

**THE PREDATORS OF JUNNAR: LOCAL PEOPLES' KNOWLEDGE, BELIEFS
AND ATTITUDES TOWARDS LEOPARDS AND LEOPARD CONSERVATION**

A Thesis

by

RAMAA JHAMVAR SHINGOTE

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

May 2011

Major Subject: Natural Resources Conservation

The Predators of Junnar: Local Peoples' Knowledge, Beliefs and Attitudes Towards

Leopards and Leopard Conservation

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Approved by:

Chair of Committee,	Michael A. Schuett
Committee Members,	David Scott
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Head of Department,	Gary Ellis

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ABSTRACT

The Predators of Junnar: Local Peoples' Knowledge, Beliefs and Attitudes Towards
Leopards and Leopard Conservation. (May 2011)

Ramaa Jhamvar Shingote, B.Sc., Pune University; M.Sc., Pune University

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Conflicts between humans and leopards have intensified in the Junnar Forest Division (JFD), India due to a combination of factors: loss of natural habitats, increasing rural human densities, and increasing leopard populations. These rural and agrarian communities that have large sugarcane plantations are vulnerable to these conflicts in the form of livestock depredation and attacks on humans, which decrease the tolerance of locals towards leopards and may undermine local wildlife conservation activities. This study used structured interviews to explore local resident's views, knowledge, beliefs, attitudes and behavioral intentions towards leopards and their conservation. The mean attitudes and behavioral intentions of respondents (N= 154) was found to be positive towards leopards and their conservation. To understand behaviors towards leopards and their conservation, a socio-psychological theory, Theory of Reasoned Action (TRA), was used. Results indicate a stronger attitudinal influence on locals' behavioral intention towards leopards and leopard conservation. Although several socioeconomic and demographic variables were found to be statistically significant in relation to attitudes, this study revealed the existence of social, psychological, and cultural variables that

shape the locals' perceptions of leopards and their conservation. The current study shows that local peoples' attitudes toward leopards are complex, with the view held by the same person often being characterized by both negative and positive aspects. This study does reveal positive dimensions to the local peoples' perceptions of leopards, which are relevant to conservation of this animal and serve as a foundation for recommendations regarding regulatory interventions and educational and management strategies for the future.

DEDICATION

Abhishek

Thank you for all the love, joy, and encouragement you have given me

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NOMENCLATURE

HWC	Human-Wildlife Conflict
JFD	Junnar Forest Division
TRA	Theory of Reasoned Action

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CHAPTER I

INTRODUCTION

Human-wildlife conflict (HWC) is fast turning into a critical threat to the continued existence of several globally endangered species all over the world. It presents a risk to ecosystem stability and biodiversity conservation as the wildlife species most commonly implicated in conflicts are threatened or tend to be more prone to extinction. Many case studies reveal the significance and gravity of HWC in countries all over the world. These human-wildlife conflicts are increasing in Africa (Browne-Nunez & Jonker, 2008), Asia (McNeely, et al., 2009), Europe (Kaczensky, Blazic, & Gossow, 2004; Kaltenborn, Bjerke, & Vitters, 1999), North America (Kellert, Black, Rush, & Bath, 1996), South America (Fischer & Lindenmayer, 2000; Polisar, et al., 2003) and Australia (Fischer & Lindenmayer, 2000). The global nature of this issue indicates that a thorough investigation is crucial to recognize and address problems to effectively support the conservation of threatened and endangered species.

While human-wildlife conflicts have far reaching environmental impacts, they also have a significant negative impact on human welfare due to the economic and social costs they bear (Kellert, 1991). Wildlife can have a negative economic impact on people due to damage and destruction of human property in the form of livestock losses, crop damage, damage to infrastructure, etc. Negative social impacts of wildlife and wildlife-

This thesis follows the style of *Human Dimensions of Wildlife*.

related conflicts include decreased peace of mind, increased fear, restriction of movement, etc (Kothari, Suri, & Singh, 1995). Finally, conflicts related to wildlife can also have a negative impact on human welfare due to the dangers of contracting zoonotic diseases, physical injury or death due to large predatory animals and the high financial costs associated with required medical treatment (Rajpurohit & Krausman, 2000).

The extensive social, economic, and environmental impacts of HWC suggest the need for wildlife managers, governments, researchers and local communities to collaborate efficiently to develop strategies for resolving the problem while safeguarding the well-being of *both* humans and the environment. Sustainable approaches that provide for the development of the local economy and encourage tolerance towards wildlife and the environment are considered to be the most effective and desirable (Guha, 1997). Therefore, for successful wildlife protection, conservation needs to be based on a combination of traditional local knowledge and sound scientific knowledge, as well as on ecological and social aspects of HWC.

It is apparent that HWC is not restricted to any particular geographic region; it is a global problem, occurring wherever humans and wildlife coexist and share limited natural resources. However, in developing countries like India, where dense human populations live in close proximity to wildlife preserves, the competition for natural resources is extremely intense and poses a serious challenge to livestock holdings, agriculture and conservation (Distefano, 2008). These conflicts tend to be particularly severe when the presence of a critically endangered species poses a threat to human welfare. The situation is further exacerbated when the species involved is a large

carnivore such as the leopard (*Panthera pardus fusca*). Therefore, a more thorough understanding of all the different aspects of conflict management is especially critical in these instances.

Conflicts between humans and leopards have intensified in India due to a combination of factors: the extensive loss of natural habitats, increasing urban and rural human population densities and, in some areas, increasing wildlife populations as a result of effective conservation programs. These conflicts occur all over India and are a growing concern. Conflicts may occur in various forms such as sightings, straying of leopards outside protected areas, livestock predation and leopard attacks on humans causing injury or death (Chhangani, Robbins, & Mohnot, 2008; Choudhury, 2004). Since it is unlikely that any of the above mentioned contributing pressures will lessen, man-leopard conflicts are likely to escalate further and present a grave danger to the continued existence of this endangered species.

Statement of the Problem

The increased encroachment on the natural habitats of leopards by humans, the decline in their natural prey base, the high resilience and adaptability of leopards, and the ideal cover provided by agricultural crops have all caused these felids to stray into human-dominated landscapes (Dar, Minhas, Zaman, & Linkie, 2009). Rural and agrarian communities that border forests and have large sugarcane plantations, such as those in Junnar District, are more vulnerable to these conflicts in the form of livestock depredation and attacks on humans (Athreya, Thakur, Chaudhuri, & Belsare, 2004). Since 2000 there has been a sharp increase in leopard sightings and conflicts in the

Junnar Forest Division (JFD). Specifically, between 2001 and 2003, 51 people were attacked, resulting in 18 fatalities, and hundreds of incidents of livestock predation were reported in the area. Such conflicts decrease the tolerance of locals towards leopards and may undermine local wildlife conservation activities (Ashraf & Menon, 2005). The goal of this study was to provide an in-depth examination of the social aspects of the man-leopard conflict in a man-leopard conflict hotspot, the Junnar Forest Division (JFD) of India.

As suggested by Bath, et al. (2008), it is necessary to be aware of the attitudes of different interest groups for successful conservation of large carnivores such as leopards, where issues may be more sociopolitical than biological. Due to limited knowledge of this issue, public support for leopard and leopard conservation continues to be a challenge in India (Marker & Sivamani, 2009). It has not been a practice in India to integrate public views into wildlife management decision-making; therefore, this practice is a novel concept. But there is an increasing awareness among conservationists that, in addition to ecological issues, a human dimensions approach is also necessary to fully understand the issues related to HWC. Applying a socio-psychological framework such as the Theory of Reasoned Action (TRA) to understand local peoples' attitudes, beliefs and norms towards leopards and leopard conservation will allow us to understand how these factors affect intention and behavior (McCleery, Ditton, Sell, & Lopez, 2006). This research, at JFD, used the Theory of Reasoned Action (TRA) to examine the attitudes of local people towards leopards and leopard conservation to address knowledge gaps and assess their support of leopard conservation.

Purpose of the Study

The purpose of the study was to examine several factors: knowledge about leopards, compensation schemes, incidents of livestock depredation and attacks on humans by leopards. All these variables and other aspects were investigated in terms of how they related to attitudes towards leopards and their conservation. More specifically the objectives of the research were:

1. To evaluate the local peoples' views towards leopards, underlying reasons for incidents of conflict with leopards and the most preferable management options to deal with problem leopards.
2. To evaluate the economic impact of HWC, specifically, the man-leopard conflict in JFD and determine whether timely/adequate compensation would increase tolerance towards leopards and their conservation.
3. To investigate the relationship between local peoples' knowledge about leopards, leopard ecology and tolerance towards leopards.
4. To use the TRA to assess the association among behavioral intentions, attitudes, subjective norms, and knowledge as it relates to leopards and leopard conservation.

Significance of the Study

This research was the first study to investigate local peoples' perceptions toward the man – leopard conflict and leopard conservation in Junnar, India using a theoretical framework. An understanding of how conflict and perceptions of a predator affect different stakeholders' opinions of leopard conservation and their opinions of current

management techniques will help elucidate the multifaceted social aspects of man-leopard conflicts. By giving us insights into the factors that influence tolerance of HWC and perceptions and attitudes towards wildlife, this study provides an understanding of the many factors that might impact peoples' perceptions of these interactions with wildlife. Using a comprehensive survey and employing the framework of the TRA, the present investigation aimed to evaluate the attitudes of the local people of Junnar towards the man-leopard conflict and leopard conservation.

This study helped generate baseline data on local peoples' attitudes towards leopards and their conservation, the level of current knowledge about leopards, leopard ecology and preferred management strategies to cope with the problem. This research identified key factors that influenced attitudes and helped fill knowledge gaps in regard to peoples' support for this issue. In many situations HWC took the form of disputes between the various stakeholders groups over wildlife management strategies, their implications, priorities, etc. HWC often give rise to disagreements that have driven research, mainly from an ecological aspect, focusing on how the situation may be dealt with and managed. This study however, also has practical implications for those seeking to examine conflicts and their effects on people, in order to formulate better mitigation measures. This research also generated data for managers on man-leopard conflicts in the JFD, and is one of the few studies that address conflict using a socio-psychological perspective.

This research made contributions in two areas. First, it generated data that could bridge the gap between scientific facts and wildlife management to help shape effective

policies to manage current HWC and avert future conflicts. Moreover, Junnar Forest Division (JFD) lies in the Western Ghats of India, an area that is a biodiversity hotspot and ranked as a conservation priority because of its vulnerable conservation status, high biological value and high endemism. Using theoretically reliable social research methods, this study could assist conservationists in understanding the circumstances and factors leading to desirable or undesirable behaviors and attitudes, which impact conservation activities.

Definition of Terms

Human-wildlife conflict –According to the World Conservation Union, human-wildlife conflict occurs when the needs of wildlife coincide with the needs of human populations creating costs to residents and wild animals (Distefano, 2008).

CHAPTER II

LITERATURE REVIEW

In many parts of the world, human population growth has become a serious concern. The drastic increase in world population density from 19 to 47 persons per km² between 1950 and 2000 (Dyson, 2004) has led to an immense pressure on our natural resources. Although modern technologies allow us to stretch the availability of these resources due to increased efficiency, population pressure, consumption levels and other factors described below, also exert a considerable impact on the resource base.

Increasing population densities also present a severe threat to wildlife and wildlife habitat. The continued appropriation of these habitats for human use leads to further fragmentation of wildlife populations, increasing HWC and the extinction of wildlife species. Even though conservation has become one of the biggest global concerns and protected areas have increased considerably in the last 30 years, issues of human density and development have further intensified fragmentation of landscapes (Krithivasan, Athreya, & Odden, 2009). As a consequence of this fragmentation, more human-wildlife interactions occur; and these interactions sometimes lead to conflicts, often having devastating effects (Kretser, Curtis, Francis, Pendall, & Knuth, 2009).

According to the World Conservation Union, HWC occurs when the requirements of wildlife overlap with those of human populations creating costs to residents and wild animals. These conflicts present a grave threat to the continued existence of several globally endangered species, and may occur in the form of attacks

on humans, livestock predation, property and crop damage (Chhangani, et al., 2008; Choudhury, 2004). HWC is not restricted to any particular geographic region, occurring anywhere humans and wildlife live side by side and share natural resources. Human population growth, changes in land use patterns, growing livestock populations, rising interest in ecotourism, fragmentation, and degradation and loss of habitat are some of the issues contributing to the intensification of HWC (McNeely, et al., 2009).

Since human population growth occurs unevenly throughout the world, its effects on natural resources are likely to vary accordingly. Therefore, as changes in land use patterns, loss of habitats, and trends in human and livestock population growth differ in developed and underdeveloped countries, incidents of HWC and the perspectives towards these conflicts also differ as a result. Conflicts between humans and wildlife are increasing throughout Asia due to several factors: the extensive loss of natural habitats, growing human/wildlife populations and conservation success (Karanth & Madhusudan, 2002). These conflicts are more intense in Asia where more than half of the world's human population resides, as does a large portion of its biodiversity.

Next, the literature pertaining to HWC as they relate to government compensation programs, fear of large carnivores and conflicts with wildlife (in the form of straying, crop raiding, livestock predation and attacks on humans) will be discussed. Further, attitudes towards leopards and how these attitudes are affected will be reviewed.

Government Compensation

Conservationists, forest officials and policy makers face a unique challenge in the conservation of wildlife that damage crops and attack, injure or kill humans and

livestock (Karanth & Madhusudan, 2002). Such conflicts threaten the welfare of humans and wildlife, as well as jeopardize the conservation of wild animals, especially if the species involved are rare, endemic and/or endangered. While this issue is a rising global concern (Kaczensky, et al., 2004; Marshall, White, & Fischer, 2007), the conflicts are most severe in the tropics where the increasing human population and competition for limited resources have led to a bitter struggle between wildlife and humans (Madhusudan, 2003).

The natural and usual human response to wildlife that poses a threat is to retaliate against the wild animal or destroy its habitat. These reactions tend to undermine conservation activities. However, a number of socio-economic factors have been identified that affect the tolerance level of the local people toward damage caused by wildlife. Some of these factors include: level of education, relative wealth, the extent of wildlife-related costs, the extent of benefits derived from wildlife, and the amount compensation received for damages suffered (A. Zimmermann, Walpole, & Leader-Williams, 2005).

The direct economic costs of HWC include losses of livestock, damage to crops and medical expenses incurred in the event of an attack. Indirect costs include the implementation of security measures designed to prevent conflict (Manfredo, Zinn, Sikorowski, & Jones, 1998), costs related to receiving compensation (Ogra, 2009) and the social costs resulting from a weakened state of physical and psychological well-being (Ogra & Badola, 2008). Thus, the social and economic impacts of conservation and management of wildlife, especially in the case of large carnivores, can be substantial

(Treves, Wallace, & White, 2009). Therefore, local support for conservation might be severely compromised if local residents are obligated to bear the cost of living with protected wildlife species, especially in underdeveloped countries with faltering economies where the monetary losses can be especially damaging (Mishra, et al., 2003). These findings led to the first study hypothesis:

H1: There is a positive association between income level and attitudes towards leopards and leopard conservation.

For the abovementioned reasons there is a need to assess as well as mitigate economic costs to make wildlife conservation beneficial for people who share the same resources (Mishra, et al., 2003). Compensation and incentive programs have been found to be quite successful in stimulating local support towards conservation (Distefano, 2005, 2008; Ogra & Badola, 2008), while centrally managed conservation programs that use coercion to achieve conservation targets have been found to have limited success in habitats traditionally used by local people. And, when executed correctly, using transparent, timely and fair methods, economic incentive approaches have been found to promote a greater level of tolerance towards wildlife (Mishra, et al., 2003; Naughton-Treves, Grossberg, & Treves, 2003). As recommended by Ogra and Badola (2008), compensation could be an effective strategy for conflict mitigation provided that compensation is adequate, and the reimbursement is timely. These insights led to the second study hypothesis:

H2: There is a positive association between adequate compensation and attitudes towards leopards and leopard conservation.

