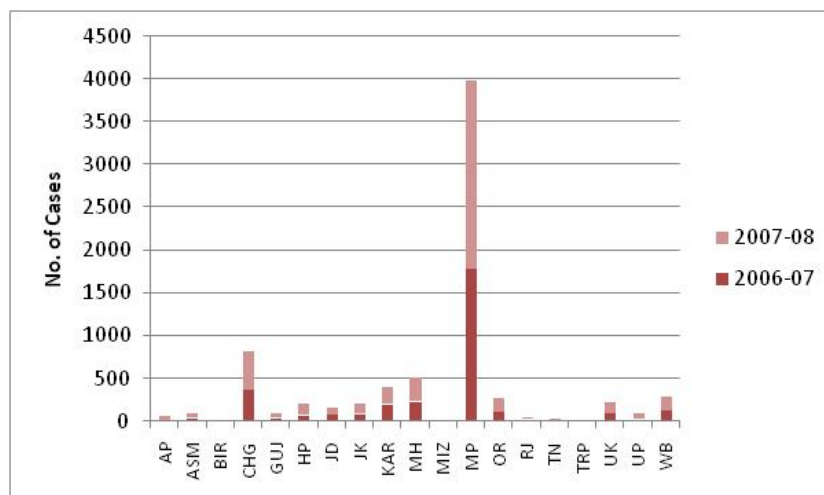


Figure 3. Number of Human Injuries in each state 2006-2008.

Damage to livestock: The number of livestock killed due to HWC is 14144. The total ex-gratia payment for livestock kills is INR 37.4 Million.

Crop damage: The total number of crop damage cases is 80956. The total ex-gratia payment for crop damage is INR 100 Million.



Blackbuck crop raiding. Photo: Kavita Isvaran.

Species involved: The elephant was found to be responsible for most human deaths, followed by leopard, sloth bear and tiger. The maximum number of deaths was in Assam. The jackal was reportedly responsible for the maximum number of human injuries, mostly in Madhya Pradesh (rabies suspected). The other species responsible for high number of human injuries are sloth bear, leopard and elephant.

Retaliatory killings of wild animals: The number of retaliatory killings of wild animals included; 153 electrocutions and 50 to poisoning. The animals electrocuted included elephant, sloth bear, nilgai, wild boar and chital. The maximum numbers of poisoning deaths were for leopard, tiger and elephant.

Official permission for killing wild animals is given in case of animals causing danger to humans or loss of property. 31 such cases were recorded for the period of the survey and include elephant, leopard, tiger, monkey, black bear, wild boar, sloth bear and nilgai.

Perceptions of conflict intensity were determined for various categories of human-wildlife conflict. The elephant, rhino and carnivores such as leopard, tiger, lion, all bear species and wolf were perceived as being responsible for human deaths and injuries and livestock kills. Herbivores such as rhino, nilgai, wild boar, bear species, monkey and gaur were perceived as being responsible for crop damage. Species perceived as responsible for property damage included elephant, monkey, rhino, langur and bear species. The elephant was perceived to be responsible in all categories of human-wildlife conflict, except livestock kills.

Mitigation measures: Various types of mitigation measures are practised by local people and the Forest Department for managing human-wildlife conflict. Mitigation measures such as noise-making, vigilance, and barriers are practised mainly against herbivores to prevent crop damage. Measures such as vigilance, patrol squads, and compensation are used against herbivores and carnivores. Trapping, tranquilising and translocating appears to be used frequently to manage conflicts due to leopard and monkey.

3.2.2 Elephant - Human Interactions in Eastern India- Orissa (activity 4.1a-1)

Principal investigator: Chanchal K. Sar (ANCF)

Background / Study objective / Study area / Methods used

The objective of the study was to gather information on human-wildlife conflicts in the eastern Indian state of Orissa, with emphasis on elephant-human conflicts.

A questionnaire was circulated to all Forest Divisions of the state to gather more basic information on the elephant-human conflict and other human-wildlife conflicts. Out of 50 administrative divisions of the state forest department, 43 divisions were covered. Information was collected for the years 2006, 2007 and 2008. The survey covered four carnivores (tiger, leopard, wolf and crocodile), two omnivores (bear and wild pig), and one herbivore (elephant). Through the survey we collected information on the extent of crop and property damaged by elephants, numbers of humans killed and injured by elephants and other wild animals, elephants killed in retaliation, ex-gratia compensation paid, elimination of dangerous animals by the forest department, relative abundance of wild animal species involved in conflict and mitigation strategies adapted by forest department and farmers.



Elephants can cause damage to cultivated crops, and be responsible for human death and injury. Photo: Nature Conservation Foundation.

Main results

According to the survey, the following species are involved in conflicts: tiger, leopard, wolf and crocodile, wild pig and sloth bear, and elephant. All the carnivores in the study were involved in human attacks leading to death and injury, as well as killing of cattle. The omnivores caused damage to cultivated crops, and were responsible for human death and injury. The only herbivore, elephant, was blamed for crop damage, property damage, causing death and injury of humans and for killing cattle.

During the study period an average of 68.5 people were killed every year by wild animals in the 43 divisions. The majority of these were by elephants (74%), followed by sloth bear 22%. Tiger, leopard, wolf and crocodile were responsible for 1% each. During the study period an average of 128 people were injured every year by wild animals in the sampled divisions. The majority of these were by wild bears (83%) followed by elephant (14%). All property (house) damage cases were caused by elephants. 17 of the divisions reported 475 partial or complete house damages every year.

Field investigations showed that crops were actually damaged by elephants, pigs and bears. However, all crop damage cases were recorded as being due to elephants. The main crop affected was paddy (rice), while maize, sugarcane, ragi (finger millet), jackfruit, and mangos were also damaged by wild animals. In the sampled forest divisions a total of 7654.22 acres of crop, mainly paddy, were damaged by elephants during the study period.

In the state a total 94 elephants were reportedly found dead in the official records during the study period. The elephant death cases recorded were not all due to the consequences of conflict. However, majority of these were due to retaliatory killing by farmers and villagers. Outside the elephant reserve areas, the level of all components of conflicts were higher. The fragmentation of forest due to e.g. industrialisation and mining is associated with an increase in the human-wildlife interface and resulting conflicts. The highest number of human killings was in the Keonjhar territorial forest division, followed by Sundergarh and Karanjia. The two divisions Keonjhar and Sundergarh cover almost 55% of the state's total mining area. The fragmentation of forest and the dependence of tribes on forest resources cause many deaths and injuries to humans. Particularly during the collection of *mouha* flowers, bears commonly attacked humans.

The establishment of big industries and the downstream subsidiary projects in Sambalpur north, Sundergarh, Angul, Dhenkanal, Athgarh and Keonjhar forest divisions restrict the normal movement of elephants. The congregation of elephants in these particular places for a long time creates food scarcity and increasing conflicts with people. The loss of elephants' movement paths of in Angul and Dhenkanal divisions has increased the problems of crop damage. Farmers are now demanding large compensations for their loss, and taking political actions, arranging demonstrations and roadblocks.

3.2.3 Elephant - Human Interactions in West Bengal - Eastern India (activity 4.1a-2)

Principle investigator: Mukti Roy (CES, IISc)

Background / Study objective / Study area / Methods used

The habitat in northern West Bengal is highly fragmented due to various developmental activities like conversion of forest into tea plantations, settlements, agriculture and exploitation of timber. Human expansion and the fragmented landscape it causes have increased the level of human wildlife conflicts.

In order to understand the status of conflict in West Bengal a study has been conducted to map human-wildlife conflicts in general, and conflicts involving elephants in particular. The main method used was to collect records from the various Forestry Department divisions.

The study also identified elephant corridors in these regions, where the elephants mainly used tea gardens for their migration. The focus was on one of the most crucial elephant corridors (Bharnobari, Dalsingpara and Beech tea gardens corridor) that fall in Buxa–Jaldapara area (figure 4). These corridors were marked and mapped. Land use patterns were mapped inside these corridor areas by tracking elephants with GPS transmitters.

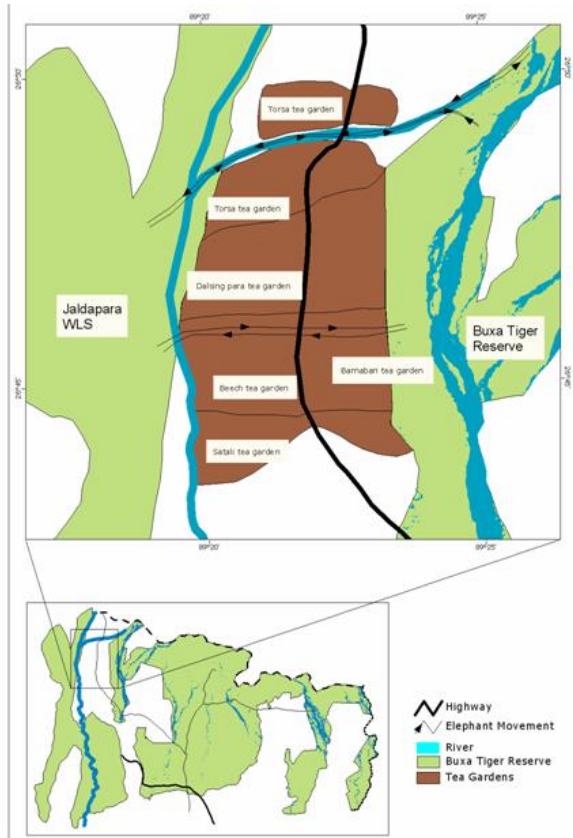


Figure 4. Proposed elephant corridor in the Buxa-Jaldapara area.

Conversion of uneconomical tea gardens to forests has been proposed as a way to reduce conflicts and contribute to carbon sequestration. For baseline scenario carbon estimation multiple plot tree species, shrub species and grass species were collected. The carbon level in these plants was estimated. For projection scenario, sample plots of 1000 m² were laid in a total of 89 plantations of different ages. Soil samples of project site and plantation area were collected and analysed.

Main results

In West Bengal there are 3 major conflict zones. In northern West Bengal, elephants, leopards and gaur are the main conflict causing species. In southern West Bengal the main conflict causing species include the elephant. In south-eastern West Bengal (Sunderbans areas) tiger is the main conflict causing species.

On average, 6,358 cases of crop damage, 1,429 cases of houses being damaged and 58 human deaths were observed between 2000-2001, and 2007-2008 in northern West Bengal. On average 23 people were killed, 57 injured, 1,763 houses demolished and 2,150 hectares of crop land were damaged by elephant in southern West Bengal (table 2).

Table 2. Elephant and human mortality in north Bengal and south Bengal

Year	North Bengal		South Bengal	
	Elephant Death	Human Death	Elephant Death	Human Death
2000-2001	20	58	4	17
2001-2002	15	56	8	36
2002-2003	35	61	2	20
2003-2004	21	52	NA	16
2004-2005	25	72	NA	27
2005-2006	19	62	NA	25
2006-2007	28	58	NA	20
2007-2008	32	44	NA	17

In the Sunderbans, south West Bengal, an average of 8 people were killed and 18 people were injured by tigers every year from 2006-2009.

In northern West Bengal elephant-human conflict cases increased with the increase in forest fragmentation. Consolidating of habitat and land use planning is needed to reduce level of conflict in these areas. Plans are being drafted to restore elephant corridors between fragmented forest patches by taking unprofitable tea gardens out of production and replanting forest. The socio-economic analysis takes into account multiple factors, including the future of the present work-force and possible carbon sequestration benefits.

3.2.4 Wildlife - Human Interactions: Nilgiri Eastern Ghats Landscape (activity 4.1b)

Principal investigator: Kannan (CES, IISc)

Background / Study objective / Study area / Methods used

The expansion of roads and township areas, increasing areas of cultivation and uncontrollable tourism appears to have resulted in human wildlife conflict in the Nilgiri Eastern Ghats landscape. A study on human-wildlife interaction in these landscapes has been carried out to assess the conflict status and to suggest possible solutions. The purpose of the study was to map the spatial and temporal distribution of human-wildlife conflicts in the study area, evaluate the wildlife human interaction across the forest division in Nilgiri Eastern Ghats landscape and mitigation measures used in the landscape, and to understand people's attitudes towards wildlife conservation.

Eleven villages were selected for monitoring of crop damage by elephants as well as cattle depredation by larger carnivores. Sathyamangalam forest division was exclusively selected for studying crop damage by blackbuck antelope. Data was collected from January 2008 to March 2009.

The study villages were visited twice a month to record data on crop damage by elephants, blackbuck and cattle depredation by tigers and leopards. Data on crop type, crop phenology, area of damage and whether it had been trampled or eaten, mitigation measures and GPS location of the place were collected during each visit to the study village.

Landowners were asked about the group composition of animals. In case of cattle lifting market value of the cattle, the animal responsible for damage, and location of the incident were collected from the owner of the cattle. Apart from these data on crop raiding and cattle lifting com-

compensation claims were collected from the forest department for the last five years to analyze the trend of conflicts over the time period.



Elephants crossing a road. Photo: John Linnell.

Main results

The level of damage by elephants was extremely high in Bandipur, Sathyamangalam and Nilgiri North forest divisions. This could be related to the availability of palatable crops throughout the year. During the study period 240 cases of crop damage by elephants were reported out of which Bandipur Tiger reserve had the highest frequency of damage when compared to other divisions in the landscape.

Similarly, 81 cases of crop damage by blackbuck were reported from peripheral villages of Bhavani sagar and the Sathyamangalam range of Sathyamangalam forest division. The emergence of crop damage by blackbuck in the periphery of Sathyamangalam division is a recent development and although it is currently negligible it may become severe in the future, necessary steps need to be taken to prevent such damage.

Conflicts involving carnivores have been increasing every year in the area. 21 cases of cattle lifting by carnivores were reported across the landscape in targeted villages in the study period. Among these villages in Mudumalai Tiger Reserve were affected most.

Information on compensation paid where elephants have caused damage to crops or property, or injuries and deaths towards humans, were collected from the forest divisions. Among all the divisions, Bandipur Tiger Reserve has the highest amounts of compensation paid.

Elephants cause the largest amount of economic loss among all the conflict animals. The intention with the compensation scheme towards people affected by elephants is to minimise negative attitude towards conservation of the species. The tolerance level of affected people was probably high in the beginning of the scheme, however currently there is widespread dissatisfaction about the scheme among villagers.

3.2.5 Understanding Human - Leopard interactions in the western state of Maharashtra, India (activity 4.2)

Principal investigators: Vidya Athreya, Kaati Trust (Pune), John Linnell (NINA) & Morten Odden (UMB/HiHM).

Background / Study area / Study objective / Methods used

A lack of understanding of the ecology behind leopard conflicts is one of the great knowledge gaps in Indian wildlife research. The goal of this project has been to conduct targeted ecological studies of leopard-human conflict in multi-use landscapes. The study was conducted between 2007 and 2011 in a highly populated irrigated valley in the Akole subdistrict, in the western edge of the Ahmednagar district of Maharashtra.

Local and state data on leopard conflict were obtained. A spatial survey of damage, conflict events, density and distribution of human populations, as well as the density and distribution of livestock, feral animals and the presence of leopards was conducted. Further, the main prey base of leopards in human-dominated landscapes was quantified and a prey census was conducted.

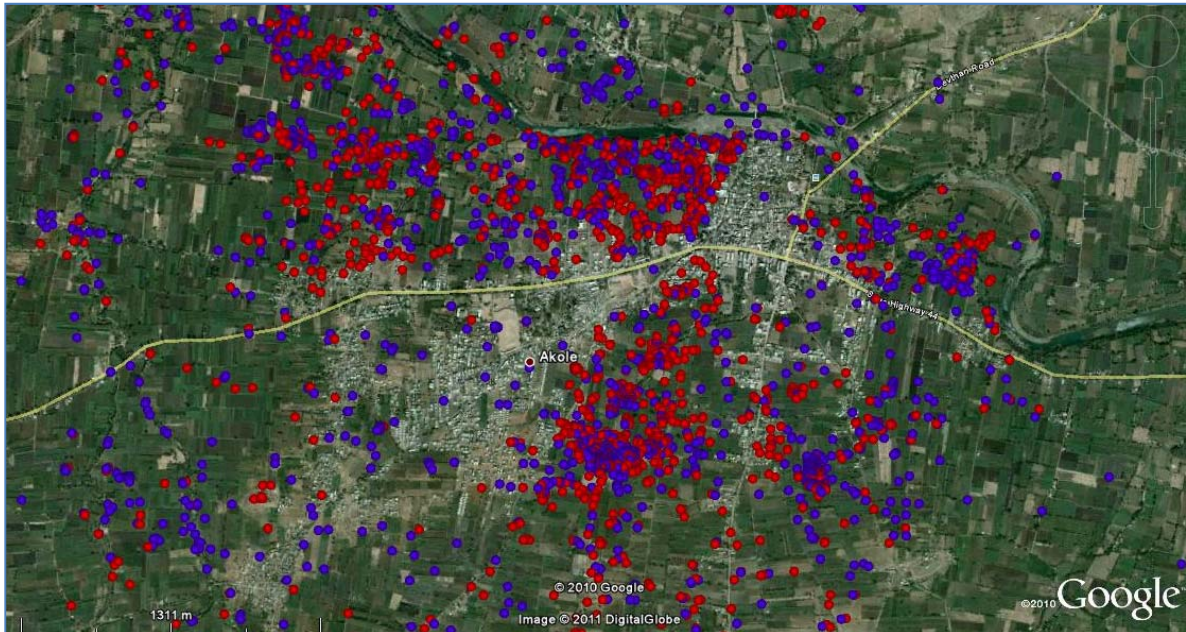
GPS telemetry technology was used to understand how the leopards utilise the human dominated landscape, leopard scats were collected for obtaining data on diet composition and prey selection and for acquiring DNA samples that will be used for leopard population density estimation, and camera traps were used to census the leopard population.



Leopard equipped with a GPS sender. Photo: Jørn Thomassen.

Main results

Five leopards were equipped with GPS collars to track the leopard's movements. A total of 11 adult leopards were photographed with the use of camera traps, six females and five males. Two of the six females were photographed with accompanying cubs. There was a high degree of concordance between the camera trap and DNA based estimates of leopard density – in the region of 6 animals per 100km².



