Documentation of Floristic Composition and Assessment of Human-Wildlife Conflict in the Gir Landscape

PROJECT REPORT

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INDEX

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Introduction

Forests play a significant role in rural livelihoods, especially in developing nations (Kumar and Shahabuddin 2005). With the advent of agriculture and industrialization, the human encroachment in the wild lands increased (Iftekhar and Hoque 2005, Grau et al. 2015, Acheampong et al. 2019), resulting in changing land use, biodiversity loss (Diaz et al. 2006, Ahrends et al. 2010) and human-wildlife conflict (Distefano 2005, Ladan 2014, Mekonen 2020).

The rural settlements along the fringes of the forests act as a buffer from the urban sprawl and are likely to keep some of the native floristic composition intact. The floristic composition and vegetation structure of an area is known to influence the animal species diversity and ecosystem functioning (Pomara et al. 2012, Gaitan et al. 2014). The floristic composition can undergo alteration due to a variety of factors. It is thus important to understand floristic composition in order to conserve biodiversity and ensure normal ecosystem functioning and human well being (Cardinale 2012, Hooper et al. 2012). This knowledge is crucial if habitats need to be restored (Dobson et al. 1997, Young 2000, Higgs et al. 2014, Palmer et al. 2016).

Farming practices can restructure the heterogeneity of agricultural landscapes and hold implications in conservation by influencing edaphic conditions, animal movement and growth of invasive alien species (Chen et al. 2013).

People and wildlife have interacted since the dawn of human evolution (Lee-Thorp et al. 2000). These interactions could be positive in instances where people benefit from wildlife through consumption, harvest or other use of wildlife or its products; or they could be negative when the needs and behaviour of wildlife affect human needs or vice versa. The negative interactions are termed as Human-Wildlife Conflict by the IUCN World Parks Congress. A multitude of factors are responsible for human-wildlife conflict (Madden 2004). One of the key factors causing human-wildlife conflict worldwide is the competition between growing human populations and wildlife for the same declining living spaces and resources (Lamarque et al. 2009). Human-wildlife conflict is likely to erode public support and build animosity against wildlife conservation (Madhusudan 2003, Naughton-Treves and Treves 2005,

Ogra and Badola 2008). These negative perceptions lead to destructive and undesirable interactions (Shabekova 2013). Thus, people's perceptions form a critical social dimensional component of human-wildlife conflicts (Hill 1998). Since biological science alone cannot provide a complete solution to the conflict without understanding the human dimension with its social, cultural, political, economic, and legal complexities (Madden 2004), an interdisciplinary approach has been proposed by social scientists and ecologists to inform policy in the management of socio-ecological systems (Mascia et al. 2003, Lawton 2007, Sutherland et al. 2008). If conservation is to succeed, it is imperative to understand local communities' attitudes, needs, aspirations, acceptance and the impact of conservation interventions to inform conservation policy and devise mitigation strategies (Dickman 2010).

The Gir Landscape is an agro-pastoral landscape which is rich in biodiversity and is globally known for harbouring the only free ranging population of Asiatic Lions (Jhala et al. 2009). The landscape is a mosaic of multiple land covers with interspersing of forests, agricultural lands, human habitations, water bodies, etc. The Gir Protected Area is situated from 20°57′ to 21°20′N and 70°27′ to 71°13′E and lies 40 km from the Arabian Sea coast in the Saurashtra peninsula of Gujarat, India. It consists of the largest pristine forested habitat in western Gujarat covering 1883.04 sq. km. with 44 small pastoralist hamlets and 10 settlement villages within its boundary and 97 revenue villages on the flanks (Singh and Kamboj 1996, Johnsingh et al. 1998). The Protected Area is a stronghold for wildlife of the region and provides tangible and intangible ecosystem services to the local populace. Gir lies within the Afrotropical realm (Singh and Kamboj 1996) in the 4B Gujarat Rajputana biotic province of Biogeographic Classification of India (Rodgers and Panwar 1988) and comprises one of the largest compact tracts of dry deciduous forests, which fall under the 5A/C1b forest subtype (Champion and Seth 1968). It is inhabited by 37 species of mammals, 38 species of reptiles, over 300 species of birds, over 300 species of insects, and over 600 species of plants (Singh et al. 2017). Mammalian large carnivores include Asiatic lion (*Panthera leo leo*) and leopard (*Panthera pardus*) and

ungulate species include chital (*Axis axis*), sambar (*Rusa unicolor*), nilgai (*Boselaphus tragocamelus*), four-horned antelope (*Tetracerus quadricornis*), chinkara (*Gazella bennetii*) and wild pig (*Sus scrofa*). Six perennial rivers originate from the forests of Gir and are a lifeline for the people of the landscape. The landscape has seen substantial alteration in the land use practices over the course of time which has inevitably led to increase in human-wildlife conflict (Vijayan and Pati 2002). The shifting agricultural practices, changes in the floristic composition and aggressive invasion of alien species pose deleterious effects on the native vegetation and habitat of the landscape. It is therefore imperative to assess how these changing land use practices have impacted wildlife and people. The socio-ecological issues of this dynamic landscape need to be delved into for addressing human-wildlife conflict.