Fear of Large Carnivores

Local peoples' perceptions concerning damage from predators tend to be negative and programs for conservation of large predators are likely to fail when the cooperation of local communities does not exist (Manfredo, et al., 1998). In the less developed regions of the world, large carnivores can have a significant economic impact of people's livelihood resulting in negative perceptions. In addition to monetary factors, the interactions between humans and wildlife are affected by a multitude of social, cultural and political factors. In the case of interactions between humans and large carnivores, an additional key factor that might affect human behavior and conservation initiatives is fear and concern for human safety (Kaltenborn, Bjerke, & Nyahongo, 2006).

Even though effective wildlife management relies heavily on social tolerance and participation of the people who are directly affected by these conservation initiatives, one of the main aspects that wildlife managers sometimes tend to underestimate is fear. Humans concerned about their health and safety have developed positive and negative responses towards animals: positive responses towards species that are advantageous and negative responses towards species that present a threat (Lagendijk & Gusset, 2008). Therefore, clearer insights into human perceptions, mainly of the people who suffer the consequences of large carnivores living in their surroundings, is necessary in order to facilitate human-carnivore coexistence (Røskaft, Bjerke, Kaltenborn, Linnell, & Andersen, 2003). This is especially crucial in India, where large carnivores are being conserved in versatile, multi-use landscapes with high human densities. In India,

previous studies have shown that farmers often enlist the help of forest officers to ward off large carnivores that might pose a threat to farm laborers. Farmers and farm laborers in some areas lose three to four workdays a year due to the presence of carnivores like lions and leopards in their sugarcane fields and fruit orchards (Vijayan & Pati, 2002), and working days lost during harvesting and tending operations greatly affect the economic conditions of daily wage earners.

In spite of all the research relating fear and negative attitudes towards large carnivores, some studies have shown that fear does not automatically imply a negative attitude towards large carnivores. For instance, some studies have found that people living in rural areas near carnivore populations experience less fear than people in areas with no carnivores; however, in these studies, both groups had negative attitudes towards carnivores (Røskaft, et al., 2003). In contrast, in other studies surprisingly favorable attitudes towards large carnivores have been reported, in spite of fear (Legendijk & Gusset, 2008). Therefore, even though fear is considered a prominent factor in the media and in human dimensions research to evaluate predator acceptance, studies have found that people's attitudes towards large carnivores need to be measured more directly (Legendijk & Gusset, 2008). Although fear is an important aspect of HWC, Zimmerman, Wabakken, & Dotterer (2001) recommended measures to compensate for and prevent livestock losses through local participation and improved knowledge, because fear it is not a direct measure of predator acceptance. Casey, Krausman, Shaw & Shaw (2005) found increased knowledge about the conflict-causing species to be an important predictor of attitudes towards the species. This led to the following hypothesis:

H3: There is a positive association between peoples' knowledge about leopard ecology and tolerance towards leopards and their conservation.

Conflicts with Wildlife – Its Many Forms

The exponential increase in human and livestock populations in the last 50 years has led to modifications of the land. Changes in land-use patterns have put an immense amount of pressure on forests and wildlife. Vast tracts of forests, marginal lands, pastures and wasteland have been cleared and brought under cultivation to meet the needs of a growing human population, and, as a consequence, even protected areas have become fragmented and disturbed by human activities. Industrialization and developmental activities such as mining, irrigation and hydroelectric projects, added to other human disturbances, have also had a severe impact on protected areas (Distefano, 2008).

Over a period of time, human-related disturbances in wilderness areas have ecologically dislocated many wildlife species that have been unable to adapt to these activities. On the other hand, some wildlife species have adapted quite well to human activities, intrusions and man-altered habitats. As a result, the interface of human-dominated landscapes and wildlife habitats has become an arena for a wide range of human-wildlife conflicts. Just as man enters the wilderness for his own needs, sometimes wildlife strays out of its habitat into human territory (Treves, Wallace, Naughton-Treves, & Morales, 2006).

HWC are a problem the world over, as humans invade the natural habitats of wildlife and wildlife uses humanized landscapes more often. HWC can occur with wild

herbivores or wild carnivores; and while these conflicts pose a threat to human property and safety, they may also have harmful consequences on wildlife populations. Thus, the management of these HWC is a priority for the continued survival of many wildlife species (Naughton-Treves, et al., 2003). Conflicts with wildlife span diverse taxa and arise due to various reasons such as, straying of wildlife into human territories, crop raiding, property damage, livestock depredation and wildlife attacks on humans. The various forms of HWC that involve carnivores are discussed below.

Straying, Livestock Predation and Attacks on Humans

The human-carnivore conflict is a global problem, as illustrated by jaguars and pumas killing cattle in South America; bears and wolves killing sheep in Europe and North America; lions and cheetahs killing goats in Africa and leopards and tigers killing livestock in Asia (Treves & Karanth, 2003). This is especially true in the case of all species of big cats occurring worldwide; as their territorial nature, protein-rich diet and large home ranges lure them into continual competition with humans. Most large felids are specialized in ungulate depredation and are therefore, on occasion, likely to kill domesticated ungulates (Patterson, Kasiki, Selempo, & Kays, 2004). In instances where these animals attack, injure or cause the death of humans, campaigns to eradicate them are unavoidable.

Few carnivores have experienced a more drastic reduction in their habitat range than large felids like lions, tigers, leopards, jaguars and cougars. Protected areas seemingly provided a possible solution to the conservation of such keystone species but they may fail if they are too small, fragmented or surrounded by human settlements

(Patterson, et al., 2004). As the human population continues to grow and expand, settlements, agriculture and other forms of development further shrink and compress wildlife populations by extending deeper into natural wildlife habitat (Sukumar, 1994). Therefore, the conservation of large felids in small, protected areas with a high human density presents significant problems when the carrying capacity of their habitats is exceeded.

Straying of wild animals from protected areas into humanized landscapes in search of food and shelter is a common problem in most regions surrounding protected areas in India. Several incidents of straying have been well publicized; e.g., the tea garden leopards of Assam, the sugarcane tigers of Dudhwa. A recent study reported a substantial increase in these visits by leopards and lions; in Gir National Park straying was observed to increase from 1995 to 1999 by 288% and 250%, respectively (Vijayan & Pati, 2002). One of the important contributing factors for straying of wild animals is the fertile, productive black cotton soil which attracts wild herbivores and, consequently, carnivores.

Several studies have demonstrated the tendency of large felids such as leopards and Asiatic lions to wander and even inhabit areas outside reserves due to the lack of unoccupied territory within protected areas (Athreya, Thakur, Chaudhuri, & Belsare, 2007a; Saberwal, Gibbs, Chellam, & Johnsingh, 1994). As reported by Saberwal, et al. (1994) sub-adult felines are often displaced from their natal territories to poorer habitats outside or along peripheral regions of protected areas. This situation is due to their inability to find territories within the protected areas on account of the high density of

felines within these areas. However, areas beyond the reserves do not have wild herbivore populations, and they are intensely cultivated. Consequently, the only available prey in these areas is domesticated livestock and this eventually leads to conflicts between the large felids and the human population occupying the land.

According to Distefano (2008), wild predators are known to prefer native prey species over livestock when prey is in abundance. However, in some cases, domesticated livestock present an important source of nutrition for large felids, and it is usually the impoverishment of prey populations that triggers the change in the diet preference of carnivores. Increased livestock populations lead to forage competition with wild herbivores and this may lead to declines in wild ungulate populations. In India, livestock graze in over 70% of wildlife sanctuaries and approximately 40% of protected areas. In some cases domesticated livestock far outnumber, outcompete and in some cases cause decline in wild herbivore populations. Thus, the reduction in natural prey species can sometimes force large cats to hunt domesticated livestock.

The lack of natural prey species combined with the conversion from sustenance farming to farming financially beneficial cash crops, such as sugarcane and mango, have led to increased conflicts with large felids such as tigers, lions and leopards in many regions of India. The large scale conversion of grasslands at the periphery of protected areas into sugarcane fields also provides ideal habitats for large felids, causing them to move into cultivated areas. Since the sugarcane cultivation regime involves little activity over long periods of time, large felids readily occupy sugarcane fields (Athreya, et al., 2004; Vijayan & Pati, 2002). These crops attract wild herbivores which in turn attract

carnivores and, in the absence of natural prey, these predators have an abundance of livestock to prey upon.

The success of conservation programs has led to the recovery of populations of declining or near extinct species; this result has also led to new and an increased number of conflicts. In India, the implementation of the Wildlife (Protection) Act of 1972 has helped check poaching and declining populations of several species of wildlife (Singh, 2005). The establishment of a network of protected areas has also helped improve felid habitat and populations (Athreya, 2007). For example, the efficient habitat management and protection of the Asiatic lions in Gir National Park, India doubled their population (Mukherjee & Borad, 2004). And, as a result, this situation caused the prey and habitat requirements of the species to be imbalanced resulting in lions straying outside the reserve and causing other forms of conflict (Saberwal, et al., 1994). The leopard population in JFD of India has reportedly grown from 20 leopards in 1997 to 75 leopards in 2004 (Athreya, et al., 2007a). This led us to hypothesize that:

H4: Those who believe there are a large number of problem leopards in the area are more likely to have a negative attitude towards leopards and their conservation.

The increase in populations of these big cats combined with the fragmentation and loss of habitat, translocation, loss of prey species and their unique ecology, has occasionally resulted in large cats occupying and residing within human dominated territories. Such instances of large felids residing outside protected areas may lead to interactions with humans. These interactions may be in the form of sightings, instances

of depredation, and attacks leading to human injury or death; therefore, large carnivores such as leopards present a serious risk to humans. Encounters between these wild animals and humans can be potentially dangerous and have in the past led to serious human injuries as well as some fatalities (Athreya, et al., 2004).

Attitudes towards Leopards and Leopard Conservation

Social tolerance of the species and support from communities is essential in the conservation and management of large carnivores like leopards (Thornton & Quinn, 2009). Successful management strategies require the involvement and strong collaboration of all stakeholders. In India, where the forests and rural habitations form a continuum, leopards have generally been incriminated for instances of livestock depredation because they usually live along the fringes of human inhabitation (Marker & Sivamani, 2009). Their presence in this environment is the result of the ideal habitat provided by sugarcane plantations, a diminishing prey base and sufficient food from domestic livestock and feral animals. The resulting incidents of man-leopard conflicts may have a considerable negative financial effect on communities living in close proximity and also reduce local tolerance towards leopards and their conservation (Bagchi & Mishra, 2006; Dar, et al., 2009).

To ameliorate the negative attitudes of locals towards large carnivores that take their livestock, several different management strategies have been applied. Spatial separation in the form of chain link fences to prevent lions and leopards from straying outside park boundaries has failed in Gir National Park, India, because chain link fences were found to be ineffective or not economically viable (Mukherjee & Borad, 2004).

Electric fences have proven more effective but the cost of installation and maintenance is very high. Guarding is another popular strategy in India that has been found to be effective in protecting livestock as well as crops. Likewise, using guard dogs is another popular strategy in some instances but in the case of leopards, guard and feral dogs have exacerbated the conflict. Relocating problem animals is another management strategy and it has been partially effective; however in the case of leopards, relocation has led to escalation of the conflict (Athreya, 2007). Conflict management strategies also include the destruction of or life-long captivity of the problem animal. Therefore, although all the different management strategies have similar goals they have yielded differing levels of success. These different management strategies have had varying success in different regions due to different ecological, social, cultural and economic realities (Distefano, 2008), which led us to hypothesize that:

H5: Those who prefer the capture/relocation/destruction of leopards are more likely to have negative attitudes towards leopards and their conservation.

In the case of leopards, they are known to be extremely adaptable, inhabiting mountains, forests, ravines, grasslands, scrublands and rocky hills. Leopards are able to survive on a wide range of prey and are not dependent on a free source of water like tigers (Athreya, et al., 2007a). Even though Indian forests have always been home to a large number of leopards, these animals have also commonly inhabited the edges of human habitations, particularly where rural settlements merge into forests. With the further depletion of forests and loss of their ungulate prey base, this animal quickly

adapted to the altered circumstances and changed its habitat. Presently, a substantial quantity of the leopards' diet consists of domesticated livestock.

The leopard population in India declined in the 1970s and 1980s but, due to the enforcement of strict conservation measures, it has grown since (Singh, 2005). India, like many other countries has implemented strict protection programs owing to the drastic declines in carnivore populations in recent years (Treves & Karanth, 2003). Here, the laws provide large felids protection both inside and outside protected areas and consequently their numbers have grown consistently over the decades. Based on the counts and analysis of trends in leopard population changes, the leopard population of India was estimated to be about 12,000 in 2005 (Singh, 2005).

Measures of conservation as well as enforcement of the Wildlife (Protection) Act of 1972 have checked poaching activities as well as assisting the declining populations to recover. However, these strategies have led to increased conflicts with leopards in some areas. As a result of the Wildlife Act of 1972, leopards that stray into human settlements and prey on livestock cannot be trapped or killed. Therefore, alternative measures are chosen to deal with them as they are a Schedule I protected species; they can be trapped or captured only in the event of attacks on humans. These felids have large home ranges and their movements have sometimes caused dangerous, fatal encounters among other animals and humans. Large felids, like leopards, wandering outside protected areas in search of water, prey and shelter present a serious threat to human communities, and threatened communities are likely to have a negative attitude towards leopards and hamper leopard conservation initiatives.

Human injuries and fatalities as a result of recurrent contact with wildlife are escalating, and these incidents affect the attitudes of people towards conservation. The occurrence of conflicts can weaken conservation efforts and bring about the retaliatory killing of large carnivores that threaten the livelihoods of the locals by preying on domestic livestock (Lucherini & Merino, 2008). Habitat destruction along with direct persecution has led to the near extinction of many large carnivores in the past (Kaczensky, et al., 2004; Mishra, 2002). Although knowledge of the diminishing populations of leopards have led to favorable attitudes in a substantial part of today's urban population, locally conflicts still exist and many of the local rural residents are strongly opposed to the recovery of the leopard populations. This led to the following hypothesis:

H6: There is a positive association between peoples' views of leopards and attitudes towards leopards and their conservation.

Conflict and Attitudes

Man-leopard conflicts present a grave danger to the continued existence of an endangered species, like the leopard (*Panthera pardus fusca*). Man-leopard conflicts are a growing concern, occurring all over India in places where man and leopards live side by side and share natural resources. Straying of wild animals from protected areas into humanized landscapes is a common problem in most regions surrounding protected areas in India (Treves & Karanth, 2003). Also, in many areas leopards are now residing outside protected areas and this presents a serious risk to humans as well as their property. Encounters between these leopards and humans have resulted in a loss of

human property in the form of livestock depredation, and also serious human injury and fatalities in some instances.

In India, rural settlements usually merge into forests, and in such areas leopards have been implicated in conflicts in the form of livestock depredation. In these areas the changes in land use patterns, especially the cultivation of sugarcane, has been found to be one of the key factors in the increasing number of conflicts with leopards (Singh, 2006). More and more, Indian farmers are moving away from the farming of traditional crops to the planting of mango orchards and cultivation of sugarcane and other cash crops for better financial returns (Saberwal, et al., 1994; Sukumar, 1994). These practices have led to the formation of an artificial forest that leopards can take shelter in. These man-made forests allow for the easier stalking of prey, and are therefore hotspots for attacks on humans (Athreya, 2006; Vijayan & Pati, 2002). Sugarcane plantations provide an ideal habitat cover as well as an alternative source of nutrition for leopards in the form of domesticated livestock and feral animals. This overlap of human and leopard habitat has led to increased interaction and conflict, which have resulted in the development of negative attitudes towards leopards and leopard conservation.

In India, the general reverence for nature, including plants and animals, has been considered to be the most important deterrent against the persecution of wild animals by people and their maintenance of a positive attitude towards wildlife refuges and wildlife (Madhusudan, 2003; Mishra, et al., 2003; Vijayan & Pati, 2002). In India, in spite of damage to crops and loss of livestock, traditions and religious and cultural beliefs make people more tolerant of wildlife. For instance, orthodox Hindus consider monkeys,

elephants, tigers, snakes and cows to be sacred animals, to be protected and revered. These traditional connections and religious beliefs concerning wild animals greatly influences people's perception of conflict and has, in some cases, even led to partial acceptance (Mishra, et al., 2003).