Leopard positions in and around Akole, Maharashtra. Map: Google.

In the 31 villages in the study area a total of 223 cases were filed with the forest department for compensation for domestic animals killed due to leopards. Compensation claims reported to the Forest Department show that the average biomass killed by leopards each year is 4360 kilos. The main proportion of species found in leopard scats was livestock and dog.

Leopards have a pan-Indian range and among the wild carnivores are responsible for the largest number of attacks on humans, many being fatal as well. Furthermore, because of the scarcity of scientific information on the leopards especially when they live outside Protected Areas, managers did not have the baseline knowledge required to deal with the conflict issue effectively. Using the results of this collaborative effort, the Ministry for Environment and Forests also issued guidelines which were sent by the Forest Minister to all the Chief Ministers of all the states and to the Chief Wildlife Wardens as well.

3.2.6 The role of Canine rabies in Human- Wolf conflict: Preliminary investigations in rural Maharashtra, India (activity 4.3)

Principal Investigators: Abi Tamin Vanak and Aniruddha Belsare (ANCF)

Background / Study objective / Study area / Methods used

Wolves and other wild canids occur in locations close to human dominated areas in India. Free roaming domestic dogs are common in such landscapes, and are known reservoir of rabies. A potential for spill over of canine rabies to wolves and other canids exists; and rabies might play an important role in human-wolf conflict.

A preliminary survey was undertaken to investigate the role of rabies as a driver of human-wolf conflicts in Solapur, Ahmednagar and Osmanabad districts of Maharashtra between December 2007 and January 2009. Villages for the work were selected on the basis of either newspaper reports of wolf attacks on humans or regional civil hospital records of human rabies deaths and dog-bite injuries. Records from the Maharashtra Forest Department (MFD) were accessed for wolf attack data, and the Maharashtra State Animal Husbandry Department records for domestic animal post-bite treatment data.

A questionnaire survey was conducted during dog vaccination campaigns organized by the Maharashtra Forest Department in villages. The aim was to determine the attitude of villagers towards free-ranging dogs, dog and wolf attacks on humans, awareness regarding rabies, and any actions they may have taken towards preventing rabies or animal bites.

After the centre-point vaccination campaign in each village, house visits for vaccinating dogs which could not be brought to the vaccination station were conducted. Owned and ownerless dogs that were difficult to get to were captured using box traps. We used the opportunity provided by the vaccination campaigns to test the dogs for rabies.

Wolf attack victims were interviewed, and we monitored the status of the human as well as animal victims periodically during the study period. One wolf captured in Solapur city was tested for rabies.



Wolf. Rabies might play an important role in human-wolf conflict. Photo: Nature Conservation Foundation.

Results

Over a five year period, records of 24 incidences of wolf attacks on humans were obtained in Ahmednagar and Solapur districts, resulting in four human deaths.

Although much attention is given to conflict situations arising from human-leopard encounters, this high rate of conflict involving wolves does not seem to have gathered as much attention, other than sporadic reports in the local media.

There may be several reasons why this human-wolf conflict does not garner much attention. These attacks occur over a wide geographic area in a sporadic and unpredictable manner. Thus there are no “hotspots” of conflict as is the case with leopard and elephant. Furthermore, these attacks are not predatory in nature, and since the “problem” animal is often killed within a short span of time, there is little simmering discontent among the local population.

The pattern of wolf attacks on humans indicates the presence of rabid behaviour by these animals. Since the Indian wolf populations occur at low densities, they are unlikely to be the main reservoir of rabies, and are more likely to get infected with rabies from a more common host reservoir. In India, dogs are implicated in 96% of rabies related mortality events and are the main reservoir host of this virus. In most rural settings, dogs commonly are associated with households or settlements and referred to as village dogs. Village dogs are usually well-tolerated by people, with the exception of dogs showing rabies-like symptoms. There are reports of villagers killing dogs with such symptoms. However, these incidences are not recorded or documented, and laboratory confirmation of rabies has never been undertaken. As a result, there is no epidemiological data available for canine rabies in rural India.

Human rabies is diagnosed based on the history of an animal bite and the clinical symptoms. Once such diagnosis is reached the relatives accompanying the patient are encouraged to take the patient home as there is no available treatment and death is inevitable. As a result, almost all rabies deaths happen outside the hospital and thus are not recorded. Further, because relatives as well as the hospitals are reluctant to conducting post-mortem examinations, there is a lack of laboratory confirmed cases. According to a national multi-centre survey to assess the burden of human rabies in India, published in 2007, there has not been a single laboratory confirmed case of human rabies.

The results from the questionnaire surveys indicate the attitude of local people to the dangers of rabies is cavalier, with all respondents indicating a lack of awareness of simple preventive measures such as administering anti-rabies vaccination of owned dogs.

3.2.7 Crop damage by a wild Indian Ungulate: Investigating ecological causes and developing mitigation measures (activity 4.4)

Principal investigator: Kavita Isvaran (CES)

Background / Study site / Study objective / Methods used

Some animals' behavioural decisions directly impact human livelihoods and may thereby undermine conservation goals. In order to address this growing concern, it is essential to understand the patterns and causes of this behaviour. In this study the crop use behaviour of blackbuck was investigated. The blackbuck is an antelope of the open plains endemic to the Indian subcontinent.

The study was conducted at the Great Indian Bustard Sanctuary, Nannaj, and aimed to develop a predictive framework for crop use by blackbuck by addressing the larger question of the factors explaining the use of a typically varied grassland-crop field landscape by blackbuck.

The study examined vegetation composition in the area, specifically grasses, and blackbuck use of the major habitat types. These were protected grasslands, unprotected grasslands,

plantations and agricultural areas. Ecological factors assumed to influence use of habitat by blackbuck were also examined.



Blackbuck. Photo: Nature Conservation Foundation.

Results

Grass species richness, height, and above ground plant biomass varied widely across the landscape. Blackbuck encounter rates in the three non-agricultural habitats varied seasonally. Protected grasslands were used extensively, followed by unprotected grasslands and least in plantations. The intensity of use of an area by blackbuck, as measured by the abundance of indirect signs, was strongly affected by forage characteristics, particularly grass biomass and grass height, habitat openness (a measure of shrub and tree density in an area) and presence of livestock.



Blackbuck on crop fields. Photo: Kavita Isvaran.

Blackbuck distribution varied widely over space and time and appeared to reflect animals balancing forage quality with a perception of threat. The findings suggest that during the monsoon

and early winter, when nutritional levels in the forage are relatively high, blackbuck may pay greater attention to perceived risk and avoid unprotected grasslands with their higher human activity and livestock and congregate in the protected patches, particularly in the protected grasslands. Towards summer, when nutritional levels are low in the forage, blackbuck appear to use the landscape more widely and range both in protected patches, where human activity is low but grasses are taller and the habitat is less open, and in unprotected patches, where human activity is high and there is some livestock presence but grasses are shorter and perhaps more profitable.

Contrary to earlier reports, this study finds that at the larger scale, blackbuck use of agricultural habitats at Nannaj was marginal rather than widespread, and was highly localized to a subset of agricultural areas adjoining non-agricultural habitats, with cereals being the most affected crops. At the scale of a field, use and consequently crop damage varied considerably. Perhaps due to a perceived higher risk, blackbuck forays into agricultural habitats was also restricted to not more than 34 meters. Mitigation measures can be tried and tested in the study area as occurrence of crop damage can be predicted quite accurately. The process of choosing workable mitigation methods for implementation is underway.

3.2.8 Crop raiding by wild Ungulates in Tadoba–Andhari Tiger Reserve, Maharashtra: A study of ecological patterns and remedial measures (activity 4.5)

Principal investigator: Milind Watve (IISER, Pune)

Background / Study area / Study objective / Methods used

Tadoba-Andhari Tiger Reserve (TATR) lies in the Chandrapur district of Vidarbha region of Maharashtra. It supports a wide assemblage of ungulates, such as wild boar, nilgai antelope, sambar, chital, gaur, and barking deer.



Wild boar is one of the main crop raiding species in the Tadoba area. Photo: Jan Ove Gjershaug.

On the western border of the Tadoba range the forest borders onto agricultural lands. 75 % of the agriculture in this area is subsistence type and monsoon dependent. Although rainfall is high, it is irregular and affects crop productivity. Crop raiding by wild herbivores worsens the scenario and is therefore a major reason for conflict. Wild boar and nilgai are responsible for most of the crop attacks.

Crop raiding is affected by a large number of variables including animal behaviour, regional climatic conditions, and local cropping patterns. An ecological study of crop raiding by wild ungulate species along the northern part of western boundary of the Tadoba-Andhari Tiger Reserve (TATR) was conducted with the purpose of identifying multiple factors that may be responsible for initiation and aggravation of the crop raiding phenomenon.

The study was conducted in two phases. In the first phase the two cropping seasons namely Kharif (monsoon crops) and Rabbi (post monsoon crops) of the year 2008-09 were covered. This phase was of an exploratory nature and consisted of interviews of farmers as well as a first hand assessment of crop damage.

Learning from the first phase the survey design was refined in the second phase and farms along three to ten kilometre long transects extending away from the park boundary were monitored periodically throughout the two cropping seasons.

Main results

Through interviews we identified different types of damages caused by different species. The raids by wild boar appeared to be well distributed throughout the season whereas those by nilgai were more likely after ripening.

People generally claimed that crop raiding was uncommon during the monsoon and became more common after the end of monsoon season. The practice of physically guarding the fields typically starts post monsoon. The observational data on the other hand showed that attacks were frequent in both Kharif (monsoon) and Rabbi (post monsoon) crops but animals appeared to travel greater distances for crop raiding in the rabbi season. The losses due to crop damage were estimated to be close to 50 % of the net produce.

Apart from direct loss by eating, trampling or digging, indirect losses caused by discouragement of farmers from investing in intensive agriculture appear to contribute to the losses.

Among the variety of crops grown in the area some are more prone to raiding compared to others. Interestingly, although soybean was among the most frequently raided crops there was an increasing trend to grow soybean. On the other hand, karadai, the suffola oil seed has no threat of crop damage at all but very few farmers grow it. For karadai the difficulty in harvesting and inability to reach the right market channels are the likely factors preventing its wide scale cultivation. It appears that raiding is not the major factor in the choice of crops, but that it is the market value that dominates the decision.

The observational data shows that the frequency of raids by wild ungulates decreases with distance from the park. Nevertheless animals appear to cover a long distance to raid crops. In the post monsoon animals appeared to travel greater distances to raid crops and this might be owing to active guarding in park neighbouring areas. Individual fields could be raided about once in a month. Nevertheless owing to their unpredictable behaviour, guarding was necessary every night. This is a major added, but hidden, cost in terms of man-hours that farmers close to the park incur.

In spite of losses incurred due to crop raiding, there are few records of farmers claiming compensation although the government offers compensation packages. It is likely that farmers are traditionally habituated to losses due to crop raiding, and hence it is not considered to be a serious issue of magnitude. It is also possible that they do not know about the compensation

packages or are kept away by the corruption and/or bureaucracy involved in such procedures. The study certainly indicates that estimates of crop damage based on compensation claims are not realistic.

Since the direct and indirect damages estimated are substantial, compensation is unlikely to be an effective solution in the long run. One needs to look for better long term remedies such as the use of non-palatable crops or novel deterrents for crop raiding species.

3.2.9 The Trouble with Turtles: Fishers, green turtles, and seagrass meadow dynamics in the Lakshadweep Islands (activity 4.6a)

Principal investigator: Rohan Arthur, Nature Conservation Foundation (NCF), Mysore

Background/ Study area / Study objective / Methods used

The herbivorous green turtle is globally threatened, but locally very abundant around the Lakshadweep islands, especially in the Agatti lagoon. Hunting has been banned for more than a decade, and fishers in Lakshadweep now blame the green turtle for a decline in their fish catch. Agatti Island, where the conflict is at its severest, was chosen as a main focus area for a study of conflicts between conservation of green turtles and the interests of local fishers. While part of the conflict between fishers and turtles can be explained by accidental gear damage and other direct damage caused by the turtle, it cannot completely explain the strength of the fishers' reactions against the green turtle.



Agatti island is part of the Lakshadweep islands south-west of India. Map: Google Earth.

The object of the study was to explore both first- and second-order conflicts between fishers and green turtles in a seagrass meadow in the Lakshadweep Archipelago. First-order conflicts are conflicts that arise as a result of animals directly utilising resources valued by humans. Second-order conflicts arise when a species is affecting a resource not directly utilised by humans, but whose modification results in real or perceived losses of resources valued by humans.

Individual and focus group interviews were conducted with fishers and other community members in order to gather traditional ecological knowledge and map their perceptions of the drivers of conflict. Based on these initial studies, a series of ecological studies were conducted in the seagrass meadow to explore the validity of some of the fishers' claims.

Main results

The results from the interviews with local fishers suggested that numbers have increased since the hunting ban. The perception among the fishing community of Agatti Island is that green turtles, found in the lagoon in high densities, are both directly and indirectly responsible for a decline in fish catches. This notion is strongly held by the majority of the fishing community, and has resulted in clandestine killing and other persecution of green turtles.

Fishers identified several mechanisms through which turtles reduced their ability to catch fish. Green turtles were perceived as creating a disturbance around nets that scare fish away from nets and reduces their catch as a result. Turtles were also accused of breaking through nets and lines, causing significant economic losses and opportunity costs, until nets were repaired or new gear purchased. These can be categorised as first-order conflicts.

Another mechanism fishers identified as reducing fish catch was overgrazing of the seagrass meadow in the lagoon by turtles. The fishers meant that overgrazing lowered the potential of the meadow to attract fish. Adult fish from the coral reef were less inclined to enter the meadow when it was overgrazed. It was also the fishers' perception that overgrazed meadows lead to lower fish recruitment and juvenile settlement in them. Overgrazing that leads to reducing fish abundance can be classified as a second-order conflict.



Green turtle at the beach in Lakshadweep. Photo: Rohan Arthur.

The observational and experimental studies conducted in the Agatti lagoon evaluated the ability of turtles to modify seagrass ecosystem stems. The studies indicated that increasing densities of the green turtle resulted in significant changes in structure and dynamics of the seagrass meadows in the lagoon.

The lagoon showed a clear spatial variation in the numbers of turtles, which, at the highest density sites had numbers that rivaled the highest reported anywhere. This variation resulted in different intensities in grazing across the lagoon, and gave the possibility to study the green turtles ability to significantly modify seagrass ecosystems at large scales.

The results showed that the turtles substantially changed the seagrass meadow structure, by reducing canopy height, shoot length, width and density. The turtles modify plant growth, reduce flowering and can potentially even cause changes in the species composition of the meadow.

Comparison between different places in the lagoon with variable turtle densities and with other islands with very low densities of green turtles, showed that the amount of fish was very significantly impacted by green turtle-induced reductions of seagrass canopy height.

3.2.10 The Nature of Conflict - understanding Knowledge and Perceptions of and Attitudes towards Sea Turtle Conservation in Orissa (activity 4.6b)

Principal investigator: Kartik Shanker (CES)

Background / Study objective / Study area / Methods used

Orissa, on the east coast of India is one of the three global sites where synchronous nesting of thousands of olive ridley turtles occurs, making this a well-recognised ecological region. However, fishing communities have begun resisting official marine conservation laws.



Ridleys turtle at the beach in Orissa. Photo: Kartik Shanker.

This study aimed to document the different kinds of gears and craft used in the marine villages, as well as developing an understanding of peoples' awareness, perception and attitude towards the sea turtles, conservation in general, fisheries laws and management.

The study included both primary and secondary data. While secondary information was collected from official sources and libraries, primary data was collected through field surveys between March and May 2010.

Main results

Fishing practices are often viewed as a threat to conservation. So far sea turtle mortality in Orissa is reported to occur most often in bottom trawl nets, and gillnets.

Trawler owners and captains are often unwilling to abide by the rules of either the marine protected areas and other areas where they are not allowed to fish. Fisherman associations have started protests because they perceive turtle conservation as being an obstacle against fishing rights.

Other threats towards the turtles are developments on or near their nesting beaches, such as building of plantations, artificial illumination, and proposals for commercial ports.

The conflicts arising out of the lack of agreement on conservation is also attributed to failure of different groups, such as fisher folk, government departments, scientists and conservationists to come together to work out effective, appropriate, and commonly agreed upon conservation measures.

3.2.11 Comparing Human - Wildlife conflict across different landscapes: a framework for examining social, political and economic issues and a preliminary comparison between sites (activity 4.7)

Principal investigator: Vishnupriya Kolipakam and Kartik Shanker (CES)

Background / Study objective / Study area / Methods used

Though protected areas in India are intended to separate humans from wildlife, they do so to varying degrees due to the presence of humans in most parks and sanctuaries. Beyond these protected areas, there are large areas of overlap between people and wildlife at the borders of these parks, and vast tracts of agricultural and wildlife habitat where people and wildlife come into contact and conflict with each other.

Hence, attitudes of local people to wildlife are an important element of conservation, and their support and attitude towards coexistence is important for conservation regimes. This study examines historical, socio-economic, political and socio-cultural factors that contribute to conflict in two study areas. The first area, Kutch in the state Gujarat is a protected area, while the second, Rollapadu in Andhra Pradesh, is a non-protected area. The methods used were structured questionnaires and focus group discussions.

Main results

The two study sites were similar in the species involved in conflict. They both experienced problems with crop raiding by ungulates (blackbuck in Rollapadu and nilgai in Kutch) and livestock loss due to the presence of wolves. However there are significant differences between the areas in the manifestation of conflict. In terms of their legal status, the area studied in Kutch is not protected, while Rollapadu includes a sanctuary.

In Kutch, nilgai are given high religious value because of their resemblance to the cow that is considered sacred by Hindus. The same tolerance was not shown towards wolves in Kutch. In Rollapadu the overall attitude towards blackbuck was very negative. According to the community, this was because of the high density of blackbuck in the area, and the lack of proper com-

pensation schemes and remuneration from forest department for lands that have been annexed to create the sanctuary. The overall attitude towards the wolves seemed to be positive, but there are more agriculturalists than pastoralists in this area.



Nilgai antelope is part of the conflict picture. Photo: Nature Conservation Foundation.