With this background, a study was initiated to understand the perceptions and attitudes of the people and generate a basic ecological profile for the fringe villages of the Gir Protected Area. The Aga Khan Agency for Habitat, India (AKAHI) initiated a programme in 2019 to channelize efforts for mitigation of human-wildlife conflict in the Gir landscape with active involvement of locals. AKAHI has been active in 20 villages in the western part of the Gir landscape where it aims to address the most imminent issues pertaining to human-wildlife conflict. As a part of the programme, youth from these villages were inducted to build capacities for addressing matters regarding human-wildlife conflict and eventually employed as *Gir Mitras*.

The objectives of the current study were:

1. Mapping of the villages
2. Documentation of floristic composition
3. Understanding the farming practices and shifts thereof
4. Identifying the factors that contribute to human-wildlife conflict

The Gir Landscape is a mosaic of multiple land covers with interspersing of forests, agriculture, horticulture, human habitations, water bodies, etc.

Methodology

1. Mapping of the villages- A supervised classification for Land Use Land Cover of the 20 villages was carried out using QGIS and the latest Google Earth satellite imagery available for the landscape (Chuvieco and Congalton 1988). Data collection formats were developed to collect the requisite data. After orientation of the office staff of the AKAHI Chitravad field office, the community cadres in the form of *Gir Mitras* were trained in December 2020 to collect and record geospatial data for different Land Use Land Cover (LULC) classes in their villages *viz.* agriculture, horticulture and agroforestry, wasteland, forest, human habitation, built up, road, railway, water body and drainage (Annexure 1). These GPS locations were used for carrying out ground validation of the village maps (Schowengerdt 1997). Kappa analysis was carried out for assessing the accuracy of the classified maps (Congalton 1991). The outputs were obtained in the form of vector maps for each village.

   The data collection for the remaining objectives was based on questionnaire surveys with villagers in the project villages. Based on the data available with AKAHI regarding the human population in the project villages and considering that the data would have to be collected by the trained community cadre within a stipulated time frame, it was decided to survey 5% of the average human population in these villages which could represent the overall perceptions and help in generating a baseline. This translated to 100 individual surveys to be carried out in each village. The 100 surveys were then divided into 30 surveys for documentation of floristic composition through interviews with senior citizens, 35 surveys through interviews with farmers for understanding the farming practices and shifts thereof and 35 surveys through interviews with villagers for assessment of human-wildlife conflict.
2. Documentation of floristic composition- Questionnaires for data collection were developed in the local language through discussions and consultations with competent authorities in AKAHI. The community cadres were trained in conducting field surveys and data collection in May 2021. Data regarding the

current status, factors responsible for the status, presence of invasive alien species and suggestions for habitat improvement in the forested areas, Reserved *Vidi*, Non-Reserved *Vidi*, wastelands and *gauchars* in the villages were recorded based on observations made by the *Gir Mitras*. Additionally, the information on number of livestock grazing per day and visitation by large wild mammals in the *gauchar* and wastelands were also recorded by *Gir Mitras* (Annexure 2). Information on the invasive alien species in the villages was also recorded by *Gir Mitras* (Annexure 3). Another semi-structured questionnaire survey for assessment of floristic composition in the villages was carried out with senior citizens in the project villages to obtain their views and perceptions regarding the change in floristic composition, factors responsible for the change, the major floral species that were observed/not observed 50 years ago, species that play a significant role for people, livestock and wildlife, their awareness regarding invasive alien species as well as Traditional Ecological Knowledge and Ethnobotanical uses of various flora in their villages (Annexure 4).

3. Understanding the farming practices and shifts thereof– This was achieved through semi-structured questionnaire surveys with farmers in the project villages. The surveys were designed in consultation with AKAHI competent authorities in the local language. The community cadres were trained to conduct field surveys subsequent to orientation of the office staff of the AKAHI Chitravad field office in February 2021. Through the surveys, perceptions of farmers regarding changes, reasons behind the change, advantages and disadvantages in cropping patterns, use of fertilizers as well as insecticides/pesticides during the past 50 years, comparative occurrence of pests in the last 50 years, and views on organic farming and effect of current farming practices on human-wildlife conflict were recorded and documented (Annexure 5).
4. Identifying the factors that contribute to human-wildlife conflict- A semi-structured questionnaire in the local language was developed in consultation with AKAHI competent authorities (Annexure 6). The office staff of AKAHI Chitravad field office was given an orientation for requisite data collection and the community cadres were trained by the AKAHI Chitravad field office staff

subsequently in February 2021. The surveys were designed to carry out interviews with villagers in the project villages to collect data on the socio-economic status of the respondents, their land holding, livestock holding, cultivated crops, dependence on forests, etc. Data regarding the perceptions towards human-wildlife conflict and coexistence, ecogeography of conflict event sites, employed mitigation measures, their cost and efficacy, benefits availed for mitigation, suggestions for efficient mitigation, and expectations from the government or society were recorded through the surveys.

Field data collection in the project villages

Training of community cadre: the *Gir Mitras* at AKAHI Chitravad office

Results

3.1 Geospatial Mapping of the Project Villages

A total of 1400 GPS locations were obtained for 20 villages from the field for ground validation and accuracy assessment. The Land Use Land Cover (LULC) maps for the study villages were developed with a mean Kappa value of 0.99 ± 0.005 SE (Figure 1.1).