Incidents of man-leopard conflicts can have a considerable negative financial effect on communities living in close proximity, reducing local tolerance towards leopards, their conservation and conservation in general (Bagchi & Mishra, 2006; Dar, et al., 2009). Human injuries and fatalities as a result of continual contact with leopards are increasing in number and these incidents impact the attitudes of people towards leopards and their conservation. In addition to conflict, a lack of financial compensation incentives and fear of leopards can weaken conservation efforts. These views have led to retaliatory killings of leopards that prey on domestic livestock and which threaten the livelihoods of the local people (Lucherini & Merino, 2008).

Even though declining populations of leopards and high levels of urbanization have contributed to a transformation in attitudes towards these carnivores (Naughton-Treves, et al., 2003), these favorable attitudes are chiefly found in the urban population. Locally, the conflicts still exist and many rural residents are strongly opposed to the recovery of leopard populations. Therefore, as suggested by Hussain (2003), large carnivore conservation programs that improve the social and financial welfare of the impacted local communities are needed.

Theoretical Approach

Since the density of persons in India has increased from 120 to 342 per km² from 1950 to 2000 (Dyson, 2004), the understanding of perceptions and patterns of conflict is particularly relevant in India, where high-density human populations live within large carnivore ranges. Therefore, there is a need for effective management practices that promote coexistence and minimal conflict, along with positive changes in local people's attitudes towards wildlife and increased awareness of the need to protect nature. This goal can be accomplished with research that incorporates a human dimension and is based on a sound theoretical framework such as the Theory of Reasoned Action (TRA).

Ajzen and Fishbein's (1980) TRA states that the decision to engage in a certain behavior is the direct result of behavioral intention. And, an individual's intention is a function of two main determinants, one being personal in nature and the other reflecting social influences. The personal aspect, *attitude toward the behavior*, depends on the person's positive or negative evaluation of performing the behavior. This attitude is a function of *behavioral beliefs*: a person who believes that carrying out a particular behavior will lead to a positive outcome will have a positive attitude towards performing the behavior and vice versa. The other factor that influences an individual's intention, *subjective norm*, is the individual's assessment of social pressure on him/her to perform or not perform a particular behavior. Subjective norms are also a function of beliefs, *normative beliefs*, i.e., the person believes that certain individuals feel that he/she should or should not carry out a particular behavior.

The TRA assumes that people rationally process information and consider the implications of their actions before performing a behavior. The essence of the theory is that voluntary behavior can be predicted by factors such as beliefs, subjective norms, attitudes and intentions. This theory is appropriate when the behavior of interest is voluntary, easily performed and the decision to act can be contemplated. This is the case in the present research scenario which intends to determine the locals' intentions towards leopards and their conservation. Even though this study did not aim to observe actual behavior, behavioral intention is considered to be good predictor of actual behavior under the same conditions. Therefore, this study examined the intentions of locals to follow guidelines to prevent conflict, not harm innocent leopards, and not kill leopards in retaliation.

Researchers who have used the TRA have found it to be robust enough to clarify and predict behaviors as well as being helpful in creating intervention strategies to modify, change or maintain behaviors (Ajzen, 1991). It has been found to be critical in isolating target audiences and target behaviors as well as in isolating and identifying target beliefs that have been valuable in the course of outlining effective interventions (Aipanjiguly, Jacobson, & Flamm, 2003). This theory maintains that a person's behavioral intentions are associated with a person's attitudes and subjective norms; behavioral intention directs the corresponding behaviors, in the absence of external factors (Carr & Tait, 1991). According to the TRA, behavior may be altered in two ways. The first way is by changing beliefs and outcome evaluations in performing a

particular behavior; the second is by changing normative beliefs and motivations to comply with those normative beliefs regarding that particular behavior.

The TRA has been used extensively to examine and explain a variety of behaviors associated with the environment (Dolisca, McDaniel, Shannon, & Jolly, 2009) and natural resource management (McCleery, et al., 2006). For instance, TRA has been used to examine landowner's participation in conservation programs (Sorice & Conner, 2010), differences in farmers and conservationists attitudes towards conservation (Carr & Tait, 1991), attitudes towards wolf reintroduction (Pate, Manfredi, Bright, & Tischbein, 1996), marine conservation attitudes (Aipanjiguly, et al., 2003; Jett, 2007), attitudes towards NPS-controlled burn policy (Bright, Fishbein, Manfredi, & Bath, 1993) and attitudes towards lethal deer management (Fulton, Skerl, Shank, & Lime, 2004).

Studies that utilize techniques such as persuasion and socio-psychological theories are especially significant in the literature related to conservation and natural resources, where the application of these techniques is still in the early stages. These studies are important as they help establish guidelines to operationalize and apply such theories. In addition, these studies emphasize the need for recognizing and isolating the intended audience and behaviors of interest, and highlight the value of identifying target beliefs to facilitate the drafting of interventions (Aipanjiguly, 2001).

Although increasing conflicts due to human-wildlife interactions have stimulated research, the research has mainly focused on the ecological perspective. Little research has been done on the social and economic factors that influence the success or failure of

conservation initiatives (Marshall, et al., 2007). In fact, there is a dearth of literature on the social aspects of HWC, and the majority of the literature that exists focuses on developed nations. A social science perspective and general awareness of the dynamics involved in the man-animal conflict will contribute to an understanding of the social aspects of conservation. This approach should provide insights into what drives public opinion and attitudes toward wildlife and tolerance for HWC, by providing a perspective on the factors that affect people's attitudes towards interactions with wildlife (A. Zimmermann, et al., 2005).

An understanding of the local residents' attitudes and beliefs towards wildlife species can help identify potential interventions for promoting behaviors that contribute to conservation (Kaltenborn, et al., 1999). A few researchers have examined perceptions towards leopards in areas of conflict, but they did not explore the relationships between knowledge, attitudes and behaviors concerning leopards and their conservation. Most of the research examining this phenomenon in developing/under-developed countries is focused on trying to define management strategies to minimize negative interactions, e.g., livestock depredation and crop-raiding. Little of this research has been based on established theoretical frameworks such as the TRA or its modification, the Theory of Planned Behavior (McCleery, 2009).

Although previous research has specifically examined local residents' attitudes towards human-carnivore conflicts in India, the work has largely focused on socio-demographic variables as they relate to conflict. Previous research has found that HWC can be mitigated through effective and adequate economic compensation (Ogra &

Badola, 2008), and those who suffer greater losses due to wildlife tend to be less tolerant (Dar, et al., 2009; Mishra, 2002). In addition, while affluence was related to greater tolerance, poorer residents who stood to lose more were less tolerant (Saberwal, et al., 1994; Singh, 2006). However, none of these past studies have mediated the relationship between these characteristics and conflict by using normative and attitudinal factors or public attitudes towards leopards and their conservation.

In this study, the TRA provides a mechanism to understand behavior on the basis of attitudes, norms and experiences. It can help researchers identify the origin of behavioral intentions (Dolisca, et al., 2009). The TRA maintains that a person will perform a behavior based on the belief that the people who are close to them think they should perform and have a positive attitude towards the behavior (McCleery, et al., 2006). Since the TRA links attitudes and subjective norms to behavior, it is a useful tool for a detailed study exploring attitudes towards leopards and their conservation. According to the TRA, a person's intention to perform a pro-social action or stop performing an anti-social action is based on the individual's attitude toward the behavior as well as his/her subjective norm (Bates, Quick, & Kloss, 2009). The TRA predicts that a person who believes that leopards and leopard conservation should be valued also believes that there is social pressure from other important people to adopt these behaviors and would be more likely to embrace them. An examination of the local residents' knowledge about and support for leopard conservation as well as the influences on their specific beliefs should help provide a basis for recommendations to

establish effective communication between the local residents and the leopard conservationists.

CHAPTER III

METHOD

This study assessed the views, knowledge, attitudes, beliefs and behavioral intentions of local residents of Junnar Forest Division (JFD) about leopards and their conservation. This chapter describes the research methodology used in the study and is divided into the following sections: 1) Study Site, 2) Sampling and 3) Operationalization of Variables.

Study Site

The JFD has the highest population density of leopards within a 500 km² area in India (Athreya, 2006). The land in Junnar is very fertile; this region is surrounded by dams, and has an abundant supply of water. Farming is one of the main occupations of the locals, with vegetables, grapes and sugarcane being some of the main crops grown in this region. The vast sugarcane plantations provide an ideal environment for leopards and, according to forest officials, this congenial environment has improved the survival rate of leopard cubs by 50 percent (Athreya, 2007).

This division holds the record for the greatest number of leopards trapped within a range: 57 leopards in 2001. Leopards attacked 50 people between 2001 and 2003, 18 of which resulted in fatalities. In addition, 570 cases of livestock (cattle) depredation were reported (Athreya, et al., 2004). Although the northern part of Junnar has always been considered leopard country, the rapid deforestation of the Junnar and the planting of vast tracts of sugarcane fields that provide ideal cover, combined with dwindling numbers of

natural prey, has forced these elusive predators to stray into human habitat (Athreya, et al., 2004). The government incurred expenses of more than 6 million Indian Rupees, in 2002, which included compensation claims, hospitalization fees for leopard attack victims and the costs of feeding and relocating the captured predators.

The JFD is subdivided into 7 ranges: the Narayangaon, Junnar, Otur Shirur, Khed, Chakan and Ghodegaon ranges. Since the entire 4360 km² of predominantly human-dominated landscape in the JFD was too large for this study, the Narayangaon range was chosen from among the seven ranges. The study focused on this range because even though conflict with leopards occurs throughout the entire division, it was reportedly most severe in the Narayangaon range. This area is an ideal choice for a study site since it is a hotspot for conflict; forty-two leopards have been removed from this area in the last few years. The number of leopards present has been attributed to the ideal cover provided by the surrounding sugarcane fields. And because the local residents live in fear of the frequent visits of the big cats, a hotline has been established to report leopard sightings and lodge complaints of attacks and incidents of livestock depredation. Two villages, Bori and Belhe, were selected from the Narayangaon range (Fig. 1) based on the recommendations of Forest Department officials and local key informants, who reported that the incidence of conflicts had been high in these two villages.

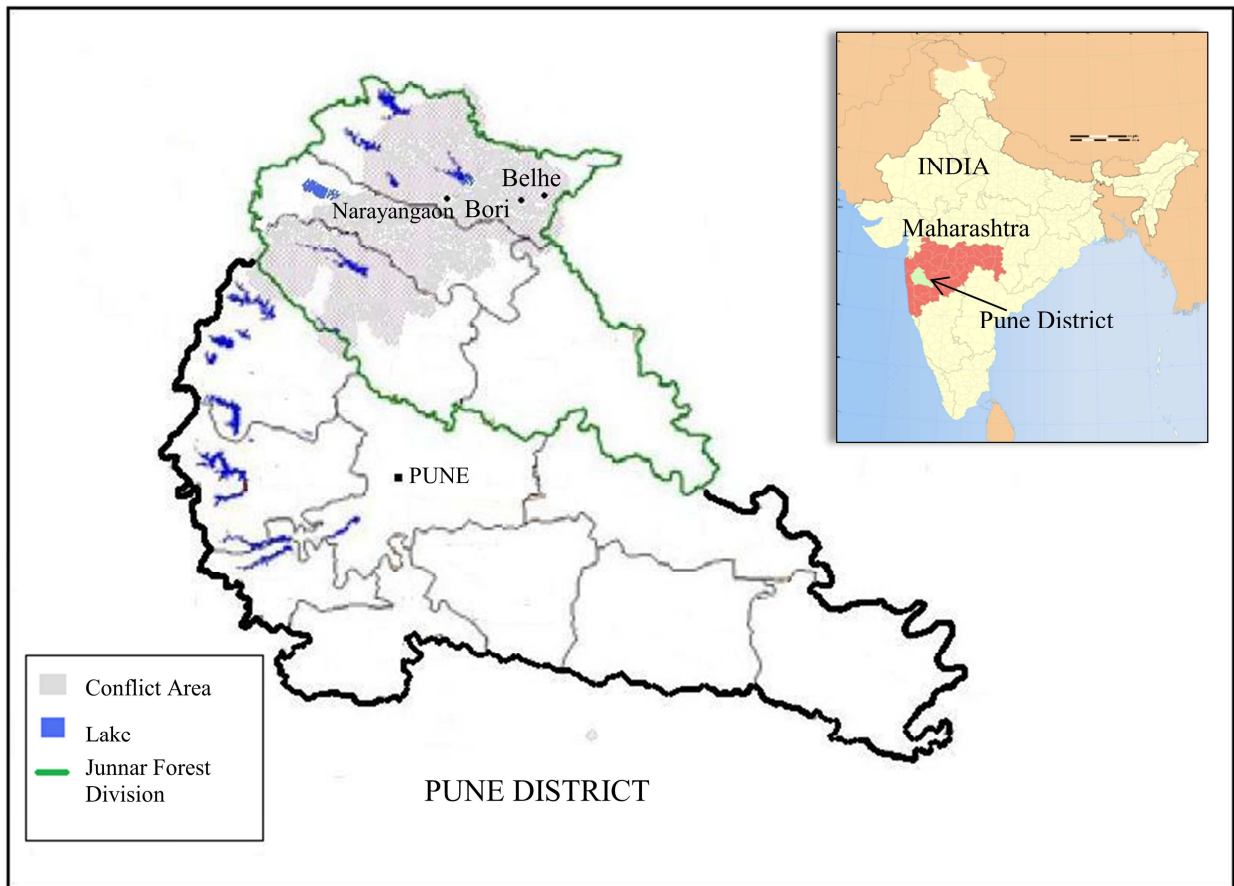


Figure 1. Location of the Study Site. Research area included the two villages of Bori and Belhe.

Sampling

The populations of interest for the study were the residents of the two villages of Belhe and Bori. Both these villages were in the Narayangaon range of the JFD and were chosen for the study due to the high incidence of conflicts with leopards. The locals and Forest Department officials also recommended that the main part of the village, the *gaavthaan*, not be used in the study because people living in this area may spend their entire lives without ever seeing or hearing a leopard. The main conflict exists in the

small settlements in the areas surrounding the *gaavthaan*. These settlements, *malaas*, are a part of the village (Bori/Belhe), and situated less than a couple of kilometers from the main village within farmlands. This is where the problems with leopards and conflicts between humans and leopards occur.

Settlements or *malaas* from each village were chosen based on recommendations by the Forest Department. The sample for this study was obtained from the local *gram panchayat* of each village; the *gram panchayat* is the local government at the village or small-town level in India. And this governing body gathers census data as well as other demographic data. The village of Belhe had a total of 1650 households (including households in the *gaavthaan* and all the *malaas*) and the village of Bori had a total of 1532 households (including households in the *gaavthaan* and all the *malaas*). Then, a list of households for the recommended settlements or *malaas* was obtained from the *gram panchayat* of Belhe and Bori, and used as a sampling frame. As a result, a list of 353 households in Belhe and 296 households in Bori was generated.

Door-to-door surveying was conducted; for each village, the 4th household in the list was identified and selected to be surveyed. The number of adults in the household was determined, and the adult with the next birthday was asked if they were aware of the man-leopard conflict in the JFD. If they were aware of the man-leopard conflict and willing to participate in the study, the questionnaire was administered; if they declined, the next household was chosen in the same manner. The participant population was restricted to adult men or women, 18 years and above, and the household was treated as the unit of analysis.

The sampling frame was used to choose a random sample of 80 households (from each village) who were aware of the man-leopard conflict in the village. Using the power tables of multiple regression, a sample size of 50 would give a statistical power of around 0.80 with a small effect size of 0.2 (Clark-Carter, 2004). A total sample size of greater than 100 households was considered appropriate to obtain a more statistically representative sample.

Survey Instrument – Operationalization of Variables

The comprehensive questionnaire provided a mechanism for the thorough study of attitudes of local residents towards leopards and their conservation in an area of severe man-leopard conflict. Once the participating household was identified and the household member agreed to participate, a face-to-face interview was conducted. An interview was the method of choice because the data collection instrument was a structured questionnaire (Bernard, 2000). This research was based on the quantitative method involving the collection of cross-sectional surveys using a questionnaire. This quantitative method was considered to be the most appropriate approach, because it used the TRA to explore local peoples' attitudes towards leopards and leopard conservation. In addition, the use of quantitative methods is considered to be the preferred approach in testing a theory (Creswell, 2003).