The study shows that there is not necessarily a link between how often people encounter or experience damage caused by wild species, and the extent of their negative sentiments towards the species. Historical and cultural factors may play an important role in shaping people's attitudes. For example, in Kutch, people with low encounter rates and/or with no damage from wolves had negative opinions about wolves, while in Rollapadu, people with both low and high encounter rates with wolves were positive. However, this does need to be verified against actual losses incurred from wolves in both areas, and whether differences in levels of pastoralism influenced this difference in attitude.

There were key differences in the attitudes towards compensation schemes. In Kutch, where compensation schemes were not introduced on a regular basis, people felt that it could not replace their losses. But in Rollapadu, where compensation is supposed to be provided on a regular basis, people feel that more and regular compensation could help to resolve conflict. Communities from both areas felt that the government was not sensitive to their needs, and that it needed to take active steps to protect them from crop loss. Both areas also agreed that conservation laws were not useful to society and that they should be drafted in consultation with local communities.

In Kutch, most people favoured non-lethal solutions to conflict, while in Rollapadu, people were more antagonistic, and felt that either elimination or implementation of satisfactory compensation programmes were required. This antagonism is likely to be related to the fact that most villages have not received compensation for the lands taken over by the forest department for the sanctuary, and because of procedural difficulties in getting compensation for crop loss. While there are multiple axes along which the two areas differ, the presence of the sanctuary and the relationship with the forest department appears to have created additional levels of conflict and antagonism in the Rollapadu region.

These case studies show how antagonism towards laws can lead to retaliation, and negative attitudes towards animals, thus having the opposite effect than the laws were intended to have. The need to involve communities in creating conservation frameworks, or at least in local decision making, seems necessary if their support is required for conservation.

The results presented in this report are preliminary, and further data collection and analysis should be carried out. The gap in people's perception about conflict, official figures, and government perceptions about conflict needs to be more closely examined. Given the role of a suite of social factors, such as local knowledge, culture, economic status and governance, it is critical that future studies incorporate these aspects to gain a nuanced understanding of conflict which will lead to better mitigation and management plans. Even more important, a general

understanding of the drivers of conflict can help shape policy so that conflict can be reduced to the greatest extent possible. At the very least, policy needs to be modified, so that it does not aggravate conflict and negatively impact conservation objectives.

3.2.12 Crop Damage by Wildlife in a Garhwal Himalayan village (activity 4.10)

Principle investigator: Vijay Jardhari, Prabhakar Rao and Ayushman Choudhary (KALPAVRIKSH)

Summary

Jardhargaon village is situated in the Himalayan foothills, in the district of Tehri Garhwal in the State of Uttarakhand. The village has a total population of 2000. Most villagers are engaged in agriculture. The problem of wildlife damaging crops has increased recently. Based on interviews and discussions with the farming community of Jardhargaon, the study briefly describes the situation of crop damage in the village, and seeks to identify potential solutions.



Rhesus Macaques cause extensive damage to crops in the Jardhargaon village, Uttarakhand. Photo: Jan Ove Gjershaug.

Farmers whose fields are situated in close proximity to forests report that they have always lived with wild animals and are accustomed to some crop loss from them. The situation has become worse with wildlife numbers increasing coupled with shrinkage in the forested area. Monkeys and wild boar cause the greatest problems by trampling, uprooting and eating the plants and crops. Months of hard labour can be undone by wildlife raiding crops, monkeys during day time and boar during night.

These are some of the suggestions given by the villagers to deal with crop raiding:

- The villagers are demanding controlled culling of pigs and trapping (and relocation) of monkeys. They want the Government to pay for all the charges involved. The villagers want trapped monkeys moved away from the village and released in wildlife sanctuaries.
- The demand of farmers is that compensation should be based on market values of crops. Instead of cash, the farmers are ready to accept crops and grain as compensation.
- In the valleys, solar fencing is being demanded by farmers. They want this to be done under the National Rural Employment Guarantee Scheme (NREG) being implemented in the State. Construction of stone walls is another option. Such walls and fences can keep away many animals but not monkeys.
- Monkey sterilization has also been suggested as way of reducing their numbers.
- There has never been a greater need of reviving some of the neglected age old practices of keeping wild animals away from the farms.
- Eradication of lantana (an invasive plant species) and planting grass and other fodder species is another programme suggested under NREG. Lantana has spread wildly in the grasslands in close proximity to the houses and farms. These thickets are believed to provide ideal resting place for pigs.

3.2.13 What does large carnivore predation of buffalo mean to the Toda? Understanding cultural, politico-legal and ecological contexts and consequences of Toda conflicts with tigers and leopards on the Nilgiri pastures, Southern India (activity 8.1)

Principle investigator: Siddhartha Krishnan, ATREE (Ashoka Trust for Research in Ecology and the Environment)

Background / Study area / Study objective / Methods used

Afforestation in the Nilgiri hills has provided a habitat for tigers and leopards, and led to an increase of their presence. This has again led to an increase in attacks on buffaloes, which serve as both livestock and cultural symbols for the Toda. The Todas in the Nilgiri hills are a community of around 1500 persons. Although traditionally they were pastoralists with a buffalo based economy, the Todas have gradually become more dependent on agriculture. However, the buffaloes still are of great cultural importance.



Tiger predation on sacred buffaloes is a major problem for the Todas. Photo: Espen Lie Dahl.

Using a qualitative sociological framework this study seeks to go beyond the material consequences of predation, and to understand what these conflicts mean to the Todas, who have their own definitions of the conflict. Understanding what conflicts mean to people, their capabilities and needs, is important in deciding strategies for conflict mitigation and landscape management.

Topic guided and oral history interviews were conducted with Toda families belonging to all of their 15 patrilineal groups (family groups claiming common ancestry through the male line). In addition field notes of landscape observations, unstructured encounters and conflict events were written down. Documentary and archival records were sourced from the state archives in Chennai and from Toda respondents who possessed such records.

Main results

Material evidence for tiger presence and predation was collected through narration of encounters by Todas, physical evidence observed during fieldwork as well as photographs of injured buffaloes and carcasses. Buffalo predation has material consequences in terms of loss of livelihood. The main income bringing livestock products from the buffalo are milk and dung.

In addition to their significance for livelihood, buffalo are given high cultural value. Toda religion is a highly ritualized buffalo cult, and sacred buffaloes are central in lifecycle events. The Todas classify their buffaloes into different categories, ranging from the domestic to the ritual-sacramental. You have the 'secular' buffalo that are reared and milked for domestic purposes. In addition there are various categories of 'sacred' buffalo associated with each patrilineal group. The sacred buffaloes are given high ritual importance and graze on pastures around temples. Milk from sacred buffaloes can only be used for temple rituals, and not for household or commercial use. A sacred buffalo killed by a tiger cannot be replaced.



A sacred buffalo killed by a tiger cannot be replaced. Photo: Ketil Skogen.

Toda perceptions of livestock loss also need to be located in a wider phenomenon of change in the pastoral landscape. For the Todas the Nilgiris Shola pastures are a well defined mix of a

sacred and production (cultural) landscape. Transformation of grasslands into eucalyptus, pine and wattle plantations has reduced grazing ranges. In addition the new forests also provide tigers with cover to prey upon Toda Buffalos more often.

For the Todas, both the forests and the tigers are perceived as not belonging in their pastures. The forest department which has afforested their landscape are believed to have released the tigers from zoos into their landscapes. Todas claim that the tigers' 'unnatural' behaviour, including occasional failure to kill a captured buffalo or their frequent proximity to hamlets is evidence for this theory.

The report argues that conflict resolution and its institutionalization through landscape level conservation can only succeed if one understands the Toda ideas of landscape, predator presence and conservation.

3.2.14 Human - large carnivore interactions in Akole, north-western Maharashtra (activity 8.2)

Principal investigator: Sunetro Goshal (ATREE / UMB)

Background / Study site / Study objective / Methods used

The area around Akole in the south western part of Maharashtra is an agricultural landscape, with a complex web of human communities that share space with a dense population of leopards. From a social scientific perspective this study investigates how people and wildlife, specifically large carnivores, coexist in a human-dominated rural landscape in western India, which is outside the protected area network. Besides providing a descriptive account of the interaction, the research asks why people tolerate a potentially dangerous carnivore in their midst, and how they deal with issues of conflict.

Data was collected through fieldwork using participant observation and qualitative interviews. Historical data was obtained through archival research. This project uses the findings as a point of departure to focus on the complex negotiations carried out in the socio-economic, political, cultural and ecological landscapes, which modulate coexistence and conflicts between people and large carnivores.

Main results / conclusions

Interactions between large carnivores and people are complex, especially in a human-dominated multi-use landscapes. In Akole, different systems of knowledge coexist and compete, each with their own sets of assumptions, implications and grey areas. The various trends influence attitudes towards leopards, and provide a context to adapt to the presence of large carnivores in the landscape.

Although neither static nor universal, there exists a degree of empathy towards the leopards amongst people in Akole that stems from a worldview that places people and their culture within nature. This worldview is informed by religious, especially Hindu, social and cultural narratives.

People in Akole are not necessarily obsessed with the idea of life being sacred and in some circumstance are willing to entertain the idea of killing too. Furthermore, there are obvious individual variations in the strength of this belief. The important point here is to acknowledge its existence and possible impact on attitudes towards leopards.

In some of the communities, like Thakkars and lower class Maratha families, the leopards feature amongst the rich pantheon of village deities, in the form of the "big cat" deity *Waghoba*,

and the female deity *Waghjaimata*. These narratives bring the leopard into the human social sphere and also provide a framework to negotiate coexistence between people and large cats, through a mix of respect, social control and appeasement.



Some communities perceive the leopard male (and the tiger) as the deity Waghoba, and the female as the deity Waghjaimata. Photo: Espen Lie Dahl (leopard) / John Linnell (Waghoba).

Several individuals admitted that they were scared of leopards and would rather they be removed from their area to a conservation landscape. These individuals subscribed to a different narrative, which respects the leopard and its right to live but in a protected area and not in an agricultural landscape like Akole. Empathy is also strained by the existence of fear of leopard attacks on humans. Protest marches are known to be held in the immediate wake of leopard attacks.

The leopards of Akole are also invested with deep symbolic meanings. The most pertinent symbolisation of leopards (and wolves) in the research sites has been as an expression of social relations, stresses of stratification and inherent power dynamics.

For instance, many members of marginal communities, and even the lower classes of dominant communities, claimed the government released leopards to prevent them from extracting firewood from their plantations. These individuals were willing to tolerate the presence of large carnivores and even the occasional loss of livestock or dogs, as they had no other option. This attitude is embedded in a wider perception of powerlessness to influence decisions that affect them, at different levels.

In contrast, the wealthier and more powerful individuals viewed the leopards as a threat to their authority and wanted them removed from the landscape. These individuals blame the state for not acting but exercised their influence to ensure that the department put up trap cages to live-trap and remove leopards, while also extracting compensation from the government for degradation.

The forest department is legally invested and empowered with the responsibility of conserving wildlife including the leopards. They thus punish individuals who harm wildlife as well as those who trespass on their plantations. As a result, they are held morally responsible for any untoward incidents like degradation and attacks by leopards, which soon translate into pressure from political figures and superior officers.

3.2.15 Understanding and Mitigating Human-Wildlife Conflict in the Biligiri Rangaswamy Temple Wildlife Sanctuary in the Context of the Forest Rights Act 2006 (activity 8.3)

Principal investigator: Nitin Rai (ATREE)

Background / Study area / Study objective / Methods used

Human-wildlife conflict is not only produced by the material loss of household production but is produced by a systematic erosion of local rights, livelihoods and access to resources that is driven by wildlife conservation actions. Tribals and forest dwellers have been treated as encroachers by an administration that has viewed forests as the property of the state. These are forests that originally were exploited for timber and other products while more recently they have become viewed as areas with high levels of biodiversity that needs to be protected. The earlier commercial extractive agenda and the more recent conservation agenda have both marginalized tribals whose subsistence livelihoods are intricately linked to forests and whose habitations lay within these forests.

The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act (Forest Rights Act) was enacted in 2006 to restore rights to forest land, resources and management to scheduled tribes and traditional forest dwellers. The act aims to correct the historic injustices that scheduled tribes have suffered at the hands of colonial forestry laws as well as post-independence Indian forest management. This project explored the implications of the Forest Rights Act for mitigating human-wildlife conflicts. For a more grounded understanding the protected area Biligiri Rangaswamy Temple (BRT) Wildlife Sanctuary in south-eastern Karnataka was chosen as a study site. Here, human-wildlife conflicts prevail in the form of crop depredation and occasionally human mortality and injury. Elephants and wild boar are common crop raiders.



Elephants are common crop raiders. Photo: Raman Sukumar.

Wild boar that raid crops was mentioned by the Soligas (a local tribal group) as the most problematic conflict species, and was therefore chosen for closer study. Thus, the study investigates wild boar raids of fields, their intensities and frequencies, economic costs, Soliga perceptions of conflict, observations of boar behaviour, and the impacts of the Forest Right Act on

boar raids along with mitigation potential. The methods used in the project were economic baseline surveys, qualitative interviews, transects for ecological baselines, and focus group interviews.

Main results

All along the Soligas have witnessed the forest being invaded by lantana (an invasive plant). The Forest Rights Act has generated a strong sense of security and sentiments over the landscape among the Soliga.

The Soliga have given assistance over identification of priority areas for lantana clearance and suggestions of how to reduce parasitic plants during fruit harvest, thus vesting of conservation rights may potentially lead to lantana removal.

The Soligas offer keen insights into wild boar group dynamics and raiding behaviour, and provided valuable suggestions for how to decrease crop raids and improve forest condition through the control of invasive species. Crop raiding though prevalent in the pre-sanctuary period, was less intense as tubers were abundant, their regeneration facilitated by frequent fires. Other mitigation options that the Forest Rights Act can open up include access to bank loans for installing solar powered electric fences. Solar fencing is widely suggested as a preferred technology to mitigate conflicts.



Another common crop raider - the Wild boar. Photo: John Linnell.

But techno-managerial efforts such as solar fences and trenches and clearing lantana around fields is only going to mitigate the issues at the surface while the actual conflict over rights and livelihoods will continue to simmer. It is not the wild boars that the Soligas regard as being the greatest conflict, rather it is the conservation policies of the forest department. The lack of tenure security over land and forest results in the inability to 'cope' with the problem. This is therefore a political and ideological issue and not merely an 'ecological' problem to be mitigated.

The vesting of forest rights while not in itself mitigating the problem might go a long way in alleviating the poverty that wild boar raids cause as well as providing the possibility for Soligas to be involved in making the decisions on how to mitigate the problem. Though the Soligas first claimed community forest rights under the Forest Rights Act, they are yet to be granted such rights. Since half the Soliga population is landless, the grant of land does not ensure better livelihoods. Community forest rights are essential.

A recent development has further provoked tensions. The notification of the sanctuary as a tiger reserve effectively nullifies potential gains made under the Forest Rights Act and threatens the Soliga with dislocation, curtailment of rights and loss of livelihoods.

4 Degree of achievement of the goals and objectives of the project

Table 3 shows the original goals, objectives, expected results and activities as written in the application to the embassy. The original text from the application is written in the left column. Notes are added on which concrete activities were launched to achieve them and a brief statement on the extent to which we have achieved them (see also chapter 3.1). The activity codes correspond to those in the annual reports. To avoid repetition most details are provided under “Expected results”.

The **overall Goal** of the project is to understand the wildlife human interactions in India and Norway and develop mechanisms of coexistence suitable to the countries.

Table 3. Degree of achievement of the goals and objectives of the project.

Project objectives (sub goals)	Explanation, ref to activities covering the sub goals
Map the spatial and temporal distribution of material conflicts between people and wildlife	Activity 2 = the “All India Survey” of conflict records collected from the Forestry Department offices across the country. The Forest Departments of most states do not have an administrative map showing boundaries of forest divisions in the states. For this reason and because of the long time it took to receive the data from the forest divisions GIS component of the study could not be carried out.
Conduct targeted ecological research where necessary to better understand the mechanisms of conflict for selected species.	Activity 4.1 – 4.7 and 4.10 = studies of interactions between leopards, wolves, elephants, blackbuck, other crop raiding herbivores and monkeys, and sea turtles with humans across a range of study sites.
Evaluate the utility of a range of mitigation measures (both those that are already in use and those which could be introduced) designed to promote coexistence.	Activity 6 = preparation for Phase II of the project as no concrete mitigation actions were intended to be applied during this phase of the project.
Promotion of mutual experience sharing among equal partners concerning the integration of wildlife into human-dominated landscapes.	The whole project has involved experience sharing between Norwegian and Indian partners and among the Indian partners.
Explore attitudes to human-wildlife relationships, and analyze [HWC] in the light of relevant social structures and culture patterns.	Activity 4.6, 4.7 and 8.1 – 8.3 = a selection of case studies using a diversity of methodologies.
Explore the challenges and opportunities of resolving wildlife-human conflicts through several means including establishing socially equitable and environmentally responsible, income-generating activity for villagers.	Activity 6 = preparation for Phase II of the project as no concrete mitigation actions were intended to be applied during this phase of the project
Expected results	Status
Database on wildlife-human conflicts for India and Norway	Activity 2 in India has resulted in a survey of forestry department records of human wildlife conflicts from most Indian states. Progress was much slower than hoped because of poor organization of forestry department records and difficulty in assessing them. However, the database is unique and has much potential for yielding results of great value, although the delay has prevented some of the hoped for analyses being completed. The experience of obtaining the data has in itself provided important insights into institutional capacity and institutional culture within the forestry department. In Norway, these data (at least concerning livestock depredation by carnivores and ungulate-traffic accidents) are already available from constantly updated and open access databases maintained by the Directorate for Nature Management and Statistics Norway respectively.