The kappa values for each village are detailed in Table 1.1.

Table 1.1: Kappa values for accuracy assessment of LULC mapping of the project villages

Sr. No.	Village Name	Kappa Value
1	Amrapur	1.000
2	Amrutvel	1.000
3	Bhalchhel	1.000
4	Bherala	1.000
5	Chitravad	1.000
6	Chitrod	1.000
7	Devgam	0.907
8	Haripur	1.000
9	Hiranvel	1.000
10	Jalandhar	1.000
11	Jashapur	1.000
12	Kenedipur	0.978
13	Ladudi	1.000
14	Mandor	1.000
15	Mandorna	1.000
16	Moruka	1.000
17	Sangodra	0.989
18	Shirvan	1.000
19	Vadla	1.000
20	Virpur	1.000

Agriculture had the maximum area coverage (83.75 sq. km), followed by horticulture & agroforestry (45.58 sq. km) and forest (44.08 sq. km) in the project villages. The village wise area coverage by different land use land cover types is detailed in Table 1.2.

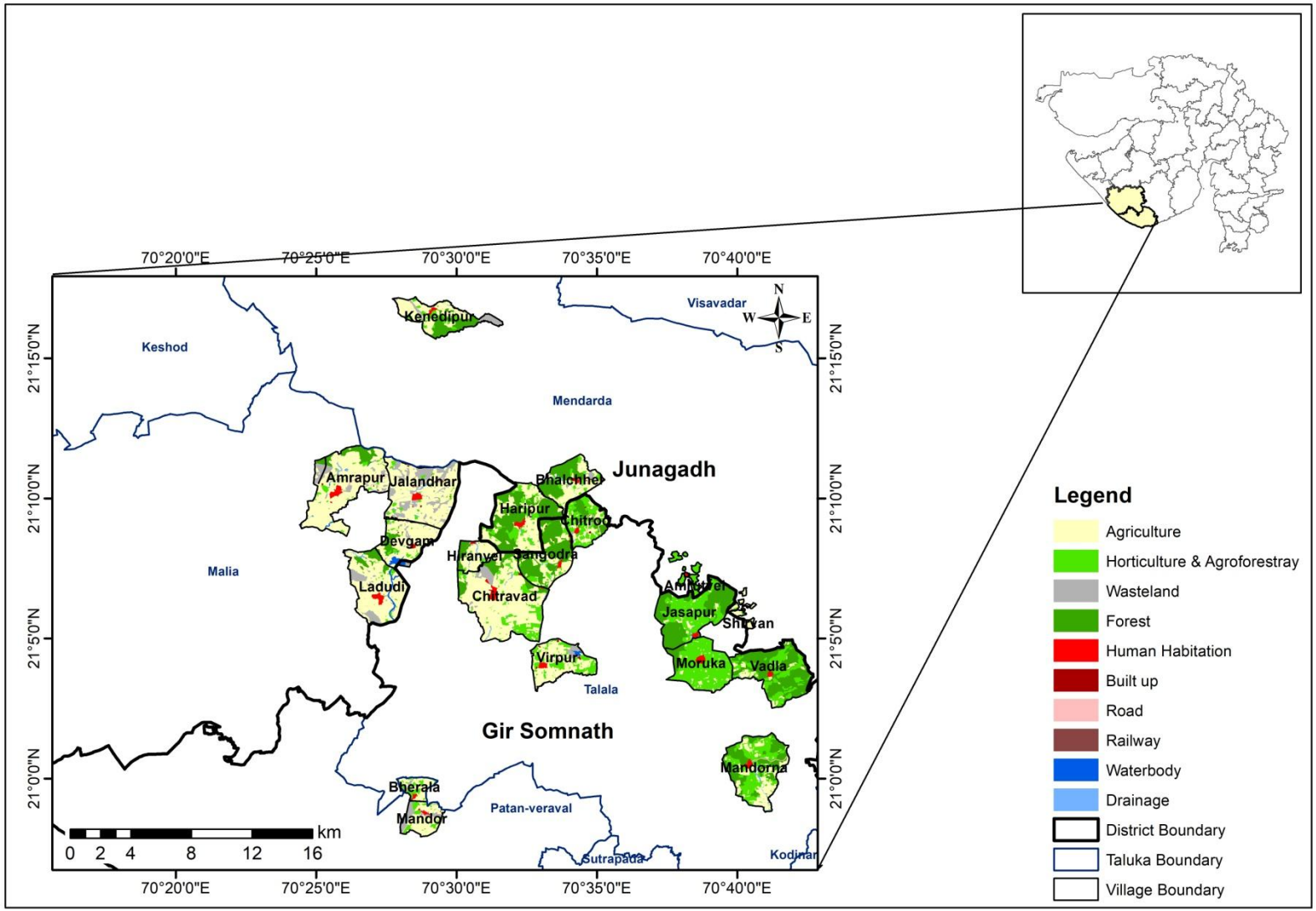

Figure 1.1: Land Use Land Cover Map of the project villages

Table 1.2: Village wise area coverage (in sq. km) by different Land Use Land Cover classes