The TRA incorporates specific methods for measuring attitudes, subjective norms and their related beliefs; therefore, the measures were developed as outlined by Ajzen and Fishbein (1980). A total of thirty-two items tied to a five-point Likert scale format were used to operationalize the TRA as follows:

- a. The ten items used to assess attitudes, subjective norms and behavioral intentions are listed in Table 1.

Table 1. Items Used to Assess Attitudes, Subjective Norms and Behavioral Intentions

Attitudes
Having no threat of financial loss due to leopards is important to me
Having no threat of leopards attacks on me, or my family, is important to me
Leopards do not normally hunt humans, therefore they present no direct threat to me or my family
Leopards and their conservation are important to me
Subjective Norms
Concerning leopards, I want to do what my family and friends think I should do
Concerning leopards, I want to do what other villagers think I should do
Concerning leopards, I want to do what Forest Department officers and conservationists think I should do
Behavioral Intentions
I intend to report problem leopards to the proper authority rather than taking matters into my own hands
I intend to follow the guidelines to prevent conflict with leopards and support leopard conservation
I do not intend to harm innocent leopards

- b. Behavioral beliefs and belief strength were assessed using eight items each. The behavioral beliefs and the corresponding belief strengths were developed as outlined by Ajzen and Fishbein (1980), and they were identified from previous studies on man-carnivore conflicts. These items included beliefs that were related to economic losses due to leopards, the threat of leopard attacks on people, the extinction of leopards, livestock depredation, communication with the Forest Department, and the protection and threatened status of leopards. Using a five-point scale, respondents rated their behavioral beliefs (1 = *strongly disagree* to 5 = *strongly agree*) as well as

the corresponding belief strength (1 = *extremely uncertain* to 5 = *extremely certain*) (Appendix A).

- c. Three referent groups, family and friends, other villagers and Forest Department officials were used to assess perceived normative pressures towards leopard conservation. Respondents were asked to detail each group's opinions about leopards and their conservation and their motivation to comply with each referent group (Appendix A).

In addition to the measures of the TRA, the questionnaire also measured other variables. The questionnaire was further divided into the following main parts:

- a. Demographic information,
- b. Knowledge about leopards and their ecology - there were seven knowledge items scored on a scale of 0 to 2 (0 = don't know, 1 = false and 2 = true),
- c. Government compensation programs – the effectiveness of compensation, and the effect of adequate and timely compensation on attitudes towards conflict were assessed using a five-point scale (1 = *strongly disagree* to 5 = *strongly agree*),
- d. Views - of leopard translocation, their life in captivity, their endangered status and agreement to participate in leopard conservation were assessed using a five-point scale (1 = *strongly disagree* to 5 = *strongly agree*). Opinions of leopards, in general, and opinions of leopards in their surroundings were also evaluated and
- e. Management strategy of preference – was assessed in cases of leopard sightings, livestock predation or attacks on human.

Before its administration, the questionnaire was translated into the local language, Marathi. To identify potential problematic questions or confusion with instructions and to improve the content validity, the questionnaire was discussed with a group of local residents of Junnar taluka. And to further improve the content validity, the questionnaire was pre-tested on ten locals in May 2010. Based on the respondents' comments and suggestions, the questionnaire was subsequently modified; the questions that did not translate clearly were corrected and questionnaire items were rearranged. The survey questionnaire was administered in June and July of 2010.

CHAPTER IV

RESULTS

The two villages of Belhe and Bori were identified and selected from the Narayangaon range of the JFD. The study was limited to this one range within the JFD based on the recommendations of the Forest Department. For both villages, the main part of the village, called the *gaavthaan*, was excluded due to the absence of conflict with leopards; and the survey was conducted in the smaller settlements within farmlands, called *malaas*. These settlements were chosen based on the recommendations of the Forest Department. The survey was conducted in June and July of 2010.

A pilot test of the questionnaire was conducted on the locals of Belhe for accuracy of translation and readability. After the required modifications, a total of 154 questionnaires were completed for the study, 75 from the village of Belhe and 79 from Bori. Since my goal was to collect a total of 160 questionnaires, the final response rate was 96%, with 154 completions and six refusals/ineligibles.

Of the six refusals or ineligible households, only one household refused to take part in the study; the remaining five were not included as they were ineligible to participate. In two of these households, the only ones available to participate in the survey were very old women who were hard of hearing and unable to hear or understand me. In the other three households the only ones available to participate in the survey were under the age of 18; therefore, these households could not be included in the study.

Sample Sizes for Belhe and Bori

The first village of Belhe had a total population of 8,128 according to 2000 census data and the village had a total of 1650 households. The main village was excluded from the study and out of a total of 11 settlements belonging to the village of Belhe, seven were chosen. A list of the 353 households within these settlements was generated with the help of the *gram panchayat*¹ office. This sampling frame was used to randomly choose the participant households. After the survey was administered, 75 completed questionnaires were returned from the village of Belhe.

The second village of Bori had a population of 6,052 according to 2000 census data and it had a total of 1532 households. The main village was excluded from the study and 12 settlements out of a total of 16 were chosen for the purpose of the study. A list of 296 households within these settlements was generated with the help of the *gram panchayat* office. This sampling frame was used to randomly choose the participant households. After the survey was administered, 79 completed questionnaires were returned from the village of Bori.

Data were entered into an Excel spreadsheet and imported into a JMP 8 software package for data analysis. Preliminary univariate analysis was performed, which included reports of frequency distributions, means, medians and standard deviations. Cronbach's alpha, which measures internal consistency and reliability, was used to assess the reliability of the scaled attitudinal, subjective norm and intention items. A reliability estimate of around 0.60 was considered acceptable, (A. Bath, Olszanska, A.,

¹ The *gram panchayat* is the local government at the village or small town level in India.

& Okarma, H., 2008; A. Zimmermann, et al., 2005) as this would imply that the scale is truly additive and reflective.

Only the data pertaining to the research objectives of this study are presented and discussed below.

Socio-Demographic Profile

Demographic data are shown in Table 2. The mean age of all respondents was 37.81 years (SD =15.35). Fifty-three percent of the respondents were male and 47% were female. The average level of education was at the secondary level (grades four to seven); 6% were uneducated, 17% had a primary level education (up to the fourth grade), 21 % had a high school education, and 16% had a college level education or higher. Farming was the main occupation of 93% of the respondents, 2% worked as farm laborers and 2% of the respondents worked in other jobs. The average household had six members, owned 4 acres of farm land and, on average, 2 acres of the farm land was under sugarcane cultivation. The average respondents had lived in the same house for over 25 years and had lived in the area over 32 years. The mean annual household income was Rs 45,245 (approximately \$1005) which can be considered as a middle class household, as reported by the National Council of Applied Economic Research.

Table 2. Socio-Demographic Profile of the Respondents

Age	18-25	25%	n = 39
	26-40	40%	n = 61
	41-60	25%	n = 38
	>61	10%	n = 16
	Mean	37.8	SD = 15.4
Gender	Female	47%	n = 73
	Male	53%	n = 81
Education	None	6%	n = 9
	Primary	17%	n = 26
	Secondary	40%	n = 61
	Higher Secondary	21%	n = 33
	Graduate or higher	16%	n = 25
Village	Belhe	49%	n = 75
	Bori	51%	n = 79
Annual Income	0-20,000	13%	n = 19
	21,000-45,000	25%	n = 36
	46,000-80,000	36%	n = 51
	>80,000	25%	n = 36
	Mean	45,245	SD = 21,726
Number of people in household	Mean	6.4	SD = 3.8
Years in this house?	Mean	25.4	17.1
Years in this area?	Mean	32.0	17.5
Land owned	Mean	4.2	5.4 acres
Land for sugarcane cultivation	Mean	2.0	3.0

H₁: There is a positive association between income level and attitudes towards leopards and leopard conservation.

Annual income and the sum of the four items measuring attitudes towards leopards and their conservation were found to be slightly correlated with a correlation coefficient $r = 0.1547$ and $p = 0.0554$, it was found to be significant at the 90 %

confidence level (Table 10). Annual income was also correlated with the sum of the three behavioral items with $r = 0.1656$, which was also significant at the 95% confidence level with $p = 0.0401$ (Table 10). Overall, the higher the annual income of respondents the more positive their attitude was towards leopards and their conservation. Therefore this hypothesis was accepted; a significant positive association was found to exist between annual income and attitudes/behavioral intentions.

Government Compensation

Although 40% of the local residents had filed to claim compensation for the losses they suffered from leopards in the last year, only 11% of them had received compensation for their losses and none of them found the compensation to be adequate to cover their losses. Out of the entire sample population only 16% had never filed a claim for compensation and only a 6% of them believed there to be no difficulties with filing for and getting government compensation. Twenty seven percent of them believed that getting compensation was incredibly hard and involved a very lengthy procedure (23%) as well as other problems (Table 3).

Table 3. Problems in Filing for / Getting Compensation

None	6%
Long Procedure	23%
Travel Cost	2%
Officer Absent	14%
Time Spent	12%
Difficulty getting payment	27%
Other	15%

Although 95% of the respondents said they would file for compensation, a much smaller percentage (31%) was actually aware of the government compensation program to which they were entitled. This lack of awareness led to over 60% of the respondents' reporting skepticism and uncertainty towards the efficiency of the compensation program. Over 80% of the respondents did not consider that timely compensation made conflict with leopards more tolerable; 75% of the respondents disagreed that adequate compensation made conflict with leopards more tolerable (Table 4).

Table 4 Government Compensation Program– Its Efficiency and Tolerance of Conflict

	Strongly Disagree	Disagree	Unsure	Agree	Strongly Agree
Compensation program efficient	11%	24%	26%	38%	1%
Timely compensation makes conflict tolerable	14%	66%	1%	18%	1%
Adequate compensation makes conflict tolerable	14%	61%	0%	23%	2%

H₂: There is a positive association between adequate compensation and attitudes towards man-leopard conflict and leopard conservation activities.

It was hypothesized that the people who had suffered monetary losses due to leopards and other wild animals (livestock depredation, crop raiding or even attacks on humans) would have a positive attitude towards leopards' conservation as long as the government compensation provided was adequate to cover their losses. No dependence was found using Chi-square analysis, as none of the respondents believed that the

compensation provided was adequate to cover the losses they had incurred and the test could not be utilized due to insufficient expected cell frequencies. Therefore, this hypothesis was rejected as no dependence could be found due to the fact that none of the respondents believed the compensation to be adequate.

Knowledge about Leopards

At the design stage of the survey questionnaire, seven items were added to indicate knowledge. Initially these items were added as true or false statements but were modified when the questionnaire was tested and the “don’t know” option was added. Respondent’s averaged 11.4 points on a 14-point scale which was scaled as 2 points for a true (correct) response, 1 for false and 0 for don’t know. The lowest possible score was 0 and the highest possible score was 14. The percentage of respondents that correctly answered each question (that is; answered - true) is shown in Table 5.

Table 5. Knowledge about Leopards

Knowledge Statements	Percent
Leopards are solitary	82%
Leopards are territorial	51%
Leopards fear humans	25%
Leopards are capable of and have often lived near human habitations	42%
Humans are not the natural prey of leopards	94%
Leopards are endangered	86%
Leopards are an important part of the ecosystem	98%

A majority of the population concurred that leopards were solitary, endangered, did not usually prey on human beings as well as the fact that they were an important part of the ecosystem.

H₃: There is a positive association between peoples' knowledge about leopard ecology and tolerance towards leopards and their conservation.

Statistical analysis revealed a significant relationship between knowledge and attitude as well as knowledge and behavioral intentions. Pearson's correlation coefficient, r , was used to measure the strength of the relationships between attitude and knowledge. The analysis revealed that the sum of knowledge items and the sum of attitude items were positively correlated with a Pearson's coefficient $r = 0.2421$, and they were also highly significant ($p = 0.0025$). Those with higher knowledge scores were also likely to have more positive behavioral intentions ($r = 0.256$, $p = 0.0014$) (Table 10). Therefore, this hypothesis was accepted, as greater knowledge led to a more positive attitude towards leopards (Table 10).

Although knowledge was positively and significantly correlated with attitude and behavioral intention, it was significantly and negatively correlated with subjective norms. Chi square analysis revealed that knowledge was dependent on annual income but independent of gender and age.

Conflict with Leopards and Patterns in Leopard Attacks

Ninety-eight percent of the respondents thought that conflict with leopards in the area did occur and were a serious problem (Table 6). Seventy one percent of survey population claimed an increase in leopards as well as leopard sign sightings in comparison to 5 years ago. About the same percentage of respondents (70%) stated an increase in the number of leopard attacks and instances of livestock depredation in the

past 5 years. The average respondent believed there were 98 leopards in the Junnar area and believed that about 23 of these leopards strayed, attacked livestock and people.

Table 6. Level of Conflict with Leopards

Is there a conflict with leopards, in this area?				
Yes	98.05%			
No	1.95%			
Leopards or signs of leopards _____ than 5 years ago	More Now 70.78%	Less Now 10.39%	The same 18.18%	Don't Know 0.65%
Leopard attacks on humans & livestock _____ than 5 years ago	More Now 70.13%	Less Now 12.34%	The same 13.64%	Don't Know 3.90%

H₄: Those who believe there are a large number of problem leopards in the area are likely to have a negative attitude towards leopards and their conservation.

Pearson's *r* correlations were performed between the number of problem leopards in the area and the sum of attitudes (Table 10). The results identified weak and statistically insignificant associations between these variables. Therefore, the hypothesis was rejected, as a negative association between attitudes and the number of problem leopards in the area did not exist.

Management Strategy of Preference in Leopard Encounters

In spite of the high level of conflict with leopards, the local residents were compassionate in regard to the leopards' predicament. They believed that if an animal was seen in the agricultural landscape or was responsible for attacking or killing livestock or a pet, it should be caught and relocated (Table 7). Even in instances where a

leopard approached, attacked or was responsible for killing a human being, 60% of the respondents preferred the animal be relocated, 25% wished the animal would live the rest of its life in captivity and 14% advocated that the animal be destroyed.

Table 7. Management Strategy of Preference in Different Circumstances of Leopard Encounters

According to you if a leopard ...	No Action	Frighten	Capture, Relocate	Captive	Destroy	Other
is seen in the area the FD should attacks/kills	0.6%	5.8%	87.0%	6.5%	0.0%	0.0%
livestock/pet the FD should approaches/attacks/kills	0.0%	2.6%	83.8%	13.6%	0.0%	0.0%
person FD should	0.0%	1.3%	59.7%	24.7%	13.6%	0.6%

H₅: Those who prefer the captivity or destruction of leopards in the landscape are more likely to have negative attitudes towards leopards and their conservation.

It was assumed that respondents who preferred that leopards seen in the landscape or responsible for attacking/killing livestock should be kept captive or destroyed would have negative attitudes towards leopards and their conservation; this hypothesis was supported. Chi square analyses between these variables did not reveal dependency; however, Pearson's r correlations revealed a significant negative correlation between the preferred management strategy and sum of the attitude items (Table 10). Those who favored captivity or destruction of leopards seen in the landscape did have negative attitudes ($r = -0.1585$, $p = 0.0495$) towards leopards as did those who

preferred this for leopards responsible for attacking/killing livestock ($r = -0.1346$, $p = 0.0961$). The same was observed about management strategy of preference and behavioral intention, as shown in Table 10, therefore, this hypothesis was accepted.

Views towards Leopards and Their Conservation

The local residents “on average” had a positive opinion of leopards; 46% liked and 23% loved leopards, in general. However, people’s feelings towards leopards living in their surroundings were much more negative, averaging 3.7; towards dislike. Only 17% of the sample population tended to *like* or *love* leopards living in their surroundings; while 30% disliked and 31% hated leopards in their surroundings. In general, the opinion towards the leopard population of Junnar *taluka* was that it should be reduced, as was supported by 77% of the sample population (Table 8).