Identification of “hot spots” of conflict in India.	This result has depended on the completion of the above (activity 2) which has delayed the formal analyses of the data.
Deeper understanding of people’s attitudes to wildlife and related conflicts.	Formal data collected through a range of social science methodologies (quantitative questionnaires, in depth interviews, observation and participation) on rural people’s attitudes towards human-wildlife conflict has been collected under the frames of activities 4.6, 4.7 and 8.1 – 8.3. In addition, the researchers involved in all other activity areas have gained a large amount of informal feedback from people in their study areas.
Impact of wildlife-human conflicts on species populations assessed in relation to their endangered status and viability.	This has been a cross-cutting sub-theme across the whole project because our main focus has been on studying wildlife impacts on humans rather than human impacts on wildlife. However, in most cases the fact that conflicts exist is because of the ability of wildlife to survive and even thrive in human-dominated environments beyond the large protected areas. We have not found any indication that human impacts on wildlife are threatening species survival within our case studies, but we do have evidence that human tolerance to conflicts may be eroding in some areas which could threaten its persistence in the near future.
Comparative implications for the implementation of the international Convention on Biological Diversity will be discussed, especially with respect to the relative roles of protected area versus multi-use landscape strategies in the two countries.	This work is conducted under activity 7. It has not been a topic of formal study, rather it serves as an overall context within which to place the implications of our results. The documentation of diverse and widespread conflicts between humans and wildlife implies that there is a strong need to modify the existing focus with the CBD (and the developments that fall with Ecosystem Services (TEEB) framework) on the benefits of biodiversity with a mutual understanding of the potential costs of biodiversity. This in turn implies that the CBD’s focus on benefit sharing must also be complemented by a focus on sharing the costs.
Preliminary adaptation strategies suggested.	The Project and activity 6 = this work consists of the preparation for phase 2.
Findings of the study disseminated to wildlife conservation policy makers in India and Norway.	There have been many meetings between project staff and the responsible authorities, especially with the Forestry Department, at all levels from local to state and national. Forestry Department staff has also been involved in fieldwork and project activities. In addition, there have been many informal and formal meetings which have allowed the results to be transferred. There has been a great deal of media focus on project results within India, and to a more limited extent in Norway. On the international level, project results have been presented in scientific journals and at scientific conferences. On the policy level, the project was represented at the Norwegian Embassy’s stand at the Delhi Sustainable Development Summit in January 2011.
Strengthened institutional cooperation between India and Norway for effective implementation of international conventions such as the Convention on Biological Diversity.	The project has led to increased awareness of the global nature of human-wildlife conflicts and the large number of similarities in issues that impede conservation of biodiversity. This awareness has been mainly raised among the researchers, however the fact that these individuals serve on a wide range of national and international working groups and committees will facilitate the transfer of this information to management and policy making levels.
Capacity building and exchange of ecological expertise between Norwegian and Indian institutions.	The positive experience of cooperation between the Norwegian and Indian institutions has led to a clear will to continue with a second phase of this project, as well as to the submission of a number of other applications for money to allow the further development of activities initiated within the frames of this project. The networking among the diversity of Indian institutions within the project should also be emphasized.
Contact and collaboration between Indian and Norwegian social science groups working with relevant issues.	The project as a whole and activities 4.6 and 8.1, 8.2 and 8.3 in particular have led to a good contact between the relevant social science groups in the two countries with joint research activities in two study areas. Of special note is the integration between social science and natural science approaches achieved

	under activities 8.2 and 4.2 and within 4.6. It is fair to say that the project has led to a far greater appreciation of the importance of social science approaches in human-wildlife conflict research.
Policy-relevant research to promote wildlife and nature conservation conducted.	A number of clear policy recommendations have been obtained from most project activities. The summing up workshop and the period at the end of the project will lead to the structuring of these recommendations.
Consultations and discussion meetings held with relevant Ministry (Environment and Forests/agriculture) and research institutions.	See above.
Activities	Status
Workshop in Bangalore during early 2007 for preparing the detailed plan of activities and to narrow down the regions/species to be covered, and develop the formats for field data collection.	Completed as planned.
Detailed but rapid survey to assess the nature and extent of wildlife-human conflicts across the country.	Covered by activity 2 - institutional issues within the forestry department led to this taking much longer time than needed.
Mapping of wildlife-human conflicts to spatial layers using Geographical Information System (GIS) software.	The map layers are available, but the delays within activity 2 have led to delays in the integration of these two databases.
Detailed survey on the attitudes of local people towards wildlife and various conflict mitigation strategies	This was covered by activities 4.6, 4.7 and 8.1 – 8.3. The scope of activity 3 ended up being less than hoped for because of logistical problems, mainly because the original plans were over-ambitious and is included in activity 4.7.
Targeted ecological studies species/regions	Activities 4.1 – 4.6 and 4.10 covered these issues. The studies were in general very successful, although they differed widely in scope and budget and accordingly had different levels of ambition.
Expert consultations and workshops to discuss the findings and prepare final project reports and publications.	Conducted as planned.
Workshops and discussion meetings to disseminate findings of the studies to all the stakeholders (researchers, policy makers and administrators) in India and Norway.	Cross cutting activity under all project activities. The interactions occurred as many informal meetings were integrated into other existing forums for science-policy interface rather than as project specific meetings, with the exception of the final project workshop.
During the third year prepare, for two Indian wildlife landscapes, detailed plans for conflict mitigation, for which further funding could be sought for implementation on the ground during the fourth and fifth years.	The project was granted a one year, no cost extension and we are currently (year 4) planning for a Phase II.
Examine the application of the findings to realize the aims of the Convention on Biological Diversity, especially with respect to the Malawi and Addis Ababa principles.	Activity 7 and above (see also chapter 15).

5 Sustainability of the co-operation between the participating institutions

The Embassy funding was essential to initiate such a large, wide-ranging project with so many partners, and it is impossible to imagine any other source of funding which could have done the same. Except for some minor challenges the cooperation has gone smoothly and there is a general understanding of the benefits of cooperation, reflected in the desire to ensure that this first phase of the project is followed up with a phase 2.

Several new contacts between project participants and among stakeholders have been made during the project period, and there are intentions and wishes to continue to interact and collaborate with the other participant institutions and stakeholders in the future.

It is in the nature of much research that a large part of the data analysis and publication of results happens in the months and years after a project formally ends, and an Embassy funded phase 2 will serve as an invaluable platform to ensure the realization of the remaining potential that lies within the data collected and the established partnerships.

The question of the sustainability of the partnerships beyond those activities funded by the Embassy is important. In general, it should be possible to sustain many of the closest partnerships. Domestic funding for this type of applied research is available within both countries. During the life of the project's phase 1 limited cofunding from other sources has been obtained for some project activities from sources such as the Kaplan / Panthera foundation, the Rufford Small Grants Program, the Research Council of Norway and the Norwegian University of Life Sciences. The fact that India is eligible to apply for European Union funding through the EU's 7th Framework Program also opens the way for potential future funding. NINA has already made several other attempts to apply for additional funding from sources such as the Research Council of Norway together with various Indian partners where the partnership was developed within the frames of this project. In summary, while it is unlikely to be able to maintain such a massive cooperative project on other funding sources, it is highly likely that a number of the more specific and closer partnerships will endure.



Local people in the Akole area. Photo: Jørn Thomassen.

6 Arrangement for institutionalisation of benefits

The umbrella project on Human Wildlife Interactions was coordinated through a series of workshops organised in Bangalore at the Indian Institute of Science. All participants of the project shared their views and findings of their individual studies. The different activities have benefited from the interactions from all the participating institutions including the Norwegian institutions as well as the Indian institutions.

The information and insights provided by the Norwegian coordinators and participants were of great help in bringing clarity to the various studies. The project therefore benefited greatly from the cooperation of all the participants. Continuation of this arrangement will benefit future projects as well. In both Norway and India there has been an attempt to involve as many individuals as possible in the project's activities, so as to give the broadest contact base possible, and hence lift the partnerships from being between individuals to being between institutes.



From the kick-off workshop in March 2007. Photo: Jørn Thomassen.

7 Mutuality of benefits derived by individual institutions

This project's cooperation has provided many mutual insights. NINA has obtained benefit from gaining knowledge about Indian conditions, and better insight into the adaptation and mitigation synergies through a dialogue with Indian experts. IISc and Indian partners have obtained benefit from insights into wildlife management techniques employed in a different societal context (Scandinavia).

The Indian partners were able to benefit from the Norwegians' experience at conducting interdisciplinary conflict research in human-dominated landscapes, while the Norwegians were able to gain critical insights into the unique levels of tolerance displayed by the rural Indians. However, many of the findings were very similar between the two countries, indicating that some aspects of human-wildlife conflict may well be universal, albeit with much local variation in the details. The Norwegian institutions have gained valuable experience with working in India while the Indian institutions have gained experience with the potential funding that is available from Norwegian sources.

The collaboration between Norway and India has also contributed to bridging the North-South gap in future discussions on biodiversity conservation policies as well as implementation of the Convention on Biological Diversity and the upcoming Intergovernmental Science Policy Platform on Biodiversity and Ecosystem Services. In the latter case there has been considerable focus on reducing the capacity asymmetry that exists between north and south – and such collaborations as this clearly help to provide the contact network between individuals, institutions and countries that are central to reducing this gap.



Indian – Norwegian partnership (Raman Sukumar, CES and Jørn Thomassen, NINA). Photo: John Linnell.

8 Assessment of technology/knowledge transfer exchanged between institutions

The project has seen a great deal of experience exchange between Norway and India. Norwegian researchers engaged themselves heavily in some of the concrete Indian case studies, especially those focusing on wolves and leopards in Maharashtra (activity 4.2 and 8.2) and on the studies conducted in the Nilgiri Hills (activity 8.1 and 8.3). From these cooperations, a number of collaborative scientific publications have and will be produced. Beyond these activities, Norwegian partners have been involved to various degrees in the planning and implementation of almost all activities in India. This being said, the greatest degree of integration of experiences will occur during the closing stage of the project when the results of the various activities are compared to each other, when scientific papers are produced and policy recommendations are developed.

The linkage was at a level far greater than expected in a capacity building project and could be best described as a mutual cooperation between equals. While the Norwegian researchers contributed some degree of technical knowledge in all fields, especially social science methods, GPS-telemetry and genetic analysis of non-invasively collected biological samples (scats), the Indian partners with whom they interacted were able to reciprocate with their own experiences and skills such that both partners learnt a lot from each other. As well as the technical cooperation, exposure to the radically different wildlife management systems and philosophies in the two countries has provided a much needed perspective on their own domestic situations



Collaboration and knowledge transfer in the field. Photo: Ketil Skogen.

9 Strategy for dissemination

Human-wildlife conflicts are a topic with massive media coverage in both Norway and India, and as such the project's results have been highly relevant for ongoing societal and political debates. From the beginning of the project it was agreed that a proper dissemination of the various project results to stakeholders, scientific community, policy makers and society was crucial to achieve a better coexistence in conflict areas. The project has produced articles in peer review scientific journals (and many more will come), written several research reports, produced conflict management guidelines, written numerous popular articles in newspapers and journals, given several interviews on radio and TV, given public and scientific presentations and even produced and performed a theatre production on leopard – human conflicts!



From the theatre production on leopard – human conflicts. Photo: Vidya Athreya.

The media has covered several of the issues that we have been studying and many journalists have interviewed project scientists or based their reports on project results. Several of the project's scientists have been very active in writing their own popular science articles and initiating the production of a wide range of communication packages ranging from TV documentaries to training courses and handbooks to popular books and, as mentioned, theatre productions – in all cases trying to use the most appropriate media to reach the desired stakeholder group. Top-up funding for communication activity was obtained from the Research Council of Norway and its activities will peak during the coming months.

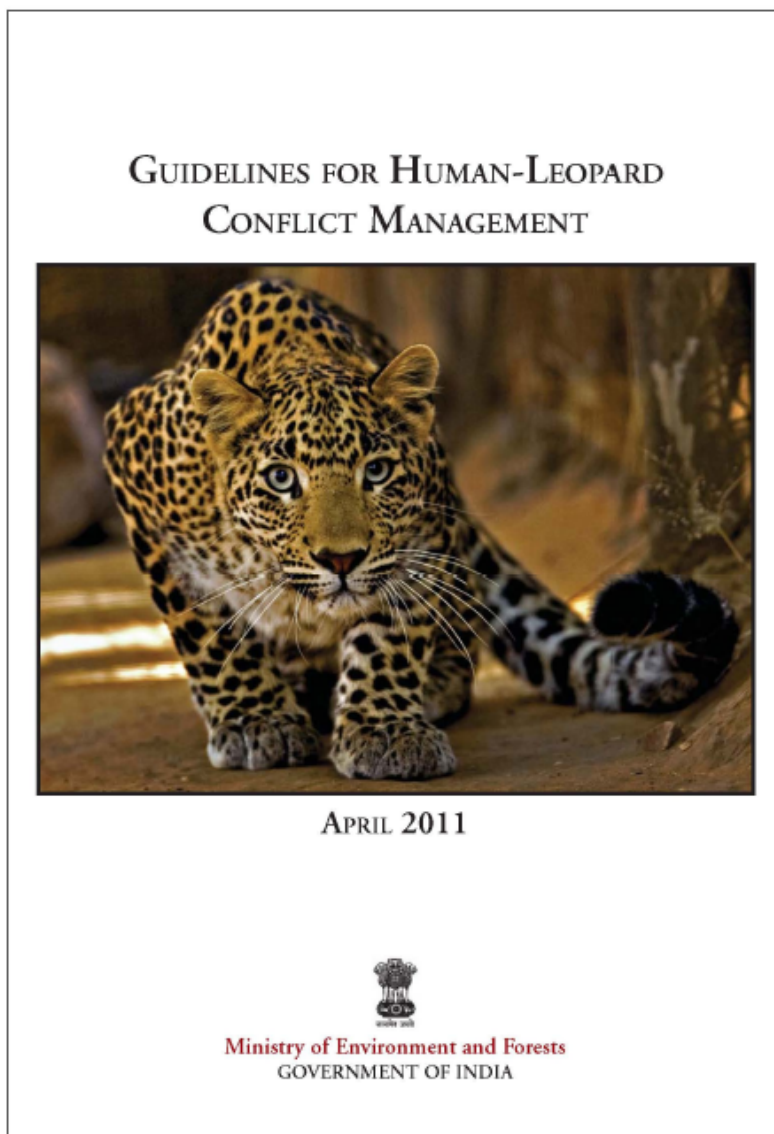
Below are listed various publications, media coverage, popular articles and other dissemination activities (table 4).

Table 4. Publications, media coverage, popular articles and other dissemination activities in the project.

Dissemination category	Reference to sub projects (activities)
Scientific publications	
<ul style="list-style-type: none"> • Athreya, V.R., Thakur, S.S., Chaudhuri, S. & A.V. Belsare. 2007. Leopards in human-dominated areas: a spillover from sustained translocations into nearby forests? - <i>Journal of Bombay Natural History Society</i> 104(1). • Athreya, V.R. & A.V. Belsare. 2008. Morphometry of leopards from Maharashtra, India. - <i>Cat News</i> 48. • Athreya, V. 2006. Is Relocation a Viable Management Option for Unwanted Animals? – The Case of the Leopard in India. ~ <i>Conservation and Society</i> 4(3): 419–423 • Athreya, V.R. 2007. Living with dangerous animals. - <i>Seminar</i> 577. • Aniruddha V. Belsare, B.V.Sc. and A.H., and Vidya R. Athreya.2010. Use of Xylazine Hydrochloride-Ketamine hydrochloride for immobilization of wild leopard (Panthera pardus fusca) in emergency situations - <i>Journal of Zoo and Wildlife Medicine</i> 41(2): 331–333. • Samrat Mondol, Navya R., Vidya Athreya, Kartik Sunagar, Velu Mani Selvaraj and Uma Ramakrishna. 2009. A panel of microsatellites to individually identify leopards and its application to leopard monitoring in human dominated landscapes - <i>BMC Genetics</i> 2009, 10: 79. 	<p>Activity 4.2. Leopards and wolves in western India: the ecology of human-leopard and human-wolf conflicts in Maharashtra, India.</p>
<ul style="list-style-type: none"> • Lal, A., Arthur, R. Marba, N., Lill, A. and Alcoverro, T. (2010) Implications of conserving an ecosystem modifier: increasing Green Turtle (<i>Chelonia mydas</i>) densities substantially alters seagrass meadow structure and dynamics. <i>Biological Conservation</i>. doi:10.1016/j.biocon.2010.07.020 • Arthur, R., Kelkar, N., and Madhusudan, M.D. (in review). Shared spaces: Understanding first and second order conflict between fishers and turtles in India. <i>Conservation Letters</i> 	<p>Activity 4.6. Sea turtles, fishers and shared spaces: understanding the roots of conflict in Lakshadweep and Orissa</p>
Scientific publications under preparation	
<ul style="list-style-type: none"> • Athreya, V. Density estimation of leopards using capture recapture methods. In prep. • Athreya, V. Diet analysis and prey availability for leopards in a human dominated landscape. In prep. • Athreya, V. The losses people face due to presence of leopards in the landscape. In prep. • Athreya, V. Using faecal DNA to estimate leopard population and sex structure in a human dominated landscape. In prep. • Athreya, V. Habitat use and home range analysis of leopards outside PA's in India. In prep. 	<p>Activity 4.2. Leopards and wolves in western India: the ecology of human-leopard and human-wolf conflicts in Maharashtra, India.</p>
<ul style="list-style-type: none"> • Mallick, S. and K. Shanker. In prep. A comparison of fishing practices, and attitudes to and perception of sea turtle conservation along the southern Orissa coast. In prep. • Sridhar, A. and K. Shanker. In prep. Agents perceptions on sea turtle conservation in Orissa - through looking glasses and multiple lenses. In prep. 	<p>Activity 4.6. Sea turtles, fishers and shared spaces: understanding the roots of conflict in Lakshadweep and Orissa</p>
<ul style="list-style-type: none"> • Ghosal, S., Athreya, V. and Linnell, J. XXXX. Paradigms of large cat conservation in India – do we have the knowledge that we need and from the places that we need it? Submitted to Economic and Political Weekly (www.epw.in) • Ghosal, S., Skogen, K and Krishnan, S., Human-Wildlife Interaction landscapes: A Comparative Study between large carnivore conservation in human-dominated landscapes in India and Norway. In prep. 	<p>Activity 8.2 Human - large carnivore interactions in Akole, north-western Maharashtra</p>
Research reports	
<ul style="list-style-type: none"> • Krithivasan, R., Atreya, V. & Odden, M. (2009) Human-Wolf Conflict in human dominated landscapes of Ahmednagar District, Maharashtra. Final report submitted to Rufford Small Grant Program. • Athreya, V.R. & A.V. Belsare. 2005 Helping the Maharashtra Forest Department rescue or treat endangered wild carnivores. Submitted to the Wildlife Trust of India, New Delhi and the Office of the Chief Wildlife Warden, Maharashtra. • Athreya, V.R., Thakur, S.S., Chaudhuri, S. & A.V. Belsare. 2004 A study of the man-leopard conflict in the Junnar Forest Division, Pune District, Maharashtra. Submitted to the Office of the Chief Wildlife Warden, 	<p>Activity 4.2. Leopards and wolves in western India: the ecology of human-leopard and human-wolf conflicts in Maharashtra, India.</p>