Village Name	Agriculture	Horticulture & Agroforestry	Wasteland	Forest	Built up	Human habitation	Road	Railway	Water body	Drainage	Village Total
Amrapur	12.31	0.71	1.71	1.88	0.02	0.41	0.07	0.00	0.41	0.13	**17.63**
Amrutvel	0.00	1.56	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	**1.64**
Bhalchhel	2.67	1.43	0.23	3.00	0.13	0.09	0.06	0.00	0.00	0.09	**7.70**
Bherala	1.35	0.76	0.17	0.00	0.00	0.10	0.02	0.01	0.12	0.00	**2.53**
Chitravad	13.57	4.06	1.23	1.91	0.04	0.43	0.07	0.00	0.18	0.46	**21.96**
Chitrod	1.84	2.86	0.20	1.46	0.03	0.13	0.04	0.01	0.00	0.00	**6.55**
Devgam	4.93	0.96	0.51	0.88	0.01	0.14	0.01	0.00	0.63	0.04	**8.10**
Haripur	5.37	2.66	0.00	6.02	0.06	0.28	0.04	0.00	0.00	0.22	**14.64**
Hiranvel	2.56	0.29	0.07	0.81	0.00	0.07	0.01	0.00	0.00	0.05	**3.86**
Jalandhar	10.01	0.89	4.37	0.00	0.05	0.31	0.09	0.00	0.00	0.35	**16.07**
Jashapur	0.83	5.26	0.00	6.73	0.00	0.15	0.02	0.00	0.04	0.11	**13.15**
Kenedipur	3.25	1.10	0.91	2.53	0.00	0.13	0.05	0.00	0.15	0.07	**8.19**
Ladudi	8.47	0.69	1.76	1.26	0.00	0.35	0.06	0.00	0.19	0.14	**12.93**
Mandor	2.32	1.07	0.85	0.00	0.03	0.11	0.03	0.00	0.15	0.08	**4.64**
Mandorna	3.71	4.65	0.00	4.54	0.00	0.24	0.04	0.01	0.00	0.24	**13.43**
Moruka	1.07	7.67	0.00	0.78	0.04	0.22	0.05	0.00	0.00	0.21	**10.04**
Sangodra	3.14	1.22	0.09	5.19	0.06	0.14	0.02	0.00	0.00	0.16	**10.00**
Shirvan	1.03	0.17	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	**1.23**
Vadla	1.09	4.60	0.00	7.10	0.00	0.14	0.01	0.00	0.00	0.05	**12.99**
Virpur	4.22	2.97	0.55	0.00	0.04	0.18	0.05	0.00	0.17	0.03	**8.21**
Class Total	**83.75**	**45.58**	**12.66**	**44.08**	**0.51**	**3.71**	**0.74**	**0.03**	**2.05**	**2.43**	

3.2 Documentation of floristic composition

3.2.1 Observations by *Gir Mitras*

The data pertaining to documentation of floristic composition was obtained from 19 project villages. The responses from *Gir Mitras* based on their observations in their respective villages showed that 79% villages (n=15) possessed a forest area. Bherala, Moruka, Mandor and Virpur do not possess any forest area. Out of the 15 villages, 20% villages possessed some part of Gir Wildlife Sanctuary, 40% villages had a Reserved Forest, 33.3% villages had a Protected Forest, 20% villages had a Reserved *Vidi* (grassland) and 33.3% villages had Non-Reserved *Vidis* (grassland).

As per *Gir Mitras*, 66.7% of the Reserved *vidis* were in an average condition, 33.3% Reserved *vidis* were in a poor condition and 33.3% Reserved *vidis* were in a good condition (Figure 2.1.1).

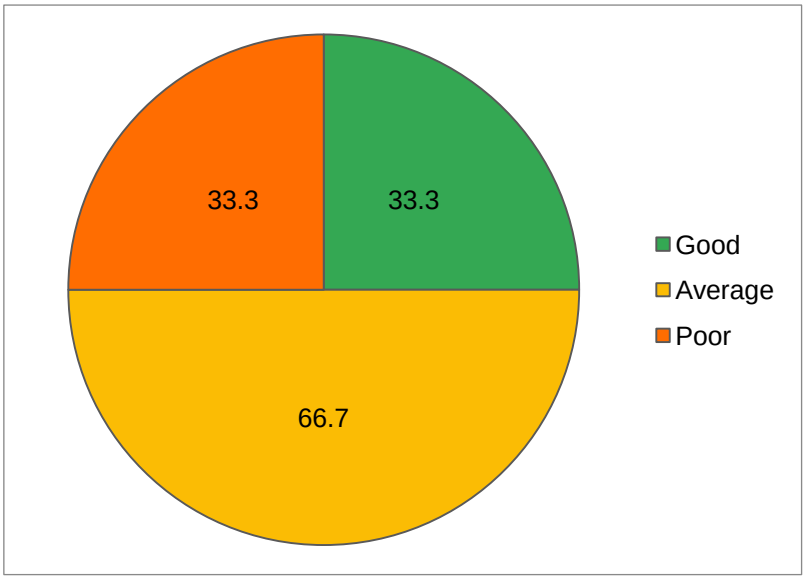

Figure 2.1.1: Percentage representation of the reported condition of the Reserved *vidis* in the project villages

The reasons for the reported condition included relatively less grass biomass (12.5%), relatively dense tree cover (37.5%), good management practices (25%), poor management practices (12.5%) and illegal livestock grazing (25%).