Table 8. Views of Leopards and Their Population in Junnar

	Eliminated	Reduced	Maintained	Increased	Mean	
Leopard population in Junnar taluka should be	7%	77%	11%	5%	2.1	
Views towards Leopards in general?	Love	Like	No Opinion	Dislike	Hate	Mean
Leopards in general?	23%	46%	16%	10%	5%	2.3
Leopards in surroundings?	2%	15%	22%	30%	31%	3.7

A greater proportion of the population tended to agree (47%) or strongly agree (8%) with the fact that leopards suffer due to translocation (Table 9). Eighty-seven percent of the respondents believed that leopards suffered due to life in captivity. Over

92% of them believed (agreed or strongly agreed) leopards to be endangered animals in need of protection and conservation. When asked if they would participate in *any* way towards leopard conservation, 78% of them had a positive attitude and less than 18% were found to be less likely to participate in leopard conservation.

Table 9. Views towards Participation in Leopard Conservation and the Effect of Conservation Related Activity on Leopards

Leopards....	Strongly Disagree	Disagree	Unsure	Agree	Strongly Agree	Mean
Suffer in translocation	1%	32%	10%	47%	8%	3.3
Suffer in captivity	0%	10%	3%	64%	23%	4.0
Are endangered, need conservation	0%	7%	1%	75%	18%	4.0
Would you participate in leopard conservation	1%	17%	5%	69%	9%	3.7

H₆: There is a positive association between peoples' views towards leopards and attitudes towards their conservation.

The results of the Kruskal-Wallis analysis on attitudes and views towards leopards and their conservation were found to be significant (Appendix B); however respondents with a more positive attitude were not inclined to advocate an increase in the leopard population nor did they think that leopards suffer in captivity. Pearson correlation analyses between these variables were found to be significant and positively correlated (Table 10). Moderate and highly significant correlations were found between the sum of attitudes and willingness to participate in leopard conservation ($r = 0.3365$, $p < 0.0001$) as well as between the sum of attitudes and view that leopards are endangered

and need protection ($r = 0.2929$, $p = 0.0002$). Therefore, this hypothesis was accepted, as positive attitudes led to positive views towards leopards and their conservation.

Table 10. Correlations between Attitude / Behavioral Intentions and Hypothesized Variables

Variables	Sum of Attitude		Sum of Behavioral Intention	
	<i>r</i>	<i>p</i> value	<i>r</i>	<i>p</i> value
Annual Income	0.1547**	0.0554	0.1656*	0.0401
Level of Knowledge	0.2421*	0.0025	0.2015*	0.0122
Opinion about leopards in general	0.2398*	0.0027	0.1253	0.1214
Opinion about leopards in surroundings	0.0827	0.308	0.1069	0.1871
Leopard population in Junnar taluka should be	-0.1631*	0.0433	0.1976*	0.014
Leopards suffer due to translocation	0.1927*	0.0167	0.1604*	0.0469
Leopards suffer due to life in captivity	0.1512**	0.0612	0.3059*	0.0001
Leopards are endangered, need conservation & protection	0.2929*	0.0002	0.3757*	<.0001
Would you participate in leopard conservation	0.3545*	<.0001	0.289*	0.0003
MS - If leopard seen	-0.1585*	0.0495	-0.264*	0.0009
MS - If leopard attacks livestock	-0.1346**	0.0961	-0.153**	0.0582
Adequate compensation makes conflict tolerable	0.081	0.3178	-0.0371	0.6481
No. of Problem Leopards	0.0567	0.4845	0.0034	0.967

Analysis Based on the Theory of Reasoned Action

The TRA involves specific methods for measuring behavioral intention, attitude, subjective norms and their related beliefs (Ajzen & Fishbein, 1980). A total of thirty-two items were measured using a five-point Likert scale format (1=Strongly Disagree, 2=

Disagree, 3= Unsure, 4 = Agree, 5 = Strongly Agree). Frequencies and means are presented in Table 11.

Analysis of the TRA followed the steps laid out by Fishbein and Ajzen (1980). Correlation coefficients were used to examine the relationships between attitudes, subjective norms and behavioral intentions towards leopards and their conservation. First the standard TRA model was estimated using OLS regressions. Second, an additional predictor variable, knowledge, was added to the model and then OLS regressions were run. Standardized beta regression coefficients were used to estimate the relative importance of the attitudinal, normative components and, later, the knowledge component and their relationships with behavioral intention. The products of each behavioral belief and belief strength item resulted in eight items; these were subjected to a principal components analysis. The resultant three principal components explained maximum variability and corrected redundancy in the data. The attitude measure was then regressed on these three principal components. The same procedure was carried out on the three product items of normative beliefs and motivations to comply. The sum of subjective norms was then regressed on the two resultant principal components.

Table 11. Theory of Reasoned Action

TRA Item	Strongly Disagree	Disagree	Unsure	Agree	Strongly Agree	Mean
Attitudes						
Having no threat of financial loss due to leopards is important to me	0%	1%	1%	80%	19%	4.2
Having no threat of leopards attacks on me, my family is important to me	0%	0%	0%	78%	22%	4.2
Leopards do not normally hunt humans, therefore present no direct threat to me or my family	9%	53%	8%	30%	1%	2.6
Leopards and their conservation is important to me	0%	7%	0%	79%	14%	4.0
Subjective Norm						
Concerning leopards, I want to do what my family and friends think I should do	0%	15%	2%	77%	6%	3.7
Concerning leopards, I want to do what other villagers think I should do	0%	20%	1%	73%	6%	3.6
Concerning leopards, I want to do what Forest officers and conservationists think I should do	0%	14%	5%	73%	9%	3.8
Behavioral Intentions						
I intend to report problem leopards to the proper authority rather than taking matters into my own hands	1%	1%	0%	69%	29%	4.3
I intend to follow the guidelines to prevent conflict with leopards and support leopard conservation	0%	1%	0%	73%	26%	4.2
I do not intend to harm innocent leopards	0%	1%	1%	68%	31%	4.3

Behavioral Intention

Three items of behavioral intentions were used to assess the respondents' behavioral intentions towards leopards and their conservation. Most of the respondents (99%) intended to report problem leopards to the authorities rather than take matters into their own hands. Similarly, almost all respondents (99%) intended to follow guidelines to prevent conflict and support leopard conservation. Ninety-nine percent agreed or strongly agreed that they did not intend to harm innocent leopards (Table 11). Since the Cronbach's alpha for all three items was 0.6143, the first behavioral intention item - "... intend to report problem leopards...." was excluded to obtain a higher Cronbach's alpha of 0.7189.

Attitude

Attitudes were assessed using four questions. To obtain an acceptable Cronbach's alpha (0.5358) one of the attitude items (item 3) was excluded from the sum of attitudes which constituted the measure of attitude (A. Zimmermann, et al., 2005). Almost all of the respondents (99%) agreed that having no threat of financial loss due to leopards was important to them and all of them (100%) agreed that not having the threat of leopard attacks on themselves and their family was important. However, a large percentage of them (62%) disagreed or strongly disagreed that leopards presented no direct threat to them, as they did not normally hunt humans. Nevertheless, 93% of the respondents agreed or strongly agreed that leopards and their conservation were important to them while 7% disagreed with the statement (Table 11). Ordinary least squares (OLS) regression of attitude and behavioral intention resulted in an adjusted $R^2 =$

0.2324 and a standardized $\beta = 0.383$, $p < 0.0001$ (Table 11). Attitude and behavioral intention were also found to be correlated at $r = 0.4878$ and was highly significant, $p < 0.0001$.

Behavioral Beliefs and Belief Strengths

Beliefs regarding leopards and their conservation were assessed using a list of eight behavioral beliefs; these were identified from previous studies examining man-carnivore conflicts. Respondents rated their beliefs (*strongly disagree* to *strongly agree*) as well as their corresponding beliefs strengths (*extremely uncertain* to *extremely certain*) on a five-point scale. For each respondent, the behavioral belief was multiplied by the belief strength; a principal components analysis was run on the resultant products of behavioral beliefs and belief strength. The first three principal components were then regressed on the measure of attitude (sum of attitudes 1, 2 and 4). The principal components of the product of behavioral beliefs and belief strength resulted in an adjusted $R^2 = 0.3015$ and principal components 1 and 2 were found to be significant ($p < 0.0001$ and $p = 0.0481$, respectively). The third principal component was not found to be significant, $p = 0.7784$.

Subjective Norm

To assess the normative influence of important people towards behavior three items were used. About 77% agreed that what their family and friends thought about leopards and their conservation was important to them; 73% agreed that other villagers' thoughts about leopards and their conservation were important to them. The same number (73%) agreed that the opinions of conservationists and Forest Department

officials were important (Table 11). The Cronbach's alpha for all three items was 0.5936. All three items were summed to give a measure of the subjective norm. OLS regression of the subjective norm and behavioral intention resulted in an adjusted $R^2 = 0.0403$ and a standardized $\beta = 0.383$, $p < 0.0001$ (Table 12). Attitude and behavioral intention were also found to be correlated at $r = 0.1032$ and was highly significant, $p = 0.0072$.

Normative Beliefs and Motivations to comply

According to the TRA, an index obtained by multiplying a person's normative beliefs by their motivations to comply can be used to predict the person's subjective norm. Three referent groups: family and friends, other villagers and Forest Department officials, were used to evaluate perceived normative pressures towards leopards and their conservation. For each respondent, the normative belief was multiplied by the corresponding motivation to comply. A principal components analysis was run on the resultant products of normative beliefs and motivations to comply. The first two principal components were then regressed on the measure of subjective norm and resulting in an adjusted $R^2 = 0.1189$. Both the principal components were found to be highly significant ($p < 0.0001$ and $p = 0.0069$, respectively).

Table 12. Simple Regression Analysis Summary for Predicting Behavioral Intention

Dependent Variable	Independent Variables	β	$p(\beta)$	R^2	F	$p(F)$	r	p
Behavioral Intention	Attitude	0.383	0.000	0.232	47.473	0.000	0.4878	<.000
		2		9	3		*	1
Behavioral Intention	Subjective Norm	0.103	0.007	0.040	7.4337	0.000	0.2159	0.007
		2	2	3			*	
Behavioral Intention	Knowledge	0.146	0.002	0.050	9.1469	0.002	0.2015	0.012
		2	9	5		9	*	2

The TRA model was first evaluated by running a series of Pearson's r correlations after which multiple regressions were performed (Figure 2). Results of the Pearson's correlations suggest that the model is consistent with the TRA. By using regression analysis, the TRA model was found to be consistent with TRA theory (Table 13). When intention was regressed on attitude and subjective norm, the resulting random effects model had an $R^2 = 0.2858$ and therefore explained about 29% of the variance. The standardized coefficient for attitude was reasonably high ($\beta = 0.3769$, $p < 0.0001$) and explained 21% of the model's variance. Subjective norm had a smaller standardized coefficient ($\beta = 0.0948$, $p < 0.0035$) and had the ability to predict 1.4 % of the variance in intentions towards leopards and their conservation. The random effects model was used at this stage to get the variance component for each factor; this provides the percentage of variability that each factor accounts for in the model, and it revealed that subjective norm had a lesser influence than attitude on intentions.

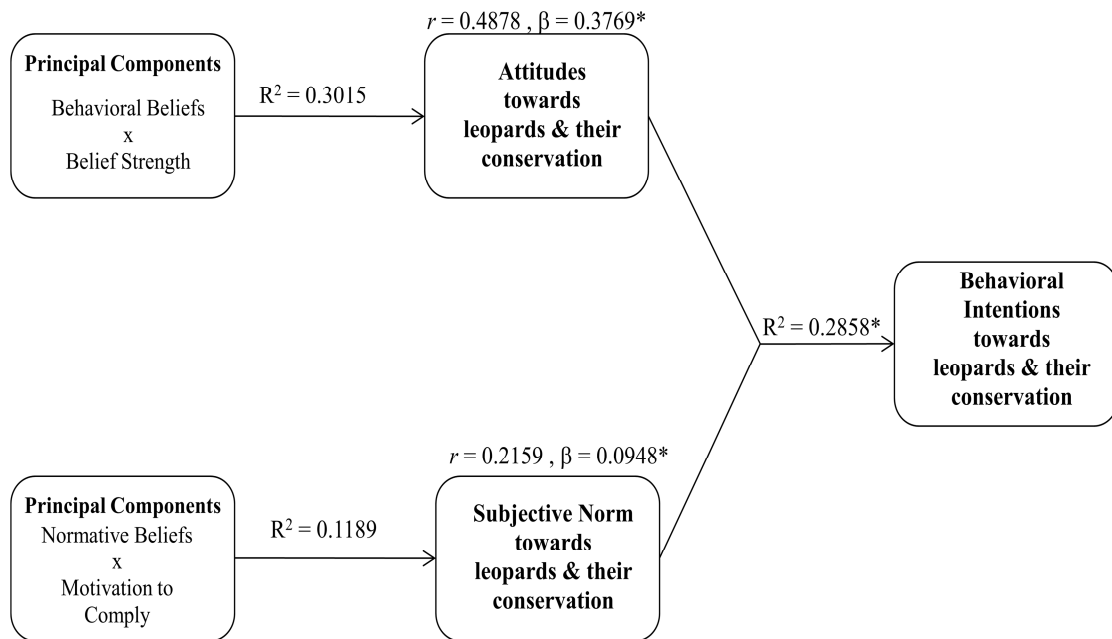


Figure 2. Theory of Reasoned Action Model. All variables are statistically significant at $p < 0.05$. For prediction of intention ($n = 154$), $R^2_{adj} = 0.29$.

When level of knowledge was added to the model, the amount of variance explained increased to 32%. Attitude and subjective norm were found to be significant contributors to the model, and the level of knowledge too was found to significantly contribute to the model. Therefore, the results of the multiple regressions (Table 13) show that the model is a significant predictor of behavioral intention. The predictor variables of attitude, subjective norm and knowledge explain 32% of the variability in behavioral intentions (Figure 3). Results also demonstrate that attitudes contribute the most to the behavioral intentions towards leopards and their conservation. Even though subjective norm and knowledge were significant contributors to the model, their contribution was low.

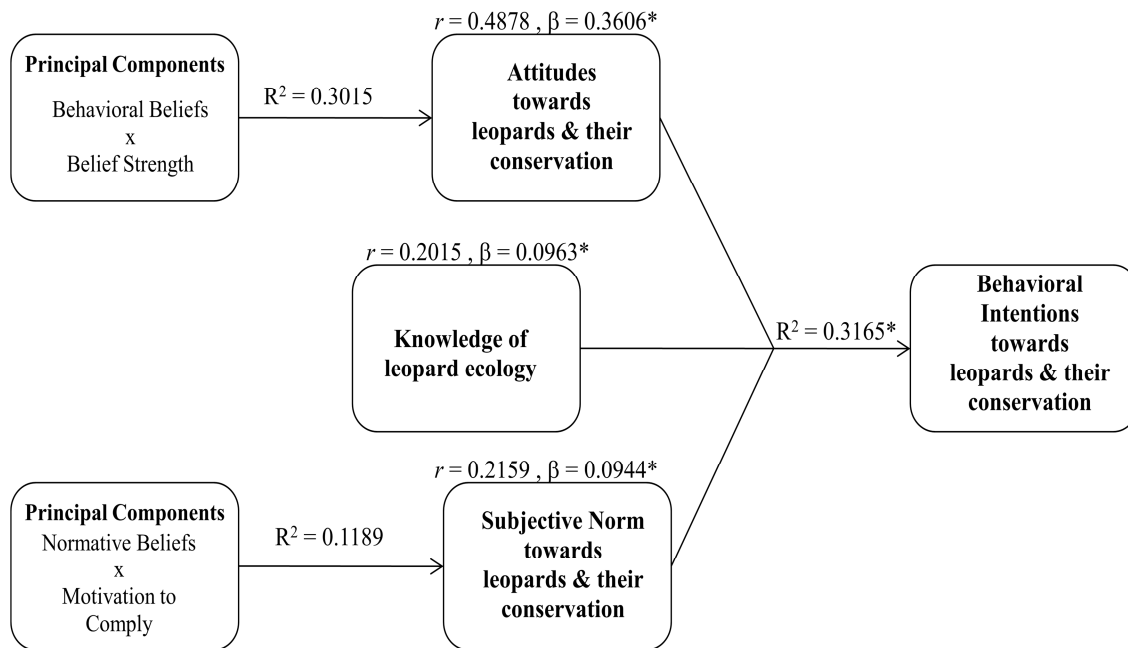


Figure 3. Theory of Reasoned Action Model Including Knowledge as a Statistically Significant Background Variable. For prediction of intention ($n = 154$), $R^2_{adj} = 0.32$.