<p>Maharashtra State Forest Department, and the Wildlife Protection Society of India, New Delhi, India.</p> <ul style="list-style-type: none"> • Athreya, V.R. & A.V. Belsare. 2005 Training Maharashtra Forest Department personnel to use chemical restraint and micro-chips to better manage man-leopard conflict. Report submitted to The Rufford Maurice Laing Foundation, U.K. • Athreya, V.R. & A.V. Belsare. 2006 Providing the Maharashtra Forest Department technical and veterinary support to better deal with wild animals that require human intervention. Technical report submitted to Wildlife Trust of India, New Delhi and the Office of the Chief Wildlife Warden, Maharashtra. 	
<ul style="list-style-type: none"> • Vanak, A.T., Belsare, A.V. & Gompper, M.E. (2007). Survey of disease prevalence in free-ranging domestic dogs and possible spill-over risk for wildlife - a case study from the Great Indian Bustard Sanctuary, Maharashtra, India. Final report, Rufford Small Grants Foundation, UK. Pp 1-13 http://www.ruffordsmallgrants.org/files/RSG%20Vanak%20Final%20Report%202007.pdf 	<p>Activity 4.3. Canids in western India: rabies as a driver of Human-Wolf conflict and the role of free ranging domestic dogs as carriers of the disease</p>
<ul style="list-style-type: none"> • Krishna, C.Y. & Isvaran, K. 2010. Crop damage by Blackbuck: Investigating ecological causes and developing measures for mitigation. Interim report submitted to Maharashtra State Forest Department. 20pp. • Krishna, C.Y & Isvaran, K. 2010. Wildlife mortality on roads in the vicinity of the Great Indian Bustard Sanctuary, Nannaj. Report submitted to Maharashtra State Forest Department. 12pp. 	<p>Activity 4.4. Blackbuck in western India: a proposal to examine ecological mechanisms and develop measures for mitigation of crop damage by a wild Indian ungulate</p>
<p>Technical reports</p>	
<ul style="list-style-type: none"> • Linnell, J., Thomassen, J. & Jones, K. 2011. Wildlife-Human Interactions: From Conflict to Coexistence in Sustainable Landscapes. - NINA Special Report 45. 12 pp. http://www.nina.no/archive/nina/PppBasePdf/temahefte/2011/45.pdf • Thomassen, J., Linnell, J. & Skogen, K. 2011. Wildlife-Human Interactions: From Conflict to Coexistence in Sustainable Landscapes. Final report from a joint Indo-Norwegian project 2007-2011. - NINA Report 736. 81 pp 8+ appendix). 	<p>The project</p>
<ul style="list-style-type: none"> • Jayant Kulkarni (CES, IISc). 2011. All India Forest Division level questionnaire survey of Human - Wildlife conflict (activity 2). • Sar C K & Lahiri-Choudhury D K. 2011. Elephant-Human Interactions in Eastern India- Orissa (activity 4.1a-1) • Mukti Roy 2011. Elephant-Human Interactions in Eastern India- West Bengal (activity 4.1a-2) • Kannan, G. & Sukumar, R. 2011. Wildlife Human Interactions: from Conflict to Coexistence in Sustainable Landscapes: Nilgiri Eastern Ghats Landscape (activity 4.1b) • Vidya Athreya. 2011. Understanding human Leopard interactions in the western state of Maharashtra, India (activity 4.2) • Abi Tamin Vanak & Aniruddha Belsare. 2011. The role of Canine rabies in Human-Wolf conflict: Preliminary investigations in rural Maharashtra, India (activity 4.3) • Kavita Isvaran & Chaitanya Krishna. 2011. Crop damage by a wild Indian Ungulate: Investigating ecological causes and developing mitigation measures (activity 4.4) • Milind Watve. 2011. Crop raiding by wild Ungulates in Tadoba-Andhari Tiger Reserve, Maharashtra: A study of ecological patterns and remedial measures (activity 4.5) • Rohan Arthur, M.D. Madhusudan, Nachiket Kelkar, Aparna Lal, Núría Marbà & Teresa M. Alcoverro. 2011. The Trouble with Turtles: Fishers, green turtles, and seagrass meadow dynamics in the Lakshadweep Islands (activity 4.6a) • Aarathi Sridhar, Sasmita Mallick & Kartik Shanker. 2011. The Nature of Conflict - understanding Knowledge and Perceptions of and Attitudes towards Sea Turtle Conservation in Orissa (activity 4.6b) • Vishnupriya Kolipakam & Kartik Shanker. 2011. Comparing human wildlife conflict across different landscapes: a framework for examining social, political and economic issues and a preliminary comparison between sites (activity 4.7) • Vijay Jardhari, Prabhakar Rao & Ayushman Choudhary. 2011. Crop Dam- 	<p>Technical reports from this project, see annex 1</p>

<p>age by Wildlife in a Garhwal Himalayan village (activity 4.10)</p> <ul style="list-style-type: none"> • Siddhartha Krishnan. 2011. What does large carnivore predation of buffalo mean to the Toda? Understanding cultural, politico-legal and ecological contexts and consequences of Toda conflicts with tigers and leopards on the Nilgiri pastures, Southern India (activity 8.1) • Sunetro Ghosal. 2011. Human - large carnivore interactions in Akole, north-western Maharashtra (activity 8.2) • Nitin Rai & Siddhartha Krishnan. 2011. Understanding and Mitigating Human-Wildlife Conflict in the Biligiri Rangaswamy Temple Wildlife Sanctuary in the Context of the Forest Rights Act 2006 (activity 8.3) 	
<p>Manuals</p>	
<ul style="list-style-type: none"> • Human-Leopard conflict management guidelines (English) • Human-Leopard conflict management guidelines (Hindi) • Human-Leopard conflict management guidelines (Marathi) • Guidelines for Human-Leopard conflict management (Ministry of Environment and Forests, April 2011) http://www.eSocialSciences.com/data/articles/Document1224201149.698123E-02.pdf 	<p>Activity 4.2. Leopards and wolves in western India: the ecology of human-leopard and human-wolf conflicts in Maharashtra, India.</p>



Guidelines for human-leopard conflict management are one of numerous outputs from the project. Source: Vidya Athreya.

Popular articles and reports	
<ul style="list-style-type: none"> Raman Sukumar & Lalitha Murali Elephants. 2011. People & The Battle For Peaceful Co-Existence. <i>Current Conservation</i> 2010, vol 4 issue 4. John Linell & Morten Odden. 2011. Mind The Moose: Tales Of Conflict From The Land Of The Midnight Sun. <i>Current Conservation</i> 2010, vol 4 issue 4. Arati Rao. 2011. Whose Right Is It Anyway? The Farmer-Ungulate Conflict. <i>Current Conservation</i> 2010, vol 4 issue 4. Janaki Lenin. 2011. Sugarcane Leopards. <i>Current Conservation</i> 2010, vol 4 issue 4. Rohan Arthur & Kartik Shanker. 2011. Olive And Green: Shades Of Conflict Between Turtles & Fishers In India. <i>Current Conservation</i> 2010, vol 4 issue 4. Jay Mazoomdar. 2011. Act Responsible At The Top. <i>Current Conservation</i> 2010, vol 4 issue 4. Sindhu Radhakrishnan & Anindya Sinha. 2011. Dr. Jekyll And Mr. Hyde: The Strange Case Of Human-Macaque Interactions In India. <i>Current Conservation</i> 2010, vol 4 issue 4. Sunetro Ghosal, Siddhartha Krishnan & Ketil Skogen. 2011. Space Odyssey: Rephrasing Conflicts Over Large Carnivore Conservation. <i>Current Conservation</i> 2010, vol 4 issue 4. Ranjan Chakraborty. 2011. Prioritizing the Tiger: A History of Human-tiger conflict in the Sundarbans. <i>Current Conservation</i> 2010, vol 4 issue 4. Janaki Lenin. 2011. Circumventing the Elephant. <i>Current Conservation</i> 2010, vol 4 issue 4. Raman Sukumar, John Linell & Kartik Shanker. 2011. Can We Solve Human-Wildlife Conflict? <i>Current Conservation</i> 2010, vol 4 issue 4. 	<p>Project – Special issue of <i>Current Conservation</i> 2010, vol 4 issue 4.</p>
<ul style="list-style-type: none"> The need for more proactive solutions ~ Pankaj Sekhsaria - 16th Oct 2010 Leopard Tamil Article Sep-2010 Lessons from human - wildlife conflicts Precaution is better than a wrong treatment Leopard trouble: Any solution? Athreya, V.R. 2004. What do we do with the leopards? <i>Hornbill</i> July – Sep 2004 Athreya, V.R. 2009. Leopards and people. <i>Sanctuary Asia</i>. February. Linnell, J., Odden, M., Goshal, S., Athreya, V. 2011. Det er en leopard på kjøkkenet (<i>It's a leopard in the kitchen!</i>) <i>Våre Rovdyr</i> 1/2011. 	<p>Activity 4.2. Leopards and wolves in western India: the ecology of human-leopard and human-wolf conflicts in Maharashtra, India.</p>
<ul style="list-style-type: none"> Arthur, R and K. Shanker. 2010. Olive and Green: Shades of conflict between turtles and fishers in India. <i>Current Conservation</i> 4.4. Sridhar, A. <i>The unfairness of doing good. Infochange News & Features</i>, December 2010 http://infochangeindia.org/Environment/Coastal-commons/Questions-about-conservation.html Sridhar, A. and K. Shanker. Conservation beyond penalties and punishment <i>Infochange News & Features</i>, April 2010. http://infochangeindia.org/Agenda/Coastal-communities/Conservation-beyond-penalties-and-punishment.html 	<p>Activity 4.6. Sea turtles, fishers and shared spaces: understanding the roots of conflict in Lakshadweep and Orissa</p>
<ul style="list-style-type: none"> Ghosal, Krishnan and Skogen. 2011. 'Space odyssey: Rephrasing conflicts over large carnivore conservation'. <i>Current Conservation</i>. Untitled comparative paper with Sunetro Ghosal (NORAGRIC) and Ketil Skogen (NINA) in progress. 	<p>Activity 8.1 What does large carnivore predation of buffalo mean to the Toda? Understanding cultural, politico-legal and ecological contexts and consequences of Toda conflicts with tigers and leopards on the Nilgiri pastures, Southern India.</p>
<ul style="list-style-type: none"> Jones, K. & Skogen, K. 2011. Ulv, ulv – tiger, tiger (Wolf, wolf – tiger, tiger). <i>Forskning.no</i>. 16. May 2011. http://www.forskning.no/artikler/2011/mai/288068 	<p>Social science components</p>
Newspapers and journals	
<ul style="list-style-type: none"> Down to Earth February 2011 - Leopards in our alley learning to live with the leopards? ~ DNA Mumbai 29 Jan 11 	<p>Activity 4.2. Leopards and wolves in western India: the ecology of human-leopard and</p>

<ul style="list-style-type: none"> • Dont Shoot a cornered cat ~ Indian Express • Leopards in my backyard ~ Pankaj Sekhsaria • Ajoba's trek from Malshej Ghat to national park ~ The Times of India, Mumbai • LET'S UNBELL THE CAT ~ The Times of India, New Delhi • LIVING EARTH ~ Indian Express • The different shades of human animal relations ~ Financial Express • Watching the cat walk ~ Bangalore mirror • Article published in the Marathi Newspaper 'Gavakari' ~ 17th June 2010 • Article published in the Marathi Newspaper 'Prabhat' ~ 17th June 2010 • Article published in the Marathi Newspaper 'Navakal' ~ 16th June 2010 • Article published in the Marathi Newspaper 'Nagar-Vrutant' ~ 15th June 2010 • Article published in the Marathi Newspaper 'Sarvamat' ~ 15th June 2010 • Article published in the Marathi Newspaper 'Sakal' ~ 14th June 2010 • Leopard trouble: Any solution? ~ Article published in the Marathi Newspaper 'Sakal' on 1st November 2009 • Precaution is better than a wrong treatment ~ Article published in the Marathi Newspaper 'Sakal' on 10th November 2009 	human-wolf conflicts in Maharashtra, India.
<ul style="list-style-type: none"> • Vanak, A.T. (2008). "A dogged problem". Down to Earth Magazine, Issue: August 31, 2008 http://www.downtoearth.org.in/full6.asp?foldername=20080831&filename=news&sec_id=50&sid=43 	Activity 4.3. Canids in western India: rabies as a driver of Human-Wolf conflict and the role of free ranging domestic dogs as carriers of the disease
<ul style="list-style-type: none"> • Anandha Vikatan Tamil weekly interviewed us on 29-10-2008 on the topic "Why elephants are invading village?" 	Activity 4.1b. Wildlife-Human conflict in the Nilgiris Eastern Ghats landscape
<ul style="list-style-type: none"> • Ketil Skogen interviewed in an article in the Norwegian newspapers "Fædrelandsvennen" and "Aftenposten" June 6th, 2011: Folk & rovdyr – Mange former for samliv ("People and carnivores – many paths to coexistence") 	Project
Radio/TV coverage	
<ul style="list-style-type: none"> • Kartik Shanker and Aarthi Sridhar have been interviewed on Air India Radio shows regarding sea turtle conservation issues in Orissa. 	Activity 4.6. Sea turtles, fishers and shared spaces: understanding the roots of conflict in Lakshadweep and Orissa
<ul style="list-style-type: none"> • Vidya Athreya, John Linnell, Jørn Thomassen and Sunetro Ghosal: Human – leopard coexistence in Akole – "Schrödingers Katt" on NRK (Norwegian Broadcasting Corporation) at 19:45 hours, 11 March 2010 	Activity 4.2 and 8.2 Human – leopard interactions in Akole (merged titles)
<ul style="list-style-type: none"> • IBN Lokmat carried a documentary of our work at 1000 hours on 10 October 2010 	Activity 8.2 Human - large carnivore interactions in Akole, north-western Maharashtra
<ul style="list-style-type: none"> • Ketil Skogen interview 18th May 2011: Rovdyr i India og Norge i programmet "Banden" på NRK P3 (carnivores in India and Norway in "Banden" on NRK (Norwegian Broadcasting Corporation), channel 3) http://www.nrk.no/programmer/sider/banden/ 	Social science components
Films	
<ul style="list-style-type: none"> • July 2011: "Elephants days and nights" (taken from the title of one of Sukumars popular books), is a film produced to reflect the conflict study in West Bengal. It has a lot of footage about the GPS collaring and elephant movement as well, and ends with the issue of possible conversion of tea plantation to forest plantation using carbon credit financing. • We plan to organize screening to general (conservation, natural history, forest department) audiences in some of the major cities. Copies will also be distributed to forest departments and conservation organizations. Ashish 	Activity 4.1a. Elephants in eastern India (West Bengal)

and Shanthi Chandola who made the film will also explore the possibility of channels such as National Geographic and Discovery screening the film. Norwegian TV possibilities will also be checked.	
Public presentations at scientific / technical conferences	
<ul style="list-style-type: none"> Sridhar, A. 'Everybody loves a good fence: MPAs and control over coasts' Presented at the 30th Annual Symposium on Sea Turtle Biology and Conservation, 27th -29th April, 2010, Goa. Sridhar, A. 'Are Marine Protected Areas capable of achieving conservation in India?' At the Bombay Natural History Society Centenary Celebrations in Bangalore, 17th -19th February 2009. 	Activity 4.6. Sea turtles, fishers and shared spaces: understanding the roots of conflict in Lakshadweep and Orissa
<ul style="list-style-type: none"> Skogen, K. Conflicts over large carnivores in India and Norway: How do people's understanding of the landscape affect attitudes? <ul style="list-style-type: none"> Game research days, Grimsö Research Station, Sweden, October 2010. Hedmark University College course in "Human dimensions", January 2011. HWC conference in Bangalore, March 2011. International Symposium on Society and Natural Resource Management, Madison, Wisconsin, June 2011 ("forthcoming"). 	Social science components
<ul style="list-style-type: none"> Linnell, J. Conservation and conflicts: why saving the world is not easy! Thursday Seminars at the Norwegian University of Science and Technology (NTNU) Museum of Natural History and Archaeology 	Project
Forthcoming presentations	
<ul style="list-style-type: none"> Vidya Athreya and Sunetro Ghosal will talk at the ACES conflict conference in Aberdeen in August http://www.aces-2011.org/ 	Activity 4.2 and 8.2
<ul style="list-style-type: none"> Jørn Thomassen will present the project at the Norwegian University of Science and Technology in September 2011: "They can live with us, but can we live with them" 	The Project

Several manuscripts are under preparation for submission to peer reviewed journals.

10 Assessment of any commercial spin-offs or prospects for commercial benefits as a off shoot of the project

It has not been the aim of the project to gain any commercial spin-offs or prospects. However, potential spin-offs from the project can be a better coexistence in the multiuse landscapes given that the recommendations are followed up. Reduced crop damage will in particular mean increased access to food which again can have commercial value.



Landscape in Maharashtra. Photo: Jørn Thomassen.

11 Decentralisation and engagement with civil society

The project involved institutions from a wide range of geographic locations across India – in fact the partners were based almost entirely outside Delhi, coming from Pune, Bangalore and Mysore. In addition, it involved institutions with a wide range of structures, including universities, government funded research institutions, foundations and environmental NGOs. Likewise, in Norway, the main institution was based in Trondheim, but project collaborators were also situated in Oslo, Ås, Hedmark and Agder.