The invasive alien species reported from these *vidis* include *Senna tora, Senna uniflora, Prosopis juliflora, Lantana camara* and *Parthenium hysterophorus.* Of these, *Lantana camara* and *Senna uniflora* showed the least occurrence with *Senna tora* and *Prosopis juliflora* being recorded from all the *vidis* (Figure 2.1.2).

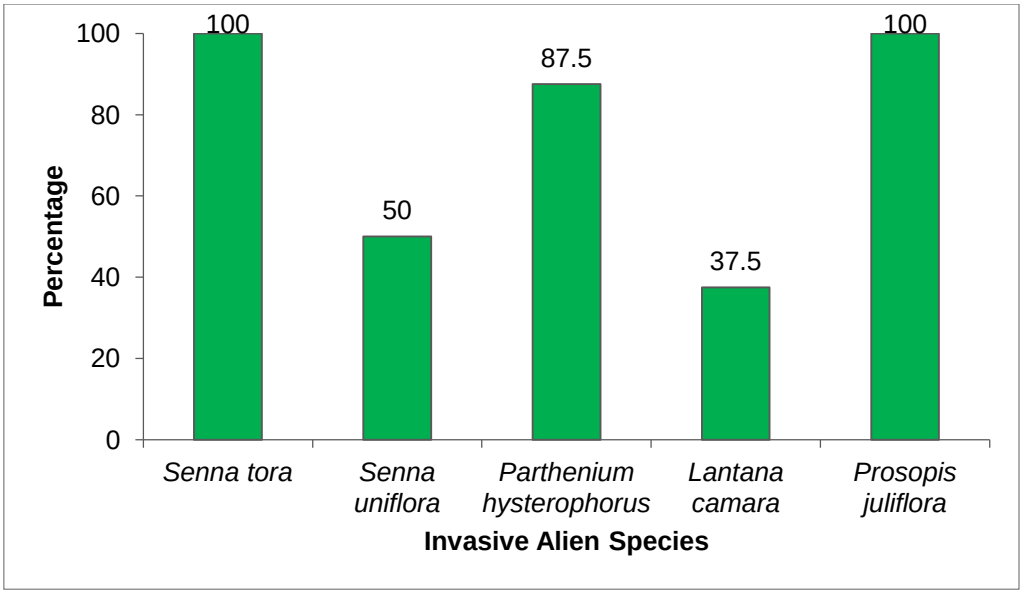

Figure 2.1.2: Percentage representation of occurrence of Invasive Alien Species reported from Reserved *vidis* in the project villages

The suggestions for improvement of the Reserved *vidis* included plantation of trees and grass, pollarding, removal of weeds and invasive alien species, protection and better management measures and water hole development (Figure 2.1.3).

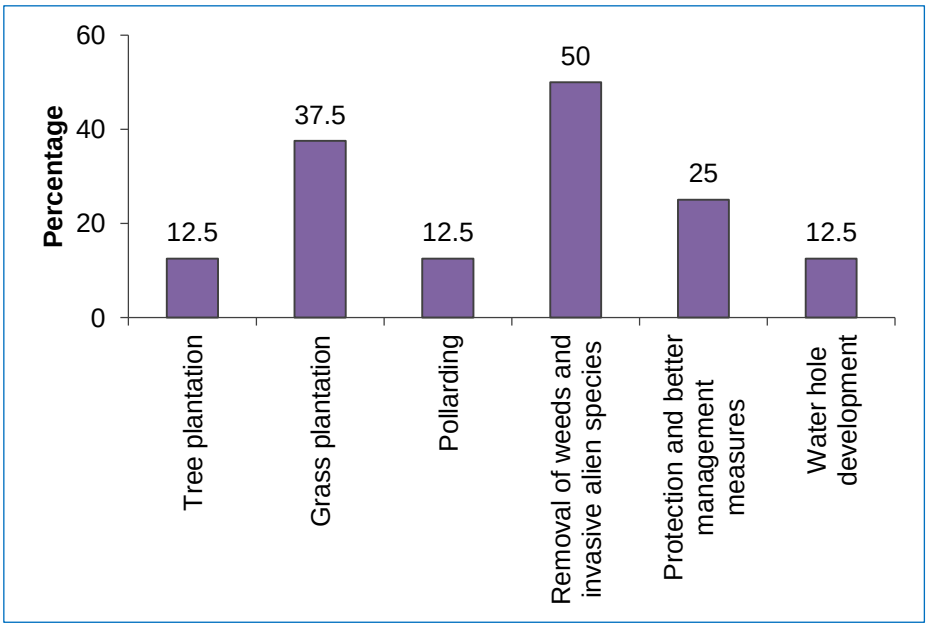

Figure 2.1.3: Percentage representation of improvement measures suggested by *Gir Mitras* for Reserved *vidis* in the project villages

85.7% *Gir Mitras* reported average condition of the Non-Reserved *vidis* with none of the *vidis* reported in good condition (Figure 2.1.4).