Table 13. Multiple Regression Analysis Summary for Predicting Behavioral Intention

Dependent Variable	Independent Variables	β	$p(\beta)$	R^2	F	$p(F)$
Behavioral Intention	Attitude	0.3769	0.000	0.2858	30.3005	0.000
	Subjective Norm	0.0948	0.0035			
Behavioral Intention	Attitude	0.3606	0.000	0.3165	23.2805	0.000
	Subjective Norm	0.0963	0.0026			
	Knowledge	0.0944	0.0206			

CHAPTER V

DISCUSSION

The Indian Leopard (*Panthera pardus fuscus*) population has increased in the JFD, and these cats have been implicated in attacks on pets, livestock and humans in this area. These incidents of conflict have had significant negative economic effects on the local population, and have led to human injuries and fatalities. Such man-leopard interactions combined with a lack of financial compensation programs could affect the attitudes of the local communities towards leopards and their future conservation.

The social acceptance of this species and cooperation from local communities in its conservation is crucial for the management and the continued survival of this large carnivore. This study provides an in-depth examination of the attitudes of local people of the JFD towards leopards and their conservation. The results identify the characteristics of local residents of the JFD, including their attitudes, beliefs, perceived reasons for conflict, knowledge of leopards, and views towards leopards and their conservation. These findings can provide a foundation for recommendations regarding regulatory interventions and educational and management strategies for the future.

Attitudes and Behavioral Intentions

Simultaneously loved and hated, the leopard is an integral part of the ecosystem. Most of the locals acknowledge this fact. Although the locals may resent that leopards prey on their pets and livestock and, on occasion, attack humans, their feelings about

leopards are not limited to the economic loss they experience. Although several socioeconomic and demographic variables have been found to be statistically significant in relation to attitudes, this study revealed the existence of social, psychological and cultural variables that shape the locals' perceptions of leopards and their conservation. The current study has shown that attitudes toward leopards are complex, with the same person often displaying both negative and positive views of them. And even though leopards are loathed when they attack people or livestock, this study reveals positive dimensions of the local peoples' perceptions of leopards, which are relevant to the conservation of this animal.

This study is one of the first attempts to quantitatively assess attitudes towards leopards and their conservation in the JFD, India. Past research in India and other parts of the world has revealed that local peoples' attitudes towards large carnivores responsible for livestock depredation and attacks on humans are usually negative (Dar, et al., 2009; Røskaft, Händel, Bjerke, & Kaltenborn, 2007; Saberwal, et al., 1994). However, attitudes towards large carnivores such as black bears and cougars have also been found to be skewed in the positive direction (Morzillo, Mertig, Garner, & Liu, 2007; Thornton & Quinn, 2010) which is consistent with past research in many different regions of the world. While fear of leopards is expected and natural, it is often cited as the main reason for having negative attitudes towards the animal. In contrast, other studies have reported surprisingly favorable attitudes towards large carnivores, and it has been hypothesized that the fear may also turn into a fascination with the animal (Legendijk & Gusset, 2008).

The results of this study demonstrate that even though not having the threat of financial loss and attacks on humans due to leopards was important to the locals; so were leopards and their conservation. Behavioral intentions were also found to be skewed in the positive direction for the most part. In other parts of the world, and even in India, innocent wild animals have been killed as a result of retaliatory killings; however, in this study, the locals did not intend to harm innocent animals, intended to report them rather than taking matters into their own hands and intended to follow guidelines to prevent conflict. Consequently, this is a significant finding: that in spite of economic losses and fear of attack, residents maintained a positive attitude and behavioral intentions towards leopards in general. This positive outlook may be attributed to the fact that most of the respondents lived on the land, as farmers tend to be more aware of the fragile balance of nature and the ecological importance of a top predator like the leopard. It could also be attributed to the fact that, on average, the survey participants were relatively aware, conscious of conservation activities, better educated and more affluent due to the development of the region and proximity to a city. Since the conservation of this animal involves and affects the local population of Junnar, such positive perceptions of leopards should be acknowledged and investigated further.

Demographic Variables

Thornton and Quinn (2009) reported that gender differences in attitudes may be attributed to the fact that females have less experience with large carnivores compared with men, who have more experience through hunting. However, the present study found no differences in attitudes based on gender. In India, hunting is illegal and women work

in the fields as well; therefore, they have about the same amount of experience with leopards as men do, which may explain why no differences in attitudes were found. Additionally, the observed positive relationship between education and attitudes ($r = 0.2029$, $p = 0.0116$) was also to be expected, since increased education implies broad-mindedness, greater awareness and exposure to current issues including environmental and conservation-related issues. In rural India, livestock are sometimes considered as a form of savings used to finance weddings, pay dowries, pay for funerals, etc. and provide agrarian households with a supplementary income in the event of crop failure. The loss of this supplementary income is also upsetting because most livestock owners are emotionally attached to their animals (Naughton-Treves, et al., 2003), hence, the positive attitudes towards leopards despite the high incidence of livestock depredation is surprising. It may be that the comparatively positive attitudes of the respondents can be attributed to the fact that most of the farmers in the sample population have a higher standard of living, compared with subsistence farmers in other parts of India who also suffer economic losses to large carnivores (Mishra, 2002). In further support of this supposition, respondents within a higher income bracket were found to have more positive attitudes towards leopards and their conservation. This result is to be expected, as the consequences of economic losses, such as losing livestock to leopards, are not as dire for those who are financially better off. The comparatively higher incomes of the study participants, in contrast to poorer, subsistence farmers in other parts of the country, may explain the overall positive attitudes and intentions of the local residents.

Government Compensation

Previous investigations of HWC have suggested that compensation schemes for livestock losses to wild carnivores can improve locals' attitudes toward the acceptance of wildlife (Dar, et al., 2009). Nevertheless, neither adequate nor timely compensation were found to improve individual attitudes towards leopards in this study. Furthermore, informal conversations revealed that the locals considered the compensation payments to be inadequate. Most of the respondents were disgruntled with the system used by the government to compensate villagers for depredated livestock. They reported difficulties in getting the compensation, procedural problems and the absence of Forest Department officials as some of the problems they faced. This dissatisfaction with the current compensation program could explain why the locals did not believe compensation programs would improve tolerance towards the leopards or alleviate conflict with these animals in the region.

Even though compensation was not found to improve tolerance towards leopards, earlier studies (Bangs, et al., 1998) have stated that it would be a mistake to discontinue the program as the public expects these reimbursements. Bangs, et al. (1998) reported that stopping compensation payments may cause retaliation and greater hostility towards the wild species involved. However, it is unknown whether effective and efficient compensation for losses due to leopards might ameliorate locals' attitudes towards leopards. The respondents disagreed with the statement that compensation would affect their attitudes positively, but their skepticism could be attributed to their distrust of the Forest Department and cynicism regarding the effectiveness of the program. Thus, there

is a need to replace protracted bureaucratic procedures with transparent, effective and efficient government compensation programs which help foster trust towards the Forest Department and strengthen positive attitudes towards leopards and their conservation.

Knowledge

Respondents scored an average of 11.4 on the 14-point knowledge scale. Half the respondents were unable to correctly answer the item that asked whether leopards are territorial, and only 40% of them were aware that leopards often live near human habitations. This highlights the need for increased public awareness about leopard ecology. Increased knowledge and awareness might reduce incidents of livestock depredation by leopards, increase tolerance towards their existence in the landscape and reduce degradation and loss of habitat.

The study results revealed that knowledge levels were significantly and positively correlated to attitude scores concerning leopards and their conservation. Also, the mean knowledge scores of respondents with a more positive attitude towards leopards and their conservation were also found to be significantly higher than those with more negative attitudes. So, a greater knowledge of leopard ecology implied more positive attitudes towards leopards and their conservation. These results were consistent with past research studies, suggesting a direct relationship between knowledge about and attitudes towards bears and other carnivore species (A. Bath, Olszanska, A., & Okarma, H., 2008; Morzillo, et al., 2007). Aipanjiguly et al. (2003) found knowledge levels to be significantly and positively correlated with attitudes supportive of manatee conservation.

These findings together with other research suggest that knowledge about a species is a significant predictor of attitudes towards it.

Similarly, knowledge was also found to be positively and significantly correlated with behavioral intentions. However, in the present study subjective norms were found to be negatively and significantly correlated with knowledge, and a similar finding was reported by (Bates, et al., 2009). The negative relationship between knowledge and subjective norms makes intuitive sense; the more a person considers him/herself to be knowledgeable about leopards the less likely it is that they would consider another's views on the subject.

Also, past research has indicated that knowledge is dependent on age (Campbell & Lancaster, 2010). Although knowledge was not dependent on age in the present study, this could be due to the fact that only a handful of study participants were under the age of 20 or over 60. Previous studies have also reported that females have lower knowledge levels (A. Bath, Olszanska, A., & Okarma, H., 2008), conversely, in this study, knowledge was not found to be dependent on gender. This finding, that females had the same level of knowledge as men, is positive and surprising, especially as traditional farmer families are rather patriarchic, and women do not receive as much education as men in India. The finding that knowledge was dependent on annual income was consistent with past research and not surprising, because those with higher incomes are more likely to be better educated or know well-educated people. The direct relationship between views, attitudes, intention and knowledge suggests that increased knowledge might give the public a more positive view of wildlife, but past research has shown that

this is evident only under certain conditions where educational programs are carefully targeted, assessed and prepared (A. Bath, Olszanska, A., & Okarma, H., 2008). And, if not implemented properly, wildlife educational programs can backfire. For instance, the knowledge level was found to be negatively correlated with attitudes towards bears (Kaczensky, et al., 2004; Szinovatz, 1997), and Bath (1998) also found that people with higher knowledge levels tended to score more negatively on attitude tests. Consequently, we can conclude that any campaign to raise awareness and increase knowledge about leopards in the JFD should be carefully targeted and prepared so as to reinforce existing positive attitudes.

Despite the fact that in this study attitudes were found to be positive in the presence of low knowledge scores, this does not imply that knowledge about leopards is unimportant. As reported by Kaczensky, et al. (2004), knowledge is difficult to quantify, and while it may not necessarily change attitudes, it can be a foundation used to strengthen and rationalize attitudes. Knowledge is an important predictor of attitudes and carefully applied awareness campaigns could help reinforce or develop positive attitudes towards the conservation of an animal species associated with human conflict.

Number of Problem Leopards

It was assumed that the estimated number of problem leopards in the area would affect the attitudes of the respondents negatively. However, attitudes were not found to be sensitive to the number of leopards or the number of problem leopards in the area, and this result was consistent with research by Naughton-Treves, et al. (2003) and Bath, et al. (2008). The absence of this assumed relationship may be attributed to a lack of

awareness of the actual number of leopards, proportion of problem leopards amongst this population and the actual extent of predation. The estimated leopard population is not widely known by the local population; the newspapers and television only report incidents concerning leopards when the attacks occur on people. This information could be provided to the locals by the local Forest Department, but the lack of trust in the agency prevents them from doing so.

Past studies have revealed that the presence or absence of a large carnivore has little or no affect on those with positive attitudes; researchers have warned that the support for conservation of a carnivore species might decline if the population increases and causes more damage (Andersone & Ozolinš, 2004; Røskaft, et al., 2007). For that reason, even though this study reveals attitudes and behavioral intentions that tend to be positive, if the populations of these carnivores increase and cause damage beyond a threshold level of tolerance, the support for conservation of the species is likely to decline. Thus, action is needed not only to avoid a decline in positive attitudes but also to further strengthen this positive outlook.

Management Strategy of Preference

The capture and relocate approach was shown to be the management strategy of choice in the event of sightings, livestock depredation or personal attacks in this study. This result was an unexpected outcome and contrary to past research, which has shown that lethal control is the strategy of choice for rural citizens in dealing with livestock predating wolves (Manfredo, et al., 1998), and capture and relocate is the strategy usually chosen by urban and suburban citizens (Kellert, 1987). According to

Zimmermann, et al. (2001), the significant negative relationship between the severity of management strategy chosen and attitudes could be attributed to the fact that attitudes have been known to change over time (A. Bath, Olszanska, A., & Okarma, H., 2008). Zimmermann, et al. (2001) argued that those living with large carnivores over a long period of time may develop positive attitudes towards them. Based on these findings, the preference of the locals for capture and relocation of problem leopards could be attributed to the fact that the average resident was found to have lived in the area for over 32 years and may have grown accustomed to living with this predator. Since respondents had lived in the area for so long and even lived in the same house for over 25 years, they saw no point in killing or holding the animal captive, because they know that this has not mitigated the conflict.

The choice of a comparatively milder management strategy to deal with problem wildlife could also be attributed to differences in wildlife value orientations. Previous inquiries comparing wildlife value orientations between hunters and non-hunters have established considerable differences between the beliefs held by the two groups (Davenport, Nielsen, & Mangun, 2010). There may be two reasons behind the choice of a less harsh management strategy: hunting is illegal in India and a general reverence for nature that serves as a deterrent to the choice of lethal control for problem leopards (Mishra, et al., 2003). Those who hunt or support hunting are more likely to be dominionistic, that is, express dominance over wildlife. But, since hunting is not legal in India, the idea of dominance over wildlife is less pervasive.

Views Towards Leopards and Their Conservation

The respondents had a love – hate relationship with the leopards; though most of the residents liked and accepted leopards in general, there was a not-in-my-backyard mentality; their presence in that landscape was not acceptable to most. This result is consistent with other studies examining conflict with wild animals (Davenport, et al., 2010; Thornton & Quinn, 2010). Naturally the respondents were aware of the importance of leopards in the ecosystem. The leopard is a top predator, so its extinction would lead to forest depletion, which would lead to droughts. Since most of the respondents were farmers, a drought would be devastating for them; therefore, a majority of the respondents did not want that the leopard population eliminated, only reduced in that landscape. This awareness can be attributed to the fact that most of the respondents are farmers who work the land and are well aware of the delicate balance of nature.

While they appreciated the intrinsic beauty of leopards and considered their conservation important, they were not willing to tolerate livestock losses and attacks on humans. Furthermore, as reported by Zimmermann, et al. (2005), while a majority of the locals agreed that leopards deserve protection and held positive attitudes towards leopards in general they had negative attitudes towards the leopards in their surroundings. Thus, positive perceptions cannot be considered a guarantee that respondents (farmers) will protect leopards in *their environment*. The fact that most of the respondents were conscious of and sympathetic about the endangered status of the leopard, were willing to participate in leopard conservation and were aware of the

leopards' suffering due to translocation could be attributed to their personal pro-conservation attitudes.

Theory of Reasoned Action

This study aimed to assess the relationships between attitudes, subjective norms, knowledge and behavioral intentions using the TRA approach. The study results suggest that the basic TRA predicts local peoples' attitudes towards leopards and their conservation to some extent. The adjusted R^2 (0.2858) and level of significance ($p < 0.0001$) for predicting behavioral intentions, subjective norms and attitudes in this study, while not very high, were consistent with past research using the TRA. For instance, Gotch and Hall (2004) reported that attitudes and subjective norms accounted for 22% of the variance, while using the TRA approach to understand nature-related behaviors among children. Whittaker, et al. (2001) reported R^2 values ranging from 0.04 to 0.32 in their examination of beliefs and attitudes towards the urban wildlife hunt in Alaska. Yet, from a practical perspective it is important to note that the study model was unable to account for about two-thirds of the total variance in behavioral intention. This implies that the TRA has been unable to capture essential sources of variance in this study.