Further, the various project sites were located almost all over India, from West Bengal and Uttaranchal in the north to Lakshadweep and Nilgiri hills in the south. The nature of most of the projects resulted in extensive contact and engagement with the civil society – the main target of the human-wildlife conflict picture. The extent of these are listed below in chapter 13.



The nature of most of the projects resulted in extensive contact and engagement with the stakeholders - interviewing local people has been important in several of the project activities. Photo: John Linnell.

12 Stakeholder meetings

A wide range of stakeholder engagement has occurred in most of the activities (table 5). This has largely occurred through the informal contacts that emerge when conducting ecological research in rural areas or interviewing people during social science studies.



John Linnell talking about human-wildlife conflicts to local forest officers. Photo: Jørn Thomassen.

All these interactions involve a two way transfer of knowledge and experience. In addition, to these informal engagements, most projects have had extensive contact with the forestry department and local village councils.

Table 5. Stakeholder meetings conducted in the project.

Activity 4.1a. Elephants in eastern India (West Bengal)				
SI No	Place of Meetings	Date of meeting	Meeting with	Reason for meeting
1	West Bengal Forest Department		Mr.S.B.Mondal, Principal Chief Conservator of Forest (Wildlife),West Bengal	Wildlife-human conflict & CDM elephant corridor project
2	West Bengal Forest Department		Chief Conservator of Forest (Wildlife) ,northern Circle	Wildlife-human conflict & CDM elephant corridor project
3	West Bengal Forest Department		Conservator of Forest northern Circle	Wildlife-human conflict & CDM elephant corridor project
4	West Bengal Forest Department		Divisional Forest Officer. Jalpaiguri	Wildlife-human conflict & CDM elephant corridor project
5	West Bengal Forest Department		Divisional Forest Officer. Wildlife-III	Wildlife-human conflict & CDM elephant corridor project
6	West Bengal Forest		Divisional Forest Officer,Wildlife-II	Wildlife-human conflict & CDM elephant

	Department corridor			project
7	West Bengal Forest Department		Field Director ,Buxa Tiger Reserve	Wildlife-human conflict & CDM elephant corridor project
8	West Bengal Forest Department		Deputy Field Director, Buxa Tiger Reserve ,West	Wildlife-human conflict & CDM elephant corridor project
9	West Bengal Forest Department		Deputy Field Director, Buxa Tiger Reserve ,East	Wildlife-human conflict & CDM elephant corridor project
10	West Bengal Forest Department		Range officer, MalSquad	Wildlife-human conflict & CDM elephant corridor project
11	West Bengal Forest Department		Range officer, khunia Squad Squad	Wildlife-human conflict & CDM elephant corridor project
12	West Bengal Forest Department		Range Officer, Binnaguri Squad	Wildlife-human conflict & CDM elephant corridor project
13	Tea Management		Doors Branch Indian Tea Association	CDM elephant corridor project
14	Tea Management		Manager Beech Tea Garden	CDM elephant corridor project
15	Tea Management		Manager Dalsingpara Tea Garden	CDM elephant corridor project
16	Tea Management		Assistant Manager BharnobariTea Garden	CDM elephant corridor project
17	NGO		Doars Jagaran, Bnarhat, Jalpaiguri	CDM elephant corridor project
18	NGO		Nature and Adventure Society,Oodlabari,Jalpaiguri	CDM elephant corridor project
19	Osmanabad	Sept. 08	Meeting with the Resident Medical Officer in the Civil Hospital	Discussions regarding human rabies records maintained by the hospital
20	Osmanabad	Sept. 08	Meeting with the District Animal Husbandry Officer, Osmanabad	To obtain information regarding Animal rabies cases
21	Ropale Village, Dist. Solapur	Nov. 08	Meeting with the villagers	Discussions regarding organising vaccination campaign
22	Javala, Nannaj and Savargaon Villages, Ahmednagar District	Dec. 08	Meeting with the villagers	Discussions regarding organising vaccination campaign

Activity 4.1a. Elephants in eastern India (Orissa)

SI No	Place of Meetings	Date of meeting	Meeting with	Reason for meeting
Berhampur Circle				
1	Berhampur	Oct.10	DFO Berhampur & other office staff of the forest division.	Discussed about the information available on the wildlife - human conflict and possible mitigation methods adopted by the villagers and the efficiency of these methods. Collected information about the distribution of conflicting species.
2	Ghumsur North	Oct.10		
3	Ghumsur South	Oct.10		
Bhawanipatna Circle				
4	Subarnapur	Mar.10	DFO Subarnapur office staff of the forest division.	Discussed about the information available on the wildlife - human conflict and possible mitigation methods adopted by the villagers and the efficiency of these methods. Collected information about the distribution of conflicting species.
5	Bolangir	Mar.10	DFO Bolangir & other office staff of the forest division.	
6	Kalahandi North	Mar.10	DFO Kalahandi North & other office staff of the forest division.	
7	Kalahandi South	Mar.10	DFO Kalahandi South & other office staff of the forest division.	
8	Khariar	Mar.10	DFO Khariar & other office staff of the forest division.	
9	Sunabeda WL	Mar.10	DFO Sunabeda WL & other office staff of the forest division.	
Koraput Circle				
10	Malkangiri	Mar.10	DFO Malkangiri & other office staff of the forest division.	Discussed about the information available on the wildlife - human conflict and

11	Koraput	Mar.10	DFO Koraput & other office staff of the forest division.	possible mitigation methods adapted by the villagers and the efficiency of these methods. Collected information about the distribution of conflicting species.
12	Jeypor	Mar.10	DFO Jeypor & other office staff of the forest division.	
13	Nawarangapur	Mar.10	DFO Nawarangapur & other office staff of the forest division.	
14	Rayagada	Mar.10	DFO Rayagada & other office staff of the forest division.	
Sambalpur Circle				
15	Sambalpur North	Sep.08	DFO Sambalpur North & other office staff of the forest division.	Discussed about the information available on the wildlife - human conflict and possible mitigation methods adapted by the villagers and the efficiency of these methods. Collected information about the distribution of conflicting species.
16	Sambalpur South	Jan.09	DFO Sambalpur South & other office staff of the forest division.	
17	Rairakhol	Jan.09	DFO Rairakhol & other office staff of the forest division.	
18	Bamra WL	Sep.08	DFO Bamra WL & other office staff of the division.	
19	Hirakud WL	Sep.08	DFO Hirakud WL & other office staff of the division.	
Angul Circle				
20	Angul	Aug.08	DFO Angul & other office staff of the forest division.	Discussed about the information available on the wildlife - human conflict and possible mitigation methods adapted by the villagers and the efficiency of these methods. Collected information about the distribution of conflicting species.
21	Athgarh	Aug.08	DFO Athgarh & other office staff of the forest division.	
22	Athmallik	Aug.08	DFO Athmallik & other office staff of the forest division.	
23	Cuttack	Aug.08	DFO Cuttack & other office staff of the forest division.	
24	Dhenkanal	Aug.08	DFO Dhenkanal & other office staff of the forest division.	
25	Satkosia Wildlife	Jun.08	DFO Satkosia Wildlife & other office staff of the division.	
Bhubaneswar Circle				
26	Chandaka WL	Aug.08	DFO Chandaka WL & other office staff of the division.	Discussed about the information available on the wildlife - human conflict and possible mitigation methods adapted by the villagers and the efficiency of these methods. Collected information about the distribution of conflicting species.
27	Khurda	Mar.10	DFO Khurda & other office staff of the forest division.	
28	Puri WL	Mar.10	DFO Puri WL & other office staff of the forest division.	
29	Nayagarh	Oct.08	DFO Nayagarh & other office staff of the forest division.	
30	Mahanadi WL	Oct.08	DFO Mahanadi WL & other office staff of the division.	
31	Rajnagar WL	Mar.10	DFO Rajnagar WL & other office staff of the division.	
32	City Division	Mar.10	DFO City Division & other office staff of the forest division.	
Baripada Circle				

33	Baripada	Mar.08	DFO Baripada & other office staff of the forest division.	Discussed about the information available on the wildlife - human conflict and possible mitigation methods adopted by the villagers and the efficiency of these methods. Collected information about the distribution of conflicting species.
34	Balasore WL	Mar.08	DFO Balasore WL & other office staff of the division.	
35	Bhadrak WL	May.08	DFO Bhadrak WL & other office staff of the division.	
36	STR	Mar.08	Field Director STR & other office staff of the Tiger reserve.	
37	Rairangpur	Apr.08	DFO Rairangpur & other office staff of the forest division.	
38	Karanja	May.08	DFO Berhampur & other office staff of the forest division.	

Rourkela Circle

39	Keonjhar Territorial	Jun.09	DFO Keonjhar Territorial & other office staff of the forest division.	Discussed about the information available on the wildlife - human conflict and possible mitigation methods adopted by the villagers and the efficiency of these methods. Collected information about the distribution of conflicting species.
40	Keonjhar WL	Jun.09	DFO Keonjhar WL & other office staff of the division.	
41	Rourkela	Jan.09	DFO Rourkela & other office staff of the forest division.	
42	Sundargarh	Jun.09	DFO Sundargarh & other office staff of the forest division.	
43	Bonai	May.09	DFO Bonai & other office staff of the forest division.	
44	Deogarh	May.09	DFO Deogarh & other office staff of the forest division.	
45	PCCF Orissa Bhubaneswar WL	Feb.08	PCCF WL Orissa and other staff of the Office in the presence of Prof. R Sukumar.	Discussed about the wildlife - human conflict situation in Orissa and collection of information from the different forest divisions of Orissa.
46	CF Koraput circle	Mar.10	CF Koraput circle and other staff of the circle office	Discussed about the information available on the wildlife - human conflict and possible mitigation methods adopted by the villagers and the efficiency of these methods. Collected information about the distribution of conflicting species.
47	CF Sambalpur	Jan.09	CF Sambalpur circle and other staff of the Office in the presence of Prof. R Sukumar and representative of the local industries.	Discussed about the identification of corridor of elephants in and around Sambalpur forest circle.
48	PCCF Orissa Bhubaneswar General	Feb.10	PCCF General, Orissa and other staff of the Office in the presence of Prof. R Sukumar.	Discussed about the implementation of elephant corridor to mitigate the conflict problem.
49	Head of the Dept. Zoo. and Botani, GM college, Sambalpur	Mai.10	Head of the Dept. Zoo. and Botani, and students of the department.	We discussed about wildlife - human conflict problem and solution options.
50	27 Villages in 4 Forest Divisions	Apr.- Jun.10	Villagers of concern villages	Collected information on specific Questionnaire form same selected families.

	Workshop attended and presented paper	Date	Workshop attended by	Talk / Power point presented on topic
51	Workshop on "Elephant Management" at Manchabandha Central Nursery, Baripada, Baripada Forest Circle, Orissa,	28th March 2008	Forest Rangers, Forest protection committee members and selected villagers.	Presented paper on "Crop preference in elephant depredation prone area". And question answers with the villagers.

	Organised by Conservator of Forest and Field Director, Similipal Tiger Reserve, Baripada,			
52	Workshop on "Man-Elephant Interface" at Regional Museum of Natural History, Bhubaneswar, Organised by State Wildlife Department, Govt. of Orissa.	4th June 2008	Forest officials from eastern and central region of India, researchers and selected villagers from elephant affected villages.	Participated as rapporteur for two sessions.
53	Workshop on "Wildlife Conservation in Orissa" at Indian Institute of Mass Communication, Dhenkanal, Orissa. Organised by Wild Orissa and Indian Institute of Mass Communication.	15th Oct. 2009	Students from Indian Institute of Mass Communication, Dhenkanal, Orissa, Students from local colleges and local forest officials.	Presented paper (PowerPoint) on "Elephant Conservation in Orissa".

Activity 4.2. Leopards in western India: the ecology of human-leopard conflicts in Maharashtra, India

SI No	Place of Meetings	Date of meeting	Meeting with	Reason for meeting
1	Mumbai	09. Aug	Bombay Natural History Society	Talk on work
2	Nasik	09. May	Nashik Forest Department workshop	Policy meeting organized by state forest department
3	Mumbai	10. Mar	Bombay Veterinary College	Workshop for their students and teachers
4	Dehradun	10. Apr	Wildlife Institute of India	Workshop on telemetry
5	Shimla	10. May	HP FD	Talk to local forest officers
6	Akole	10. May	Press conference	Talking to media at study site
7	Coimbatore	10. Jun	Sacon	Talk to scientists
8	Tadoba	10. Jul	Tadoba Tiger Reserve	FD workshop
9	Pune	10. Sep	Chief Wildlife Warden Maharashtra	Talk about work
10	Karmala	11. Jan	Village Karmala	FD wanted me to talk to villagers who pressurizing FD to set up trap cages
11	Delhi	11. Mar	Meeting with central environment minister	To appraise him of leopard conflict issues
12	Dehradun	11. Mar	IGNFA	Was invited to talk at mid-career training for IFS
13	Karad	11. Mar	Multiple stakeholder workshop	FD wanted Vidya Athreya to talk at the town where leopard had been shot – meeting was organized by FD and police, media and local villagers were called

Activity 4.5. Crop Raiding by Wild Ungulates in Tadoba–Andhari Tiger Reserve, Maharashtra: a study of ecological patterns and remedial measures

SI No	Place of Meetings	Date of meeting	Meeting with	Reason for meeting
1	Nagpur	Jul.08	PCCF (Wildlife) Nagpur	Discuss objectives of the project, proposed method for data collection and expected outcome of the analysis with a

				view to seek permission for initiating field work
2 T	adoba Anderi Tiger Reserve	Jun.08-Jan.10	Farmers in villages along western boundary of TATR.	1152 farmers from 14 villages were interviewed
3 Cha	ndrapur	Jul.10 and Dec.10	Meetings with Mr. Mohanbhai Hiralal of Vruksha Mitra (Chandrapur) and Mr. Vijay Dethle of Rajora Vikas Samiti (Tal Rajora, Dist Chandrapur),	Discussing findings, and suggesting solutions viable at grass root level and applicable in regional social framework

Activity 4.6. Sea turtles, fishers and shared spaces: understanding the roots of conflict in Orissa

SI No	Place of Meetings	Date of meeting	Meeting with	Reason for meeting
1 Bhub	aneshwar, Orissa	Dec.08	OMRCC(Orissa Marine Resources Conservation Consortium)	Introduction to members about the present project and other OMRCC discussions
2 Bhub	aneshwar, Orissa	Apr.09	OMRCC	Discussions on members projects and operational aspects of the OMRCC
3 Chatrapur,	Ganjam district, Orissa	Aug.09	OT FWU representatives (fish-worker leaders) of Ganjam district	Consultative meeting on perceptions of and recommendations on legislations for marine conservation
4 Rajnagar,	Kendrapara district, Orissa	Aug.09	OT FWU representatives (fish-worker leaders) of Rajnagar, Kendrapara district	Consultative meeting on perceptions of and recommendations on legislations for marine conservation
5 Bhub	aneshwar, Orissa	Nov.09	OMRCC meeting	Discussion on furthering the objectives of the platform and on legal recognition to local monitoring efforts
6 Kaliakono,	Astarang Block, Puri district, Orissa	Jan.10	OT FWU representatives (fish-worker leaders) of Kaliakono, Puri district	Consultative meeting on perceptions of and recommendations on legislations for marine conservation
7 Kharnasi,	Kendrapara district, Orissa	Feb.10	OT FWU representatives (fish-worker leaders) of Mahalakpara block, Kendrapara district	Consultative meeting on perceptions of and recommendations on legislations for marine conservation
8	Goa, India	Apr.10	Conducted a special one-day meeting titled 'Fisheries Forum' at the 30th Annual Symposium on Sea Turtle Biology and Conservation, Goa, India	To provide an opportunity for participants to learn and share information on the nature, culture and organisation of fisher communities, the challenges and politics of fisheries management and marine conservation.

13 Policy implications

The entire project was intended to be based around applied research, and as a result all projects had clear policy implications, the most important of which are listed below (table 6). There are some overlap between Policy implications and Recommendations (chapter 14). Policy implications, however, focus more on decision making and mitigation based on existing knowledge while recommendations are more oriented against further knowledge needs and further investigations and research to better understand the mechanisms of human – wildlife conflicts.

Table 6. Most important policy implications from the project.