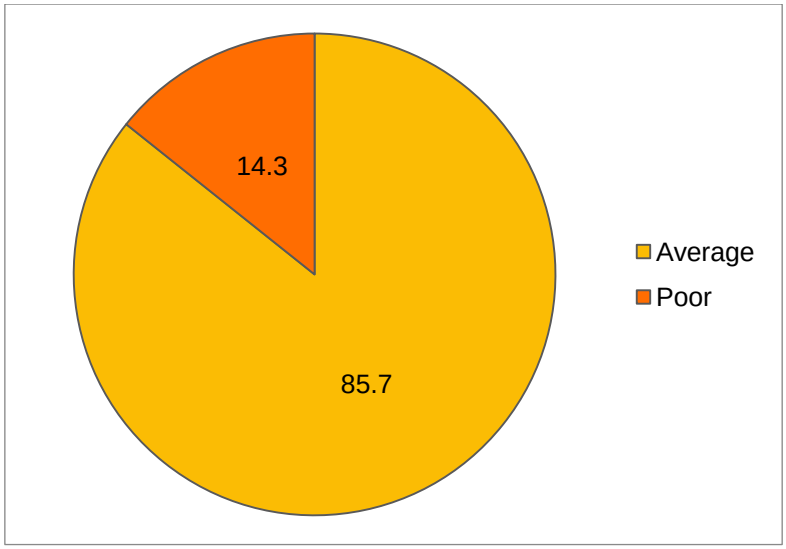

Figure 2.1.4: Percentage representation of the reported condition of the Non-Reserved *Vidis* in the project villages

The reasons for the reported condition included grazing by livestock (14.3%), invasion by alien floral species (71.4%), dense tree cover (42.9%), poor management (28.6%) and encroachment (14.3%).

The invasive alien species reported from these *vidis* include *Senna tora, Senna uniflora, Prosopis juliflora, Lantana camara* and *Parthenium hysterophorus.* Of these, *Lantana camara* and *Senna uniflora* showed the least occurrence (Figure 2.1.5).

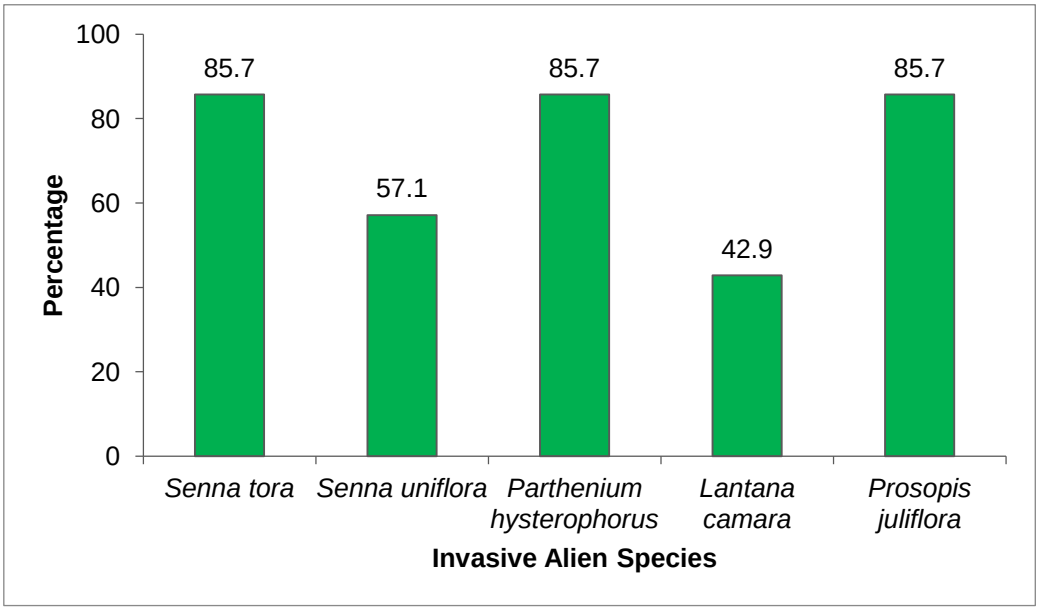

Figure 2.1.5: Percentage representation of occurrence of Invasive Alien Species reported from the Non-Reserved *vidis* in the project villages

The suggestions for improvement of the Non-Reserved *vidis* included plantation of trees and grass, removal of weeds and invasive alien species, better protection and management measures and removal of encroachment (Figure 2.1.6).