Fishbein and Ajzen (1975) stated that the relative weights of the normative and attitudinal components might differ across behaviors as well as across populations for the same behavior. Consistent with previous research on natural resource management using the TRA, the present study revealed that attitudes are a strong predictor of

behavioral intentions. For instance, Sorice and Conner's (2010) assessment of landowners' intentions to enroll in incentive programs to protect endangered species found that attitudes had a stronger relationship with intentions than subjective norms. Bright, et al., (1993), while studying public perceptions of the National Park Service's controlled burn policy, also found that a change in intention to support the policy was predicted by the level of change in attitude. The present study, too, clearly shows that the attitudinal component has a greater influence on intentions towards leopards and their conservation; the stronger correlation between attitudes and intention ($r = 0.49$) and the higher relative weight of the attitudes ($\beta = 0.3769$), shows that behavioral intentions towards leopards and their conservation fall under attitudinal control.

A positive relationship was expected and found between behavioral beliefs, attitudes and intentions towards leopards and their conservation; however, the role of the normative component was less defined. The principal components of normative beliefs and corresponding motivations to comply had a low R^2 (0.12). Subjective norm, in turn, was correlated weakly with behavioral intention ($r = 0.22$) and had a low relative weight ($\beta = 0.0948$). This was not surprising because in much of the literature associated with the TRA, subjective norm is only weakly related to intention. For example, Luzar and Diagne (1999) reported that it was not significant at all in the prediction of participation in the Wetlands Reserve Program. Besides, taking into consideration that farmers are strong, self-made people, known to be independent decision makers, the low subjective norm is not unexpected. The respondents in this study, on average, portrayed themselves as being unsure of how important leopards and their conservation were to different

referent groups (family, friends, other villagers and forest officials). This lack of awareness could account for the weak predictive ability of subjective norms for behavioral intention.

According to the TRA, behavioral beliefs are significant determinants of attitudes. In this study, though, the sum of the products of behavioral beliefs and outcome evaluations of those beliefs was found to be significant, ($p < 0.0001$) but only moderately correlated (0.4001) with the sum of attitudes. This suggests that not all the beliefs regarding leopards and their conservation were captured in the questionnaire. This could be due to the fact that the behavioral beliefs were adopted from previous studies on HWC and not obtained through elicitation interviews. The study aimed to assess behavioral beliefs and outcome evaluations regarding leopards *and* their conservation. Since the items did not measure the same unidimensional construct, this resulted in a low Cronbach's alpha value for the eight items (0.4036). A subsequent principal components analysis also revealed the multidimensionality of the items. Subsequently, the resultant principal components that explained most of the variance were regressed on the sum of attitudes with an $R^2 = 0.3015$, and were in line with values reported by Whittaker, et al., (2001) in a study examining attitudes towards urban hunting of moose.

As the name implies, the TRA presumes that the behavior is a deliberate and rational one. Consequently, an additional explanation for the moderate relationship between behavioral beliefs and attitudes could be that the locals may not have given much conscious thought to their attitudes towards leopards and their conservation.

Because they are so accustomed to dealing with leopards, the high level of conflict is second nature to them; hence, it is not a deliberate and rational action. Nevertheless, behavioral beliefs were positively and significantly related to attitude, indicating that as expected outcome evaluations and beliefs about leopards and their conservation became more positive, attitude became more positive also.

Since the initial development of the theory, Fishbein and Ajzen (1975) have maintained that variables not specified by the TRA have only an indirect effect via subjective norm or attitude; this finding was supported in this study. When subjective norm and attitude are included in the model, attitude accounts for 21% of the model's variance. And, when knowledge is introduced into the model, it falls to 19%, although the contribution of residuals and subjective norm remains almost unchanged. Thus, the added variable (knowledge) seems to gain some, or most, of its power from the attitude variable. In spite of the shared variance, the model's adjusted R^2 did increase with the addition of the knowledge variable ($R^2 = 0.3165$), indicating that it did provide a unique contribution prediction beyond subjective norm and attitude.

One of the major contributions of this study was that it used the theoretical framework of the TRA. Theoretical frameworks provide more than just correlations between attitudes and behaviors; they offer a means to understand how norms and attitudes influence behavior. Furthermore, these frameworks can also help researchers in the assessment and comparison of attitudinal inquiries (Decker, Brown, & Siemer, 2001). For instance, stakeholders attitudes towards leopards in Junnar could be compared to stakeholders attitudes towards leopards in another area of severe man-

leopard conflict, such as Sanjay Gandhi National Park (Athreya, Thakur, Chaudhuri, & Belsare, 2007b). Hence, the TRA framework allows researchers to identify the basis of behavioral intentions. And, according to the TRA, actual behavior can be predicted based on subjective norms, attitudes and intentions. This has been demonstrated by previous research; attitudes towards wolf reintroduction in Colorado were found to be predictive of a person's voting intention on the issue by Pate, et al., (1996) , and the TRA model was found to explain changes in the public's attitude and behavior towards the National Park Service's controlled burn policy (Bright, et al., 1993). In contrast, in this study, the behavior of conserving leopards was not observed due to logistical reasons, only the intentions towards performing it were tested using the TRA framework.

TRA measures are also most effective when measured as close to the performance time as possible (Sheppard, Hartwick, & Warshaw, 1988). For this reason, it was important to carry out the study when conflicts between leopards and humans were at their peak. Ecologists and conservationists have found that in this sugarcane belt, conflicts peak at the end of summer and the beginning of the monsoon season in the months of June and July. It is around this time that sugarcane is ready for harvesting and the ripe sugarcane starts falling, thereby exposing the leopards hidden within. The conflicts also peak around this time because farmers and laborers enter the fields to harvest the sugarcane, thus entering the leopards' habitat which leads to conflict. Since this study was carried out at the time when man-leopard conflicts peak, this increases the

validity of the measures, and the effectiveness and predictive ability of the study in examining attitudes towards leopards in a conflict hotspot.

With the success of conservation programs resulting in an increase in wildlife populations, the development of rural landscapes in India combined with the unique ecology of leopards and diminishing populations of natural prey, conflicts and negative attitudes towards leopards are almost certain to increase. Conservation efforts have recognized the need to look beyond the ecological perspective to understand the dynamics involved in HWC throughout the world. The use of sound theoretical frameworks, such as the TRA, could improve our understanding of attitudes and tolerance in the man-leopard conflict in a conflict hotspot in India, and help us understand, predict and even modify behaviors relating to the conservation of wildlife. Consequently, this study makes significant contributions to the literature and has important implications for social scientists and wildlife managers in the field.

CHAPTER VI

CONCLUSIONS

The sub-district of Junnar has grown drastically in the past two decades due to the establishment of the sugar and wine belt in the region. This growth has led to large scale cultivation of sugarcane in areas that were grasslands or used for traditional crops such as wheat. In this area, as the population grows and farm lands expand, there is increased potential for negative man-leopard conflict. Leopards are solitary and elusive animals; and, though they are rarely seen in forests they are quite common in Junnar, and, here, they live in closer proximity to human habitation than would be considered comfortable. It has been proposed that the three main factors involved in the recent increase in man-leopard conflict in India are: habitat loss, habitat fragmentation, and increased urban and rural human population densities. It is unlikely that these pressures will lessen and, for this reason, man-leopard conflicts need to be addressed in a proactive rather than a reactive manner.

Decision makers concerned with leopard conservation must accept that the conservation and management of large carnivores like leopards mainly depends on social acceptance of the species and the support of the local communities (Treves & Karanth, 2003). For a conservation strategy to be successful, all stakeholders must be considered. Given the complex nature of man-leopard conflicts in Junnar, policies and management practices need to be developed that consider and address all stakeholders and their issues. And, although finding a solution to a multifaceted problem such as man-leopard

interaction and conflict is a challenge. However, the more issues that are addressed and solutions implemented, the closer we get to the likelihood of successful coexistence with the leopard as well as other large carnivores.

This study generated baseline information about man-leopard conflict and its many different aspects in Junnar. Further in-depth studies along these lines may help us understand the complex issues of HWC and assist with conservation efforts in human-dominated landscapes. Furthermore, this study serves as a foundation for further research that examines the perceptions and attitudes of local residents toward different wildlife species in other regions of India, using similar theoretical frameworks.

Theoretical Implications

No previous research has examined the attitudes and perceptions of local residents towards leopards and leopard conservation in India using a theoretical framework such as the TRA. Yet, understanding these attitudes and perceptions can help us develop insights into what is needed to better manage this severe man-leopard conflict.

The TRA is an effective model for examining the relationships between attitude, subjective norms and intended behavior. Though the strength of the relationships between the components and behavioral intention was not found to be very strong in this study, they were both significant contributors to explaining intention in the linear model. The study also indicated that the attitudinal component weighed more heavily than the normative component in the behavioral intention towards leopard conservation. These data also suggest that fear of financial loss and attacks on family members are the most

influential attitudes determining behavior. But the large amount of unexplained variance in the model suggests that other factors also influence behavior. The amount of variation that was not explained by attitude and subjective norms may be attributed to the lack of support for the issue, due to the possibility of attacks and/or financial losses incurred. Therefore, further examination of these issues and the need to expand this research to include other variables such as fear, values, etc., may be warranted.

Expansion of the TRA model and addition of other factors to this model has explained a larger amount of variance in other studies, as well as this one. Attitudes and subjective norms were not the only determinants of behavioral intention in this study; knowledge also explained behavioral intention of local residents towards leopards and leopard conservation. Similarly, other factors such as experience, fear, views, the value of leopards and views towards their conservation may further explain behavioral intention. According to the TRA, these are subsumed by attitude. But including these variables may facilitate a description of the type of person who is more liable to promote leopard conservation, and may be of use in differentiating the behavioral intention of different groups. Extending the TRA to incorporate these factors may enhance the explanatory capability of this model.

According to the TRA, messages should target the negative consequences of a behavior, to change the target audiences' intentions to perform the behavior. Messages targeting the local communities in Junnar could inform them about the negative consequences of leopard extinction. Also, the local communities could be educated about the loss of leopard habitat and how this is affecting the leopard population.

Although *some* of the locals were aware that the loss of leopards would harm the ecosystem and affect the climate, and possibly the rains that they depend on, *all the locals need to be aware of this*. This awareness of the possibility that the extinction of leopards might affect their livelihood may further mollify the locals' attitudes towards leopards.

Management Implications

Enforcement and regulation have been effective in the conservation of endangered species such as the leopard inside and outside protected areas in India. Yet this strategy is likely to fail in the face of the current increase in the human population and habitat loss. While these interactions might have damaging effects on humans, they may also pose a threat to the continued existence of wildlife populations.

As previously discussed, fragmented protected areas are unable to contain large carnivores such as leopards that have extensive home ranges and are likely to stray out of these protected areas. As suggested by Rosenzweig (2003), the increase in human wildlife interactions call for a different approach, "reconciliation ecology", that seeks to conserve species within human-dominated environments. Conservationists in some countries acknowledge the need to include working lands in the conservation effort; therefore, in many countries, the protected areas network has been expanded to include private lands that are being used for conservation. It is a fact that, no matter how much we may condemn natural landscapes being converted into working lands; this practice will continue to increase. There is a need to improve conservation efforts within these

working landscapes which involves understanding and then ameliorating the attitudes of the occupants of these landscapes towards conservation.

The finding that all the local peoples' behavioral intentions were positive in this study, and that their attitudes were inclined towards the positive side of the spectrum, on average, in spite of severe financial losses and fear of attack, is a significant one. The presence of positive attitudes, in spite of severe conflict, was unexpected and could be attributed to the values of reverence for nature, in India and within the study's farming communities. These positive values could translate into increased tolerance of leopards by the implementation of a transparent and effective compensation program. Though neither adequate nor timely compensation were predicted to ameliorate attitudes towards leopards, improvement in the compensation scheme might still help in reducing the impact of conflict and increasing tolerance towards leopards. The government compensation program involves a long and complex bureaucratic procedure that most of the respondents were dissatisfied with; this process entails verified photographic evidence and considerable paperwork, is time consuming and compensations are only paid at the end of the financial year. Past research has shown that improvement in the government compensation program coupled with the existing positive attitudes could translate into a greater level of tolerance for man-leopard conflict, and, perhaps, even to effective conservation on private land.

Another surprising discovery of the study was that the capture and relocation of leopards was the preferred management strategy by the local people, when a leopard was responsible for livestock predation as well as human attacks. While the locals are aware

of the presence of leopards and do take precautions to protect their livestock and themselves, the measures used are clearly not very effective. Taken together, these findings point towards the need for the development and implementation of better farm, forest and wildlife management strategies that reduce the risk of conflict. Since the locals are reluctant to choose lethal management of leopards, tactics that might reduce conflicts may ameliorate attitudes and increase tolerance of leopards. For example, the risk of livestock losses might be reduced by government funding for leopard-proof pens to protect livestock. Also, the problem of financial losses due to livestock depredation might be reduced by the implementation of better animal husbandry practices. But a downside to these measures that reduce losses is the following consideration that must be made: if all the livestock are too well protected in this human-dominated landscape, what will the leopards eat?

The results suggest that any solution to the conflict with leopards should also include education and increasing public awareness to maintain positive attitudes and increase tolerance towards leopards. This approach was successful in increasing the tolerance of cattle ranchers in Namibia towards cheetahs. Previous studies (Aipanjiguly, et al., 2003; Davenport, et al., 2010) have demonstrated relationships between knowledge of wildlife species and support for their conservation; likewise, communication of facts related to leopard status and conservation could increase support for their conservation.

This research provides valuable insights for policy makers to better understand the extent of the crisis and the complexity of the problems the local people face. The

elimination of factors that lead to negative attitudes towards leopards and leopard conservation (e.g., fear of attack, fear of financial loss, lack of knowledge and lack of government compensation) is necessary for the continued survival of this enigmatic species in this landscape. At the same time, a better understanding of the factors that could improve attitudes towards leopards is essential to improve the conservation and management strategies applied towards leopard conservation.

This research was designed to better understand the behavioral intentions of local residents towards leopards and their conservation in a situation of severe man-leopard conflict. It is hoped that Forest Department officials and conservationists, alike, will have a better appreciation for this type of research, as it has the potential to improve our understanding of how other segments of the Indian population feel about leopard conservation issues. The approach and methodology used in this study could be incorporated into the conservation agencies' agendas to better ascertain the attitudes of different segments of the public on other conservation-related issues. It could prove invaluable in developing our knowledge of the underlying elements that contribute to the public's attitude towards conservation.

Analyses indicating interactions between intention and knowledge, knowledge and attitude, education and attitude, knowledge and subjective norm and views towards leopards and behavioral intention are of practical, as well as statistical, significance. These findings have considerable implications for the development of an effective communication program to increase local tolerance towards leopards and their conservation. For application purposes, results that show the intention to support leopard

conservation falls under attitudinal influences are of practical significance. As recommended by the TRA, salient beliefs can be targeted in a convincing communication and thus used to effectively modify or reinforce existing attitudes and intentions. And, in future, messages and conservation strategies can be structured so that the arguments made are based on elicited beliefs that are backed by factual evidence.

Future Research

The study was limited by the sampling of only two villages within one range of the JFD; consequently, the results of the study may not be generalizable to the entire JFD. Therefore, future research is needed to examine a larger, more representative sample from the JFD. A further examination of this issue could also include collecting similar data from other communities that experience conflicts with leopards or other species of wildlife and comparing the resultant attitudes of the different communities.

Since leopard conservation and conflict with leopards is a contentious issue, it gets media coverage from time to time when humans are attacked. For example, just a fortnight before the study, in two separate incidents, two men were attacked by leopards within a 24-hour period. The impact of the publicity surrounding these attacks on the study is unknown. This highlights the need for some longitudinal studies that assess local residents' attitudes over a period of time, which might allow researchers to gauge how these attitudes might be affected by changes in the level of conflict.

The behavioral beliefs examined in the study were identified from past literature on HWC. This might explain the low Cronbach's alpha scores, as the items included were adapted from other studies and may not have been ideal for studying HWC in

India. Therefore, future studies investigating HWC in India using theoretical frameworks should consider using focus groups to identify the behavioral beliefs of the communities they are investigating. These behavioral beliefs, although they might not be unique to Indian situations, might differ for other communities or regions within India.