Project	Policy implications
<i>Activity 2. All India survey and GIS mapping of wildlife-human conflicts</i>	The dialog with the state forest officers is in itself an important output in the project. It has revealed that data are very poorly organized in many states and that there is no overview of conflict data available to inform decision makers about wildlife policy.
<i>Activity 3. Attitudes of local people towards wildlife-human conflicts</i>	None
<i>Activity 4.1a. Elephants in eastern India (West Bengal and Orissa)</i>	<ol style="list-style-type: none"> 1. Development of strategy for wildlife –human conflict mitigation, preparedness for implementing such policy in the field. 2. Consolidation of forest area and linking of habitat through development of corridors. 3. Verification of population through different methods of census. 4. Training to forest staff with modern scientific methods of wildlife conservation for field implementation.
<i>Activity 4.1b. Wildlife-Human conflict in the Nilgiris Eastern Ghats landscape (Completed)</i>	<ol style="list-style-type: none"> 1. Awareness meeting was conducted for stakeholders in Sathyamangalam to minimize human elephant conflict. 2. Capacity building programme had been done for secondary school students in the core area of Mudumalai Tiger Reserve to highlight the role of elephants in the ecosystem. 3. Presentation had given to stakeholder of Masinagudi regarding ecology and behavior of wild elephants. 4. Black buck census have been conducted first time in Sathyamangalam forest division and also proposed for area ideal for Blackbuck habitat. 5. Removal of invasive weed in the Blackbuck habitat has been suggested to D.F.O Sathyamanagalam. 6. Map generated with distribution of Blackbuck and also area vulnerable for crop damage
<i>Activity 4.2. Leopards and wolves in western India: the ecology of human-leopard and human-wolf conflicts in Maharashtra, India.</i>	<ol style="list-style-type: none"> 1. Increase in knowledge base of the fact that a large cat can persist with minimal harm to human life even in densely human dominated landscapes 2. Increase in understanding that conflict can be controlled even in extreme cases (high density of large cat among high density of humans) 3. We can identify measures to take to reduce losses to people due to livestock depredation 4. We can identify measures to take to reduce human-large cat encounters in densely populated rural town 5. Vidya Athreya has been nominated by the NTCA as member of committee (http://projecttiger.nic.in/whatsnew/committee_leopard.pdf) which has been set up to tackle leopard mortality due to conflict 6. A workshop with Policy makers attending will be conducted in early March 2011 to present and discuss the major key findings of the project, to develop mechanisms of better coexistence between animals and humans and to promote implications of policy to control conflicts. 7. The data on wolf conflicts shows that depredation has a much smaller effect than disease in livestock mortality, and that relatively few people bother applying for compensation because of the complexity of the process.
<i>Activity 4.3. Canids in western India: rabies as a driver of Human-Wolf conflict and the role of free ranging domestic dogs as carriers of the disease</i>	<p>There are general implications that arise from the project objectives that can be used to formulate policies. The spill-over of pathogens from domestic dogs to wild canids is well established. Based on our preliminary investigations, we find that there are two main thrust areas to reduce such spill-over events:</p> <ol style="list-style-type: none"> 1. The reduction of the susceptible reservoir population of dogs. This can be achieved by sustained population control measures, targeted vaccination campaigns and edu-

	<p>cation.</p> <ol style="list-style-type: none"> 2. Reduction of contact between dogs and wild canids. This can be achieved by population control measures, responsible dog ownership programs and the restriction of free-ranging activities of dogs.
<p><i>Activity 4.4. Blackbuck in western India: a proposal to examine ecological mechanisms and develop measures for mitigation of crop damage by a wild Indian ungulate</i></p>	<ol style="list-style-type: none"> 1. Semi-arid grassland management: Findings on habitat use by blackbuck suggest that unprotected grasslands should not be converted to plantations under afforestation programmes as they become unsuitable to fauna dependent on this landscape. For the same reason, exotic trees in plantations established in semi-arid areas should be removed. Our findings indicate that blackbuck avoid areas with very tall grass; grass height was typically high within protected grasslands and plantations in the Nannaj landscape. In grassland protected areas elsewhere, grass is harvested on a rotational basis and this mosaic of habitats provides habitat for species that prefer both tall and short grass areas. A limited and carefully monitored rotational grass harvesting scheme could be tried on an experimental basis. For the suggested management interventions of reducing tree density in plantations and harvesting of grass, it is very important that it is first tried out in a small area and that vegetation changes and the behaviour of the different animal species of interest are intensively monitored in order to assess the effectiveness of management measures and make appropriate modifications. 2. Crop damage mitigation measures: Our findings concerning the level of crop damage occurring in the landscape can be used to examine levels of conflict (a more complex phenomenon involving damage, perception and other factors) and underlying reasons for this conflict. This study shows that blackbuck crop damage is localized and not extensive in Nannaj; however, in the places that it does occur, damage is frequently substantial. <p>Our study has found that fields vary widely in whether they are likely to be visited by blackbuck or not and we have identified some important predictors of whether a field is likely to experience damage or not. This information could be used to map out agricultural areas with differing levels of risk of damage by blackbuck. For the different levels of risk, appropriate potential mitigation measures can now be tested and evaluated.</p>
<p><i>Activity 4.5. Crop Raiding by Wild Ungulates in Tadoba-Andhari Tiger Reserve, Maharashtra: a study of ecological patterns and remedial measures</i></p>	<ol style="list-style-type: none"> 1. Since the direct and indirect damages estimated are substantially large and direct damage is difficult to estimate, compensation is unlikely to be an effective solution in the long run. The subjectivity of damage assessment is more likely to breed corruption. Also direct damage being only a small part of the total loss, compensation would be always inadequate. Compensations should be looked upon only as temporary solutions until long term remedies are allowed to evolve and effectively implemented. 2. Experiments on growing unpalatable crops need to be performed as a possible remedy. The remedy can be successful only if there is sufficient education of farmers towards the new crops as well as organized efforts to reach the right market. This can perhaps be effectively done through farmers' cooperatives. Efforts are underway to form such cooperatives. Alternatively the wild life management may offer buy back schemes for such crops. Some such crop species are grown locally in some areas. For example turmeric appears to be immune to attack by any wild animal. Currently it is grown in small patches and fetches good market value. So far it has not spread because of greater input costs in plantation, greater water requirement and the need for post harvesting processing that involves both cost and labour. The farmers' cooperative will try to work out solutions and promulgate such crops.
<p><i>Activity 4.6. Sea turtles, fishers and shared spaces: understanding the roots of conflict in Lakshadweep and Orissa</i></p>	<p>Lakshadweep</p> <ol style="list-style-type: none"> 1. There is often a large chasm between the normal measures of conflict and its lived experience. This gap exists because conflict can often have multiple drivers, and not all these drivers can be easily quantified. It requires a more nuanced understanding of the first and second-order drivers of conflict to clearly appreciate its full impact on human communities. This may mean a fuller understanding of the ecological processes that underly conflicts, or, in some instances, the socio-political underpinning of conflict situations. 2. While first order conflicts may be relatively easy to monetize and alleviate through compensation schemes and other such amelioratory devices, second order conflicts may be much more difficult to translate into mere monetary terms. Realistic valuations of opportunity costs and lost ecosystem services suggest that the cost of second order conflict could be an order of magnitude higher than first-order interactions. This may explain why many attempts at addressing conflict are inadequate since they normally address only 1st order interactions. 3. At a more fundamental policy level, important questions are raised about prioritizing ecosystem function and services over simple species conservation approaches. A

	<p>more holistic management of sea grass ecosystems as functioning meadows rather than turtle pastures may offer better all-round solutions for the ecosystem as well as for communities and species dependent on it.</p> <p>4. The study provides an opportunity to view coastal/ marine management decisions using an approach of understanding and resolving conflicting resource use claims. By investigating these claims, using natural and social science approaches, we have been able to uncover not just the second order triggers of conflict such as competition over limited resources (between turtles and fisheries), but also direct, or first order sources of conflict such as loss of nets from turtle hits. These findings have the potential to inform what intervention or response might be appropriate and who should adopt these, thereby providing a more grounded means of management rather than technical fixes.</p> <p>Orissa</p> <p>1. By conducting 4 district workshops on fisherfolk perceptions in the three mass nesting regions, we are utilizing the opportunity of engagement that the project presents, to assist the traditional fishworker union in Orissa in developing a clear articulation on each of the rules and regulations concerning turtles and fisheries management. This has provided the union representatives with a chance to deliberate on the areas that they can negotiate with the state and other agencies regarding fishing rights and accommodations for conservation.</p> <p>2. Our study about perceptions on conflicts and stakeholders also affords us the opportunity to understand the dynamic in operation in multi-stakeholder collaborative platforms such as the Orissa Marine Resources Conservation Consortium, as a means to resolve conflicts over conservation.</p>
<p><i>Activity 4.7. A landscape level synthesis of wild-life-human conflicts in India</i></p>	<ol style="list-style-type: none"> 1. Clearly, there are important cultural and religious factors that influence peoples attitudes and response to conflict. 2. The understanding and perception of laws also affects influences conflict. In general, the understanding of law and its intent seemed to be unclear. 3. These case studies show how antagonism towards laws can lead to retaliation, and negative attitudes towards animals, thus having the opposite effect that the laws were intended to have. The need to involve communities in creating conservation frameworks, or at least in local decision making seems necessary if their support is required for conservation. 4. The gap in people's perception about conflict, official figures, and government perceptions about conflict needs to be more closely examined. 5. Given the role of a suite of social factors, such as local knowledge, culture, economic status and governance, it is critical that future studies incorporate these aspects to gain a nuanced understanding of conflict which will lead to better mitigation and management plans. 6. A general understanding of the drivers of conflict can help shape policy so that conflict can be reduced to the greatest extent possible. 7. Policy needs to be modified so that it does not aggravate conflict and negatively impact conservation objectives.
<p><i>Activity 4.10. Crop Damage by Wildlife in a Garhwal Himalayan vil-lage</i></p>	<p>None</p>
<p><i>Activity 5. Expert and stakeholder involvement</i></p>	<ol style="list-style-type: none"> 1. A wide range of stakeholder engagement has occurred in most of the activities. This has largely occurred through the informal contacts that emerge when conducting ecological research in rural areas or interviewing people during social science studies. All these interactions involve a two way transfer of knowledge and experience. 2. In addition, to these informal engagements, most projects have had extensive contact with the forestry department and local village councils. <p>See also chapter 13</p>
<p><i>Activity 6. Conflict mitigation</i></p>	<p>Not reported, phase II</p>
<p><i>Activity 7. Convention on Biological Diversity</i></p>	<ol style="list-style-type: none"> 1. The goal of this project has been to exchange experience and jointly conduct research on human-wildlife conflicts to such a level that we have equivalent data on ecological, economic, social and political aspects of the conflicts from both India and Norway. Interdisciplinary research that collects scientific and local knowledge is crucial to turn conservation conflicts into opportunities for coexistence. 2. The results of this project have served to identify the widespread nature and diversity

	<p>of conflicts that occur between humans and wildlife, as well as the similarity of the conflict picture between two countries as diverse as Norway and India. This realization is central to understanding why the implementation of these biodiversity conventions is so difficult across diverse socio-economic and political situations.</p> <p>3. It implies that there is a need to realize that a lot of biodiversity conservation implies a cost as well as benefits and that there is a need to consider both a sharing of costs as well as a sharing of benefits.</p> <p>See also chapter15</p>
<i>Activity 8.1 What does large carnivore predation of buffalo mean to the Toda? Understanding cultural, politico-legal and ecological contexts and consequences of Toda conflicts with tigers and leopards on the Nilgiri pastures, Southern India</i>	<ol style="list-style-type: none"> 1. The main stakeholders engaged in this project are the Toda people and the Tamil Nadu Forest Department. The former are not organized into any committees or councils. 2. One meeting was conducted with Todas belonging to various clans. 3. Another meeting is planned after the completion of the report. For this meeting local/state forest department personnel and the Todas are likely to be invited. 4. Engaging with forestry agencies involved in implementing the possible grassland restoration component under the Green India Mission. The scheme itself is awaiting the Planning Commission's approval.
<i>Activity 8.2 Human - large carnivore interactions in Akole, north-western Maharashtra</i>	<ol style="list-style-type: none"> 1. This project provides a critique of existing policy framework for large carnivore conservation for its restrictive outlook in excluding people, and human-dominated landscapes, from conservation practices. 2. It provides inputs to make conservation practice, especially for large carnivores, more effective without alienating people. It provides evidence on the practical implications of political, historical, cultural and socio-economic norms and institutions, which can make conservation practice more effective. 3. It provides practical suggestions to consolidate mechanisms that can mitigate conflicts between people and large carnivores in the short and long term. This includes streamlining existing mechanisms and integrating legal, economic, socio-political and cultural institutions that facilitate coexistence and minimize the impact of losses.
<i>Activity 8.3 Towards an assessment of the management of Protected areas and Reserve forests in the context of the Recognition of Forests Rights Act, 2006</i>	<ol style="list-style-type: none"> 1. Documenting FRA implementation and its influence in changing Soliga attitudes to conservation will have consequences for a rights based approach to conservation. 2. BRT has recently been declared a Tiger reserve without any public consultation or due process. The results of the study will hope to influence the tiger reserve management in ensuring a more inclusive PA management.



Forest officers are important stakeholders in the human-wildlife conflict picture. Photo: John Linnell.

14 Recommendations

There are some overlap between Recommendations and Policy implications (chapter 13). Recommendations, however, focus more on knowledge needs and further investigations and research to better understand the mechanisms of human – wildlife conflicts while policy implications are more oriented against decision making and mitigation based on existing knowledge (table 7).

Table 7. Most important recommendations from the project.

Project	Recommendations
<i>Activity 2. All India survey and GIS mapping of wildlife-human conflicts</i>	<p>The survey was a very enlightening experience since we had to contact a large number of forest divisions from different states. Some recommendations are given below based on the experience of carrying out the survey.</p> <ol style="list-style-type: none"> 1. The records on HWC are maintained in different formats in different divisions. In most divisions the records are maintained in registers and each division has a different system of recording the information. It will be useful to develop a software that enables recording of the data on this subject in a standard format at the forest division office. This software should be distributed to all forest divisions for recording the information. Better still the data should be maintained in a centralised database over the internet. Extraction of information will then be very easy. All divisions do not yet have internet access but the process can be started at least for those divisions where internet access is available. This issue needs to be taken up with the Ministry of Environment and Forests. 2. Most states do not have an administrative map that shows all forest divisions in the state. When we tried to obtain such maps we found that they were available for very few states. Such maps should be prepared for by the Forest Department of each state. 3. An unexpected finding emerged from the study. We found large number of attacks on people due to jackal in Madhya Pradesh. On enquiry we found that the likely cause was rabies infection. This represents a very high and localised incidence of rabies. It is important to carry out an investigation into this by medical and veterinary experts. Other findings are likely to emerge when the data is analysed in detail which may warrant further investigation. 4. There are several differences in the policies and practices regarding management of human wildlife conflict between different states. It would be very useful to carry out a study on HWC management policy and practices in different states of the country and to bring out recommendations for a uniform policy throughout the country.
<i>Activity 3. Attitudes of local people towards wildlife-human conflicts</i>	None
<i>Activity 4.1a. Elephants in eastern India (West Bengal and Orissa)</i>	<ol style="list-style-type: none"> 1. To have details of elephant depredation pattern, a register of its frequency, should be maintained at all Range Offices, in which all claims along with date of raiding crop, affected area and number of marauding animals should be recorded. 2. The central database should include up-to-date data of encroachments and actual loss suffered by villagers in the Division and the State as a whole. 3. One-window system should be followed for payment of <i>ex gratia</i> relief. 4. Mining policy should be environment friendly. 5. A State level elephant task force should be set up to make micro-level recommendations for the most affected Divisions for mitigating conflict and elephant conservation measures. 6. Special efforts must be made to discourage raids on stored grain in January by erection of small energized barriers or spraying grounds surrounding stores or underground silos with repellent chemicals. 7. Storing of harvested paddy should be community based in a village and should follow the <i>Pit / Khani</i> (silo) method of Ganjam District of Orissa, where regular attack on harvested stored grain is noticed. 8. The terrain permitting, more intensive use is recommended, tractors / motorcycle without silencer for charging herds or even solitaires in the act of crop depredation. 9. Animals responsible for unprovoked and deliberate manslaughters should be eliminated from the wild by shooting or capture on proper recognition. 10. Supply of anti-depredation equipments at Range and Beat level and to VSSs, such

	<p>as flare-lights, powerful spot-light with hand-held rechargeable batteries, rockets that bang at the end, powerful crackers, spraying instruments to create big flare on lighted brands, and hooters and loud-hailers, etc.</p> <ol style="list-style-type: none"> 11. A micro-level study should be conducted to determine which villages need solar and main-line electric connection to prevent depredation, particularly of stored grain, and such lighting should be maintained by VSS or FPC of the area. 12. Creation of at least one elephant-scaring team for each Forest Division with vehicle and scaring equipments. 13. A system of attractive cash rewards for information leading to recovery of elephant / tiger / leopard products and arrest of culprits. 14. Two demo-plots or more in each of the identified forest division should be set up on non-forest land to demonstrate the economic viability of cultivating alternative cash crop unpalatable to elephants. 15. A top-most level review is urgently needed of the present highly inadequate rate of relief for house damage and ensuing speedy settlements of the claims. Government rules should be suitably amended to allow payment of <i>ex gratia</i> relief to stored grain as well as damage to fruit trees and plants. 16. In dry season, elephant range boundaries should be demarcated and must be protected and expansion of all types of agricultural activity in these areas has to be stopped. 17. On the buffer area of elephant - ranges the cultivated crop should be unpalatable to elephants. 18. Buffer zones should not be protected by electric fencing or by other barriers; only the regular cultivated areas should be protected. 19. The State should have a separate wing for all the elephant reserves of Orissa. An officer should head it not less than of the rank of CCF. 20. In depth study on bear- human conflict is essential to mitigate the problem.
<p><i>Activity 4.1b. Wildlife-Human conflict in the Nilgiris Eastern Ghats landscape</i></p>	<ol style="list-style-type: none"> 1. Realign the boundaries in protected areas and removal of invasive weeds from micro habitat of elephants would enhance the availability of vital habitat, and also minimize conflict. 2. Prepare clear land use pattern map and incorporate seasonal movement and density of elephant would give an idea of animal concentration in certain areas and alert farmer for mitigation plans. 3. Compensation paid for crop and property damage should be given immediately without delay and formalities for the same should be cut off. 4. Awareness program should be taken up immediately for the susceptible farmers in order to maintain the EPT and electric fence. 5. High priority should be given for conservation education in schools in and around the protected area to avoid serious conflict in future. 6. Encourage indigenous method of approaching conflict mitigation and also should implement subsidy plans for such approach thorough government. 7. Identify problematic animal carefully before capture and monitoring should be done on a regular basis after releasing in the wild. 8. Develop well established intelligence network to avoid poaching which continues as a threat to carnivore population in the protected areas.
<p><i>Activity 4.2. Leopards and wolves in western India: the ecology of human-leopard and human-wolf conflicts in Maharashtra, India.</i></p>	<ol style="list-style-type: none"> 1. Increase in knowledge base of the fact that a large cat can persist with minimal harm to human life even in densely human dominated landscapes 2. Increase in understanding that conflict can be controlled even in extreme cases (high density of large cat among high density of humans) 3. We can identify measures to take to reduce losses to people due to livestock depredation 4. We can identify measures to take to reduce human-large cat encounters in densely populated rural town 5. Vidya Athreya has been nominated by the NTCA as member of committee (http://projecttiger.nic.in/whatsnew/committee_leopard.pdf) which has been set up to tackle leopard mortality due to conflict 6. A workshop with Policy makers attending will be conducted in early March 2011 to present and discuss the major key findings of the project, to develop mechanisms of better coexistence between animals and humans and to promote implications of policy to control conflicts. 7. The data on wolf conflicts shows that depredation has a much smaller effect than disease in livestock mortality, and that relatively few people bother applying for compensation because of the complexity of the process.
<p><i>Activity 4.3. Canids in western India: rabies as a driver of Human-Wolf</i></p>	<p>Based on the preliminary data collected during this survey, we recommend that:</p> <ol style="list-style-type: none"> 1. More intensive surveys of rabies prevalence be carried out in affected regions.