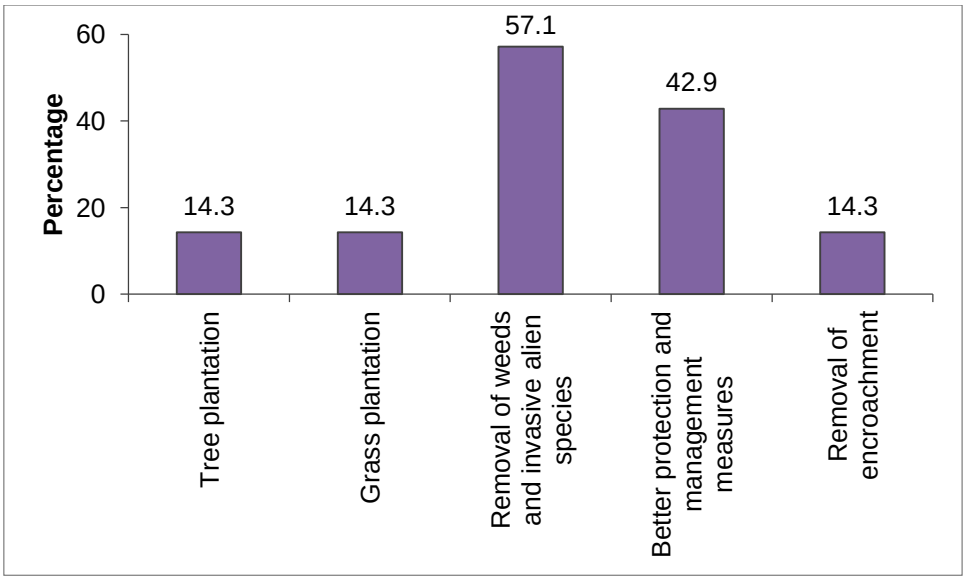

Figure 2.1.6: Percentage representation of improvement measures suggested by *Gir Mitras* for the Non-Reserved *vidis* in the project villages

Amrutvel, Vadla, Mandorna and Devgam do not possess any *Gauchar*. Majority of the project villages had a *Gauchar* of up to 4 hectares (Figure 2.1.7). Only one village i.e. Jalandhar possessed a *Gauchar* of 40 hectares.

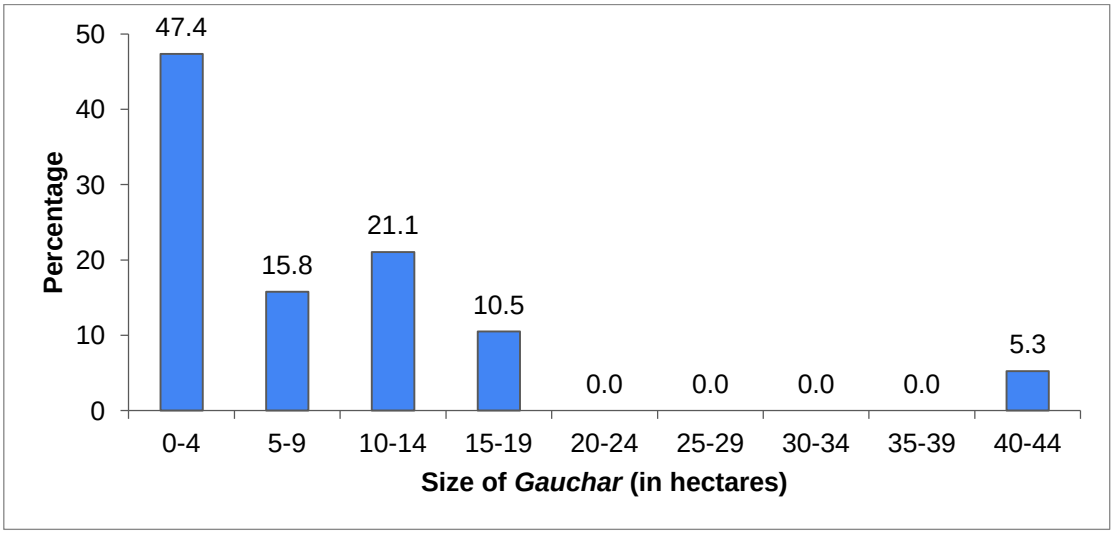

Figure 2.1.7: Percentage representation of size classes of *Gauchar* reported from the project villages

Majority of the *Gir Mitras* (66.7%) reported *Gauchars* in their villages to be in an average condition (Figure 2.1.8).

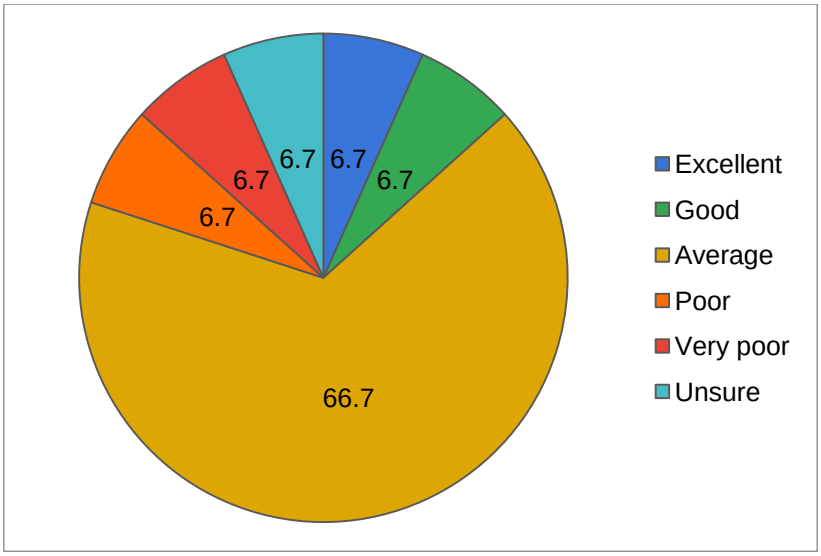

Figure 2.1.8: Percentage representation of the reported condition of the *Gauchar* in the project villages

The reasons for the reported condition include invasion by alien plant species (33.3%), dense tree cover (26.7%), encroachment (20%), poor management (13.3%), mining (6.7%), poor soil (6.7%) and cooperation by villagers (6.7%).