In Junnar, it is important to build on the positive baseline of conservation values within the farming community. This study offers a baseline assessment of attitudes and beliefs. It would be important to repeat the study using a similar survey and comparable theoretical frameworks to assess how attitudes might change over time. Comparisons with other large carnivores in India and continuing discussions with all the stakeholders are important given that the Wildlife (Protection) Act of 1972 requires amendments to guidelines to deal with endangered wildlife in present-day scenarios.

Past research and the results of the current study indicate that in the TRA subjective norms and attitudes are not the only determinants of behavioral intention. Therefore, future research needs to expand the TRA model with variables such as knowledge, fear, values, etc., to enhance the explanatory capability of the model. Even though the theory maintains that the subjective and attitudinal component subsumes these and other aspects, incorporating these might help describe the type of person who is more prone to support leopard conservation. Further, they could be used to differentiate the behavioral intentions of different groups.

A few researchers have addressed the deficiency of theoretical frameworks and low correlations in the investigation of HWC by applying the TRA. But, these theories have only been successful in predicting behaviors from intentions when the behaviors

involved are highly specific. Since this study examines attitudes towards leopards *and* leopard conservation, this could be the cause of the moderate correlation values within the model. The predictive ability of the TRA may also be limited due to the fact that behavior towards leopards and their conservation may not be completely voluntary. Since the TRA model deals solely with those behaviors that are under a person's volitional control, actions that are even partly beyond the realm of an individual's voluntary control lie beyond the conditions established for the model. Previous research has revealed that if carrying out an action entails prior knowledge or the cooperation of others, the prerequisites of the model cannot be met. Consequently, it may not be possible to carry out the action, even though the intention to do so is strong.

To address these theoretical shortcomings, future research of HWC in India could use the Theory of Planned Behavior. This theory is an extension of the TRA and has been successfully used to predict behaviors that are not simple and easily performed. Attitude to behavioral process models (ABPMs) that link behavior to attitude and account for unplanned, spontaneous behavior could also be used in the future to assess behaviors. Since theorists hypothesize that behaviors may not be influenced *only* through cognitive processes, expanding the TRA model to include past behavior might improve its predictive potential. Even though the TRA has its limitations, it is imperative that future research on the social aspects of HWC in India utilize the TRA and other attitudinal frameworks. Theoretical frameworks could also help predict and alter conservation-related behaviors and increase tolerance towards leopards (in the present

study) and wildlife in general. Furthermore, these frameworks can also help researchers in the assessment and comparison of attitudinal inquiries (Decker, et al., 2001).

In summary, understanding the social aspects of HWC is a multifaceted and exceptionally complex task. This is especially true in the case of a large carnivore like the leopard, implicated in conflict with humans. Wildlife habitats and the multitude of species that rely on them may best be preserved by understanding the attitudes, values, knowledge and other factors that influence how local people feel towards the conflict-causing species. While theories such as the TRA are beneficial in framing behavior, much more research is needed to operationalize the constructs, and to ultimately incorporate the results into coherent effective management strategies.

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APPENDIX A

Questionnaire

Crop Raiding & Livestock Depredation

1. According to you which three wildlife species in this area are most associated with conflict in this area?

(economic loss, crop damage, attacks on livestock, attacks on humans, etc)

a. _____ b. _____ c. _____

2. Have you lost any crops to wild animals in the past 5 years? **Y** **N**
(If No, move on to Question No. 5)

3. Which crops have been damaged? 1. _____ 2. _____ 3. _____ 4. _____

4. Which animals have caused the damage? 1. _____ 2. _____ 3. _____ 4. _____

5. Have you lost any livestock to wild animals in the past 5 years? **Y** **N**
(If No, move on to Question No. 9)

6. What is your purpose of keeping livestock? _____

7. Which animals have been attacked/ killed? 1. _____ 2. _____ 3. _____ 4. _____

8. Which animals were responsible for them? 1. _____ 2. _____ 3. _____ 4. _____

9. Circumstances surrounding the attack on livestock on most occasions

Direct Sighting

Signs near attack site

Marks on carcass

Suspicion

10. What was your total income loss due to crop raids and livestock depredation by wild animals last year? Rs. _____

11. Have you been compensated by the Government for your losses? **Y** **N**

12. Has the compensation been adequate to cover the losses you incurred? **Y** **N**

Why do you think these wild animals damage agricultural crops and attack livestock?

Circle the corresponding response (SD= Strongly Disagree, D= Disagree, U= Unsure, A= Agree, SA = Strongly Agree)

1. They do not have enough food in the wild - **SD** **D** **U** **A** **SA**

2. They prefer agricultural crops/livestock - **SD** **D** **U** **A** **SA**

3. They are unable to forage/hunt - **SD** **D** **U** **A** **SA**
(injured/ pregnant/with young ones)

4. They have accidentally strayed into human settlements - **SD D U A SA**

5. They live on the fringes of human settlements - **SD D U A SA**

Conflict with leopards (straying, attacking people and livestock) -

1. Do you think there exists a conflict with leopards in this area? **Y N**

2. Have you seen any leopards in the last 5 years?

No Yes, heard a leopard Yes, saw signs of a leopard Yes, saw a leopard Leopard in a well

3. Do you see more leopards (or signs of leopards) now than 5 years ago?

More now Less now About the same Don't Know

4. According to you, in the last 5 years the numbers of leopard attacks and instances of livestock depredation have:

Increased Decreased Remained the same Don't Know

5. How many leopards are there in this area according to you? _____

6. How many problem leopards (straying, attacking people and livestock) are there in this area according to you? _____

7. Actions taken to protect livestock from leopards

Guard dogs Guard Duty Leopard proof pens Metal Collar Other

8. Actions taken by people to avoid chance encounter with or attack from leopard

a. _____ b. _____ c. _____ d. _____

According to you what are the possible management strategies by the Forest Department might help mitigate conflict with leopards - Circle the corresponding response (SD= Strongly Disagree, D= Disagree, U= Unsure, A= Agree, SA = Strongly Agree)

1. Improve the habitat of leopards **SD D U A SA**

2. Improve leopard prey base **SD D U A SA**

3. Repel leopards using disruptive stimulants **SD D U A SA**

4. Do nothing **SD D U A SA**

5. According to you if a leopard is seen in the area the Forest Department should -

Take no action, monitor Frighten away Capture & relocate Keep Captive Destroy leopard Other

6. According to you if a leopard attacks/kills livestock or a family pet the Forest Department should –

Take no action, monitor Frighten away Capture & relocate Keep Captive Destroy leopard Other

7. According to you if a leopard approaches/attacks/kills a person the Forest Department should –

Take no action, monitor Frighten away Capture & relocate Keep Captive Destroy leopard Other

Views towards leopards and their conservation

Circle the corresponding response (SD= Strongly Disagree, D= Disagree, U= Unsure, A= Agree, SA = Strongly Agree)

1. What is your opinion about leopards in general?

Love Like No Opinion Dislike Hate

2. What is your opinion about leopards living in your surroundings?

Love Like No Opinion Dislike Hate

3. In your opinion the leopard population in Junnar taluka should be....

Eliminated Reduced Maintained Increased

4. Leopards suffer due to translocation? SD D U A SA

5. Leopards suffer due to life in captivity? SD D U A SA

6. Leopards are endangered animals in need of conservation and protection? SD D U A SA

7. Would you participate in any way towards the conservation of leopards? SD D U A SA

Patterns in leopard attacks

1. Date of most recent predatory attack - _____

2. The predatory attacks occur...

Always at night Mostly at night Always during day Mostly during day No pattern Other

3. Season of predatory attack usually...

Mostly during wet season Mostly during dry season All year round Other

4. Mostly the location of attack is

Forest Farm Sugarcane field Meadow Grazing field near village Other

Following are some questions about your attitudes towards leopards and their conservation

Circle the corresponding response (SD= Strongly Disagree, D= Disagree, U= Unsure, A= Agree, SA = Strongly Agree)

- | | | | | | |
|---|-----------|----------|----------|----------|-----------|
| <u>1. Having no threat of financial loss due to leopards is important to me</u> | SD | D | U | A | SA |
| <u>2. Having no threat of leopard attacks on me, my family is important to me</u> | SD | D | U | A | SA |
| <u>3. Leopards do not normally hunt humans, therefore present no direct threat to me or my family</u> | SD | D | U | A | SA |
| <u>4. Leopards and their conservation of leopards is important to me</u> | SD | D | U | A | SA |
| <u>5. What my family and friends think about leopards and their conservation is important to me</u> | SD | D | U | A | SA |
| <u>6. What other villagers think about leopards and their conservation is important to me</u> | SD | D | U | A | SA |
| <u>7. What Forest officers and conservationists think about leopards and their conservation is important to me</u> | SD | D | U | A | SA |
| <u>8. I intend to report problem leopards to the proper authority rather than taking matters into my own hands to deal with the problem</u> | SD | D | U | A | SA |
| <u>9. I intend to follow the guidelines to prevent conflict with leopards and support leopard conservation</u> | SD | D | U | A | SA |
| <u>10. I do not intend to harm innocent leopards</u>
(ones that have not caused any harm to humans and human property) | SD | D | U | A | SA |

Following are some questions about your beliefs towards leopards and their conservation

Circle the corresponding response (SD= Strongly Disagree, D= Disagree, U= Unsure, A= Agree, SA = Strongly Agree)

- | | | | | | |
|---|-----------|----------|----------|----------|-----------|
| <u>1. Leopards pose a threat to humans and livestock</u> | SD | D | U | A | SA |
| <u>2. I cannot tolerate economic losses due to leopards</u> | SD | D | U | A | SA |
| <u>3. I would be happier if there we no leopards at all</u> | SD | D | U | A | SA |
| <u>4. Presence of leopards and their conservation prevents me from leading my way of life</u> | SD | D | U | A | SA |
| <u>5. Leopards attacking livestock is an acceptable risk</u> | SD | D | U | A | SA |
| <u>6. Leopards deserve protection</u> | SD | D | U | A | SA |
| <u>7. I would like to communicate more with the Forest</u> | SD | D | U | A | SA |

Department and conservationists to find a solution to the problem of leopards **SD D U A SA**

8. Since leopards are threatened they deserve more conservation effort than other wildlife **SD D U A SA**

Circle the corresponding response (EU= Extremely Uncertain, UC= Uncertain, U= Unsure, C= Certain, EC = Extremely Certain)

9. I believe leopards are a threat to humans & livestock **EU UC U C EC**

10. I believe leopards can cause serious economic losses **EU UC U C EC**

11. I do not believe that it is important to conserve leopards for future generations **EU UC U C EC**

12. I believe that maintaining my way of life is more important than honoring leopard conservation priorities in these areas **EU UC U C EC**

13. I believe depredation by leopards is a part of life here **EU UC U C EC**

14. I believe leopards are an important, integral part of the ecosystem **EU UC U C EC**

15. I believe the Forest department and conservationists are there to help the local people **EU UC U C EC**

16. I believe that the protection of internationally endangered animals such as leopards should be prioritized over protecting agrarian activities and livelihoods **EU UC U C EC**

Following are some questions about others beliefs towards leopards and their conservation

1. My friends and family believe that leopards and their conservation is important **SD D U A SA**

2. Other villagers believe that leopards and their conservation is important **SD D U A SA**

3. Forest officers and conservationists believe that leopards and their conservation is important **SD D U A SA**

4. Concerning leopards, I want to do what my family and friends think I should do **SD D U A SA**

5. Concerning leopards, I want to do what other villagers think I should do **SD D U A SA**

6. Concerning leopards, I want to do what the **SD D U A SA**

Forest Officers and conservationists think I should do

According to you what are the reasons for conflict with leopards (straying, attacking people and livestock)

Circle the corresponding response (SD= Strongly Disagree, D= Disagree, U= Unsure, A= Agree, SA = Strongly Agree)

- | | | | | | |
|--|-----------|----------|----------|----------|------------------|
| 1. <u>Leopards do not have enough food in the wild</u> | SD | D | U | A | SA |
| 2. <u>The leopards prefer/like domesticated animals</u> | SD | D | U | A | SA |
| 3. <u>Overpopulation of leopards in the area</u> | SD | D | U | A | SA |
| 4. <u>Leopards accidentally strayed into human habitations</u> | SD | D | U | A | SA |
| 5. <u>Development within Junnar shrinking leopard territories</u> | SD | D | U | A | <u>SA</u> |
| 6. <u>Presence of sugarcane fields provides ideal habitat for leopards</u> | SD | D | U | A | <u>SA</u> |
| 7. <u>Relocation of leopards</u> | SD | D | U | A | SA |

According to you what is the main reason for the presence of leopards in the agricultural landscape?

- a. Agricultural Expansion
- b. Development
- c. Increase in No of leopards
- d. Availability of food and water
- e. Don't Know
- f. Other_____

Knowledge about Leopards

- | | | | |
|---|----------|----------|-----------|
| 1. <u>Leopards are solitary</u> | T | F | DK |
| 2. <u>Leopards are territorial</u> | T | F | DK |
| 3. <u>Leopards fear humans</u> | T | F | DK |
| 4. <u>Leopards are capable of and have often lived near human habitations</u> | T | F | DK |
| 5. <u>Humans are not natural prey of leopards</u> | T | F | DK |
| 6. <u>Leopards are endangered</u> | T | F | DK |

7. Leopards are an important part of the ecosystem **T** **F** **DK**

Government Compensation

1. Have you filed a complaint in the event of financial loss due to leopards (livestock loss/ attack on person) **Y** **N**
2. Are you aware of Government compensation scheme in event of financial loss due to leopards? **Y** **N**
3. Would you file a complaint in the event of financial loss due to leopard (livestock loss/attack on person) **Y** **N**

4. If No, then why?

None	Procedural Problem	Travel Cost	Officer Absent	Time Spent	Difficulty receiving payment	Other
------	--------------------	-------------	----------------	------------	------------------------------	-------

5. The Government system of compensation for leopards attacks in Junnar is efficient **SD** **D** **U** **A** **SA**
6. Timely compensation makes conflict with leopards more tolerable **SD** **D** **U** **A** **SA**
7. Adequate compensation would make conflict with leopards more tolerable **SD** **D** **U** **A** **SA**

Demographics

Gender **M** **F**

Age ____

Education -

None	Primary	SSC	HSC	Graduate and higher
------	---------	-----	-----	---------------------

Occupation - _____

Income per year - Rs _____

Number of people in your household _____

How many years have you lived here? _____

How many years have you lived in this area? _____

Amount of land - _____ acres

Area under sugarcane - _____ acres

APPENDIX B

Table A-1. Significant Means Comparisons of Attitudes towards View that Leopards Are Endangered

Level	Count	Score Sum	Score Mean	(Mean-Mean0)/Std0
Disagree	11	587	53.364	-1.923
Unsure	1	45	45	-0.745
Agree	115	8563	74.461	-1.5
Strongly Agree	27	2740	101.481	3.18

$$\chi^2 = 12.9395, df = 3, p = 0.0048$$

Table A-2. Significant Means Comparisons of Attitudes towards Participating in Leopard Conservation

Level	Count	Score Sum	Score Mean	(Mean-Mean0)/Std0
Strongly Disagree	1	112.5	112.5	0.803
Disagree	26	1247	47.962	-3.829
Unsure	7	546	78	0.027
Agree	106	8489.5	80.09	1.106
Strongly Agree	14	1540	110	2.955

$$\chi^2 = 21.1998, df = 4, p = 0.0003$$

Table A-3. Significant Means Comparisons of Attitudes towards Leopards in General

Level	Count	Score Sum	Score Mean	(Mean-Mean0)/Std0
Love	35	3246	92.7429	2.377
Like	71	5761	81.1408	0.967
No Opinion	25	1345.5	53.82	-2.998
Dislike	15	1179.5	78.6333	0.104
Hate	8	403	50.375	-1.823

$$\chi^2 = 15.5982, df = 4, p = 0.0036$$

Table A-4. Significant Means Comparisons of Attitudes towards Leopards in the Surroundings

Level	Count	Score Sum	Score Mean	(Mean-Mean0)/Std0
Love	3	266	88.6667	0.446
Like	23	2207	95.9565	2.223
No Opinion	34	2464	72.4706	-0.768
Dislike	46	3863	83.9783	1.215
Hate	48	3135	65.3125	-2.358

$$\chi^2 = 9.7520, df = 4, p = 0.0448$$

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