<p><i>conflict and the role of free ranging domestic dogs as carriers of the disease</i></p>	<p>2. Workshops for capacity building of the state wildlife authorities and animal husbandry departments so as to ensure rapid response to wolf attacks on humans and endeavor to either capture the animal alive or obtain a suitable sample for confirmatory analysis of rabies.</p>
<p><i>Activity 4.4. Blackbuck in western India: a proposal to examine ecological mechanisms and develop measures for mitigation of crop damage by a wild Indian ungulate</i></p>	<p>1. Semi-arid grassland management: Findings on habitat use by blackbuck suggest that unprotected grasslands should not be converted to plantations under afforestation programmes as they become unsuitable to fauna dependent on this landscape. For the same reason, exotic trees in plantations established in semi-arid areas should be removed. Our findings indicate that blackbuck avoid areas with very tall grass; grass height was typically high within protected grasslands and plantations in the Nannaj landscape. In grassland protected areas elsewhere, grass is harvested on a rotational basis and this mosaic of habitats provides habitat for species that prefer both tall and short grass areas. A limited and carefully monitored rotational grass harvesting scheme could be tried on an experimental basis. For the suggested management interventions of reducing tree density in plantations and harvesting of grass, it is very important that it is first tried out in a small area and that vegetation changes and the behaviour of the different animal species of interest are intensively monitored in order to assess the effectiveness of management measures and make appropriate modifications.</p> <p>2. Crop damage mitigation measures: Our findings concerning the level of crop damage occurring in the landscape can be used to examine levels of conflict (a more complex phenomenon involving damage, perception and other factors) and underlying reasons for this conflict. This study shows that blackbuck crop damage is localized and not extensive in Nannaj; however, in the places that it does occur, damage is frequently substantial. Our study has found that fields vary widely in whether they are likely to be visited by blackbuck or not and we have identified some important predictors of whether a field is likely to experience damage or not. This information could be used to map out agricultural areas with differing levels of risk of damage by blackbuck. For the different levels of risk, appropriate potential mitigation measures can now be tested and evaluated.</p> <p>Grassland management:</p> <ul style="list-style-type: none"> - Our findings indicate that plantation areas in Nannaj are under utilized by blackbuck, most likely because blackbuck tend to avoid more closed habitats. Therefore, reducing tree density in plantations, especially the exotic tree <i>Glyricidia sepium</i> would increase blackbuck use of plantation areas. More generally, we suggest that unprotected grasslands should not be converted to plantations under afforestation programmes as they become unsuitable to fauna dependent on this landscape. - Our findings indicate that blackbuck avoid areas with very tall grass. In grassland protected areas elsewhere (for e.g., Velavadar National Park in Gujarat), grass is harvested on a rotational basis (Figure 24) and this mosaic of habitats provides habitat for species that prefer both tall and short grass areas. A rotational grass harvesting scheme could be tried on an experimental basis. <p>For the suggested management interventions of reducing tree density in plantations and harvesting of grass, it is very important that it is first tried out in a small area and that vegetation changes and the behaviour of the different animal species of interest are intensively monitored in order to assess the effectiveness of management measures and make appropriate modifications.</p> <p>3. Monitoring of blackbuck populations: Blackbuck at low population densities is unlikely to cause extensive crop damage. Population trends can be established and incorporated into the management decisions only if long term data are available. Very little information exists on blackbuck population dynamics at Nannaj and therefore it is essential to set up a robust and effective monitoring scheme.</p>
<p><i>Activity 4.5. Crop Raiding by Wild Ungulates in Tadoba–Andhari Tiger Reserve, Maharashtra: a study of ecological patterns and remedial measures</i></p>	<p>1. Since the direct and indirect damages estimated are substantially large and direct damage is difficult to estimate, compensation is unlikely to be an effective solution in the long run. The subjectivity of damage assessment is more likely to breed corruption. Also direct damage being only a small part of the total loss, compensation would be always inadequate. Compensations should be looked upon only as temporary solutions until long term remedies are allowed to evolve and effectively implemented.</p> <p>2. Experiments on growing unpalatable crops need to be performed as a possible remedy. The remedy can be successful only if there is sufficient education of farmers towards the new crops as well as organized efforts to reach the right market. This can perhaps be effectively done through farmers' cooperatives. Efforts are underway to form such cooperatives. Alternatively the wild life management may offer buy back</p>

	<p>schemes for such crops. Some such crop species are grown locally in some areas. For example turmeric appears to be immune to attack by any wild animal. Currently it is grown in small patches and fetches good market value. So far it has not spread because of greater input costs in plantation, greater water requirement and the need for post harvesting processing that involves both cost and labour. The farmers' cooperative will try to work out solutions and promulgate such crops. However, first of all a search and experimental plantations for inedible crops suitable for the particular soil and climatic conditions need to be undertaken.</p> <p>3. The approach of self inquiry, i.e. participation of farmers in data collection appeared to be highly useful and insightful and an extension of it needs to be explored.</p>
<i>Activity 4.6. Sea turtles, fishers and shared spaces: understanding the roots of conflict in Lakshadweep and Orissa</i>	<p>Lakshadweep</p> <p>1. The study provides an opportunity to view coastal/ marine management decisions using an approach of understanding and resolving conflicting resource use claims. By investigating these claims, using natural and social science approaches, we have been able to uncover not just the second order triggers of conflict such as competition over limited resources (between turtles and fishers), but also direct, or first order sources of conflict, such as loss of nets from turtle hits. These findings have the potential to inform what intervention or response might be appropriate and who should adopt these, thereby providing a more grounded means of management rather than technical fixes.</p> <p>Orissa</p> <p>1. By conducting 4 district workshops on fisherfolk perceptions in the three mass nesting regions, we are utilizing the opportunity of engagement that the project presents, to assist the traditional fishworker union in Orissa in developing a clear articulation on each of the rules and regulations concerning turtles and fisheries management. This has provided the union representatives with a chance to deliberate on the areas that they can negotiate with the state and other agencies regarding fishing rights and accommodations for conservation.</p> <p>2. Our study about perceptions on conflicts and stakeholders also affords us the opportunity to understand the dynamic in operation in multi-stakeholder collaborative platforms such as the Orissa Marine Resources Conservation Consortium, as a means to resolve conflicts over conservation.</p>
<i>Activity 4.7. A landscape level synthesis of wild-life-human conflicts in India</i>	<p>1. The need to involve communities in creating conservation frameworks or at least in local decision making seems necessary if their support is required for conservation.</p> <p>2. Further data collection and analysis should be carried out. The gap in people's perception about conflict, official figures, and government perceptions about conflict needs to be more closely examined. Given the role of a suite of social factors, such as local knowledge, culture, economic status and governance, it is critical that future studies incorporate these aspects to gain a nuanced understanding of conflict which will lead to better mitigation and management plans.</p> <p>3. A general understanding of the drivers of conflict can help shape policy so that conflict can be reduced to the greatest extent possible.</p> <p>4. Policy needs to be modified so that it does not aggravate conflict and negatively impact conservation objectives.</p>
<i>Activity 4.10. Crop Damage by Wildlife in a Garhwal Himalayan village (Completed)</i>	None
<i>Activity 5. Expert and stakeholder involvement</i>	N.A.
<i>Activity 6. Conflict mitigation</i>	Not reported, phase II
<i>Activity 7. Convention on Biological Diversity</i>	See chapter 15
<i>Activity 8.1 What does large carnivore predation of buffalo mean to the Toda? Understanding cultural, politico-legal and ecological contexts and consequences of Toda conflicts with tigers and leopards on the</i>	<p>1. In understanding and mitigating conflicts, biologists need to also engage with sociologists and anthropologists, rather than constantly seeking the economist. Conflicts have cultural and symbolic meaning, besides material aspects.</p> <p>2. While engaging with the materiality of conflict is indispensable, engaging with people's meaningful interpretations of the conflict circumstances, the landscape of conflict, and carnivore presence is crucial. Especially in territorial forests where people will live in legislatively mandated 'violate' circumstances and thus need to be recruited to participate in conservation.</p> <p>3. Consider the upper Nilgiris for grassland restoration under the Green India Mission.</p>

<p><i>Nilgiri pastures, Southern India</i></p>	<p>Grassland restoration works well as a conflict mitigation mechanism as monitoring of predator and prey stands enhanced.</p> <p>4. Revamp the official compensation process by cutting red tape and making the process transparent.</p>
<p><i>Activity 8.2 Human - large carnivore interactions in Akole, north-western Maharashtra</i></p>	<p>1. Politics of conservation in human-dominated landscapes. Based on the research done in Akole, one can claim that more research is required to understand the politics of conservation in human-dominated landscapes. With more such studies, specific policy instruments need to be drawn up for conservation practice in human-dominated landscapes. The current policy framework is based on a PA-centered strategy and ignores the dynamics of human-dominated landscapes outside PAs, which are home to a significant percentage of wildlife and high densities of people. To succeed, such instruments must account for and strengthen existing norms and institutions, which are conducive to conservation rather than induce antagonism towards conservation and also draw inputs from different (and relevant) disciplines including biology, political science, history and anthropology (Saberwal and Rangarajan, 2003).</p> <p>2. Large carnivore management practices. A critical evaluation of current large carnivore management practices is required, including its biological and political dynamics. The result of such an evaluation can be used to draw up a protocol to manage stable populations of large carnivores, rather than translocating them in response to politico-economic pressures. This would prevent random (and unnecessary) trapping of leopards, counter political pressure to trap animals and hold the forest department accountable for management practices. The protocol also needs to provide mechanism for prompt action in case of attacks on humans, while also investigating their nature and causes. Not only will this provide feedback to improve management practices but also ensure the animals are handled appropriately. However, frontline forest department staff would still need to deal with villagers and pastoralists facing losses to leopards. These staff members must be trained in dealing with people and crisis management. It may not be practically possible to insulate the forest department from political pressure (given the entrenched interests of department officials and politicians), the protocol may provide a relatively more transparent strategy to defuse conflict situations between large carnivores and humans.</p> <p>3. Livestock Protection and Compensation Schemes. The main material interaction between people and large carnivores is through depredation of livestock and pet animals. In this context, an improvement of livestock protection is crucial. Communities like the Thakkars protect their animals better than others and as a consequence suffer fewer losses. The occasional losses might still occur and the resulting compensation must be linked to protection measures. The rationale behind this recommendation is simple; while individuals blame the department and the leopard for depredation, they often do not take responsibility for adequately protecting their animals. Furthermore, there are numerous instances of people willingly exposing unwanted animals to depredation risks, in an effort to collect compensation. It is thus imperative that compensation schemes be linked to better protection of livestock. The obvious challenge here are individuals who do not have the resources to effectively protect their animals (leaving them vulnerable to depredation) and consequently such losses can be economically catastrophic. A possible solution is to provide support to these individuals to protect their animals better, but the implementation is problematic. It might be more feasible to work with the village panchayats to incentivise the compensation scheme and provision of support to those who lack resources to protect their animals.</p> <p>The compensation scheme itself needs to be streamlined and more transparent in its functioning and purpose. In its current form, it is riddled with corruption and highly bureaucratic. It often runs counter to conservation needs and serves as a major source of friction between the forest department and legitimate applicants for compensation for depredation. It also puts the onus of conservation and management of leopards, solely on the department, eroding socio-cultural adaptive institutions that have allowed people to coexist with leopards.</p> <p>4. Strengthen institutions of tolerance. Large carnivore management needs to account and integrate socio-cultural institutions, which facilitate coexistence between people and large carnivores. These institutions precede and predate the current socio-legal framework of conservation practice in India. However, such an extension of conservation practice and its socio-legal framework is fraught with conceptual and practical challenges. It requires further research in non-protected areas, which include people in conservation while also help identify relevant socio-cultural and political frameworks.</p>

	<p>Strengthening of such institutions is justified on several grounds. Firstly, they are synergistic with conservation practices while also facilitating livelihood strategies. Secondly, they provide an existing framework for conservation, based on traditional ecological knowledge and beliefs. Conservation management can augment such existing systems, rather than waste resources trying to replace them, to produce a similar outcome. Thirdly, if done sensitively, existing socio-cultural institutions ease acceptance of the current legal framework. The first task, however, must be to identify them and work out mechanisms on how they can be augmented in different parts of the country.</p>
<p><i>Activity 8.3 Towards an assessment of the management of Protected areas and Reserve forests in the context of the Recognition of Forests Rights Act, 2006</i></p>	<ol style="list-style-type: none"> 1. Documenting FRA implementation and its influence in changing Soliga attitudes to conservation will have consequences for a rights based approach to conservation. 2. BRT has recently been declared a Tiger reserve without any public consultation or due process. The results of the study will hope to influence the tiger reserve management in ensuring a more inclusive PA management.



Supporting dialogue through appropriate fora is crucial to reduce human-wildlife conflicts. Fishermen are important stakeholders in the human-turtle conflicts. Photo: Kartik Shanker.

15 Contribution to implementation of CBD and impact on domestic wildlife management policy

Over the last three decades we have witnessed an increasing focus on the environment and biodiversity, resulting in a number of international treaties and agreements. The Convention of Biological Diversity (CBD) stands out as the first global agreement on conservation and sustainable use of biological diversity. Since 1992 more than 150 governments have ratified the convention.

The CBD outlines concrete approaches on how to achieve conservation, primarily through its “Ecosystem Approach” and its guiding “Malawi principles”. These principles were further developed in the “Millennium Ecosystem Assessment” and the “Addis Ababa principles and guidelines for the sustainable use of biodiversity”. The CBD has also served as a vital springboard for the establishment of the “Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services” (IPBES) which UNEP have received a mandate to establish from the UN General Assembly.



All sources of knowledge, here represented by the Todas, should be used when relevant according to the Malawi principles. Photo: Ketil Skogen.

Despite a focus on linking biodiversity conservation to human well-being, many countries are struggling to implement these conventions. This is due to an often overlooked fact; wildlife conservation can actually generate many conflicts with human well-being. People and wildlife often live in close proximity, and wide-ranging wildlife does not necessarily stay inside protected areas. Many species can create direct and severe conflicts with human interests. Conflicts occur in a variety of contexts, when wildlife species raid agricultural crops, damage property, kill people or livestock, or spread diseases. When conservation programs succeed, and wildlife populations expand in numbers and range, many of these conflicts increase, resulting in a need to adjust management procedures from a “preventing extinction” phase to one where the goal becomes “learning to live with success”.

Wildlife-human conflicts are currently recognized as a serious impediment to the implementation of international biodiversity conventions, species recovery plans and the management of protected areas. These types of conflicts are perhaps one of the most important aspects in the overall controversy between human interests and biodiversity conservation in general.

The goal of this project has been to exchange experience and jointly conduct research on human-wildlife conflicts to such a level that we have equivalent data on ecological, economic, social and political aspects of the conflicts from both India and Norway. Interdisciplinary research that collects scientific and local knowledge is crucial to turn conservation conflicts into opportunities for coexistence.

The results of this project have served to identify the widespread nature and diversity of conflicts that occur between humans and wildlife, as well as the similarity of the conflict picture between two countries as diverse as Norway and India. This realization is central to understanding why the implementation of these biodiversity conventions is so difficult across diverse socio-economic and political situations. It implies that there is a need to realize that a lot of biodiversity conservation implies a cost as well as benefits and that there is a need to consider both a sharing of costs as well as a sharing of benefits.



Cultural context can be an important modulator of the human-wildlife conflict picture. Photo: Jørn Thomassen.

16 Conclusions

Despite a postponed launch for a few project activities and some challenges in obtaining data in some of the activities, we feel certain that this project has been a success. The overall goal of the project has been to understand the wildlife human interactions in India and Norway (in a sample of multiuse landscapes) and develop mechanisms of coexistence suitable to the countries. The main focus in the project was put on a few species such as elephant, blackbuck and other herbivores, leopard, wolf, marine turtles – all species in conflict with humans. A large part of India was covered in the various studies on these species and in the social research component of the project.

This project's cooperation has provided many mutual insights. The Indian partners were able to benefit from the Norwegians' experience at conducting interdisciplinary conflict research in human-dominated landscapes, while the Norwegians were able to gain critical insights into the unique levels of tolerance displayed by the rural Indians.

The project has disseminated the project results in a variety of ways, i.e. produced articles in peer review scientific journals (and more will come), written several research reports, produced conflict management guidelines, written numerous popular articles in newspapers and journals, given several interviews on radio and TV, given public and scientific presentations and even produced and performed a theatre production on leopard – human conflicts! Moreover, several of the project's scientists have been very active in writing their own popular science articles and initiating the production of a wide range of communication packages ranging from TV documentaries to training courses and handbooks to popular books and, as mentioned, theatre productions – in all cases trying to use the best media to reach the desired stakeholder group.

A wide range of stakeholder engagement has occurred in most of the activities. This has largely occurred through the informal contacts that emerge when conducting ecological research in rural areas or interviewing people during social science studies. All these interactions involve a two way transfer of knowledge and experience. In addition, to these informal engagements, most projects have had extensive contact with the forestry department and local village councils.

Important outcomes from the project are numerous recommendations and policy implications, and the future challenge for stakeholders and decision makers will be to assess and implement actions to achieve a better coexistence between humans and wildlife. Interdisciplinary research that collects scientific and local knowledge is crucial to turn conservation conflicts into opportunities for coexistence which again strikes to the core of the Convention of Biological Diversity (CBD).

This project was originally conceived as being phase 1 of a two phase process, where phase 1 was intended to be mainly based on research, and phase 2 was intended to focus on implementation of some of the research based recommendations. Based on our experience so far, including both the scientific results and the institutional cooperation, there is a clear will among the participants to continue with a phase 2 where we believe that our research results will ease some of the conflicts that can have such a negative impact on both biodiversity and human livelihoods.

Annex 1. Overview of Technical reports

Access to the technical reports can be obtained by contacting NINA.





The Norwegian Institute for Nature Research (NINA) is Norway's leading institution for applied ecological research.

NINA is responsible for long-term strategic research and commissioned applied research to facilitate the implementation of international conventions, decision-support systems and management tools, as well as to enhance public awareness and promote conflict resolution.

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