The invasive alien species reported from these *vidis* include *Senna tora, Senna uniflora, Prosopis juliflora, Lantana camara* and *Parthenium hysterophorus*. Of these, *Lantana camara* and *Senna uniflora* showed the least occurrence (Figure 2.1.9).

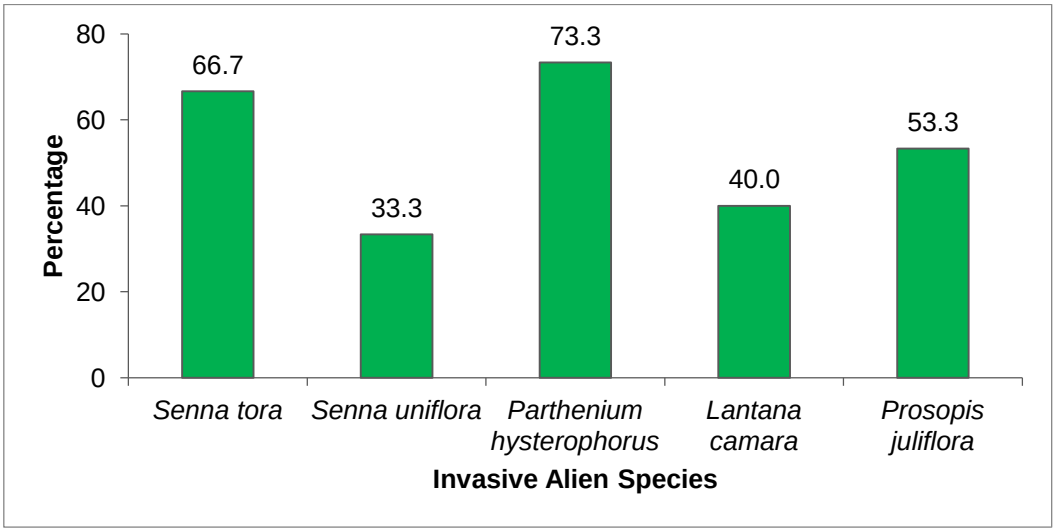

Figure 2.1.9: Percentage representation of occurrence of Invasive Alien Species reported from *Gauchar* in the project villages

Livestock grazing occurs in the *Gauchar* belonging to 14 villages except Bherala. 57.1% *Gir Mitras* reported that 51-100 livestock on an average grazed in the *Gauchar*

per day. 14.3% *Gir Mitras* reported an average number of 201-250 livestock grazing per day in the *Gauchar*. These numbers were seldom reported to be 1-50 (7.1%), 101-150 (7.1%), 251-300 (7.1%) and 351-400 (7.1%). The most frequently reported mammals in the *Gauchar* were Wild Pig and Asiatic Lion followed by Nilgai and Golden Jackal; Sambar was the least reported (Figure 2.1.10).

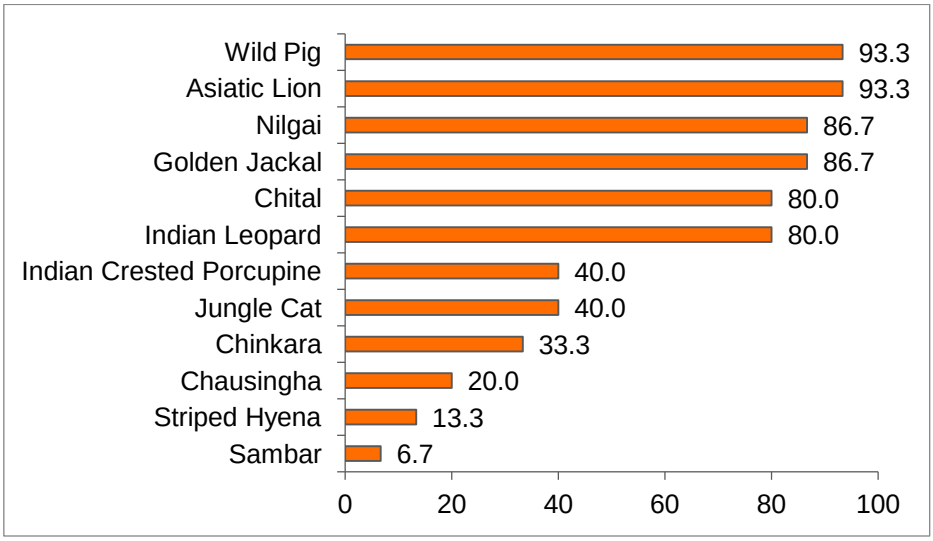

Figure 2.1.10: Percentage representation of mammals observed in *Gauchar* in the project villages

The suggestions for improvement of the *Gauchar* included plantation of grass, fencing, removal of weeds and invasive alien species, support from villagers and Panchayat, increase in the area of the *Gauchar* and removal of encroachment (Figure 2.1.11).

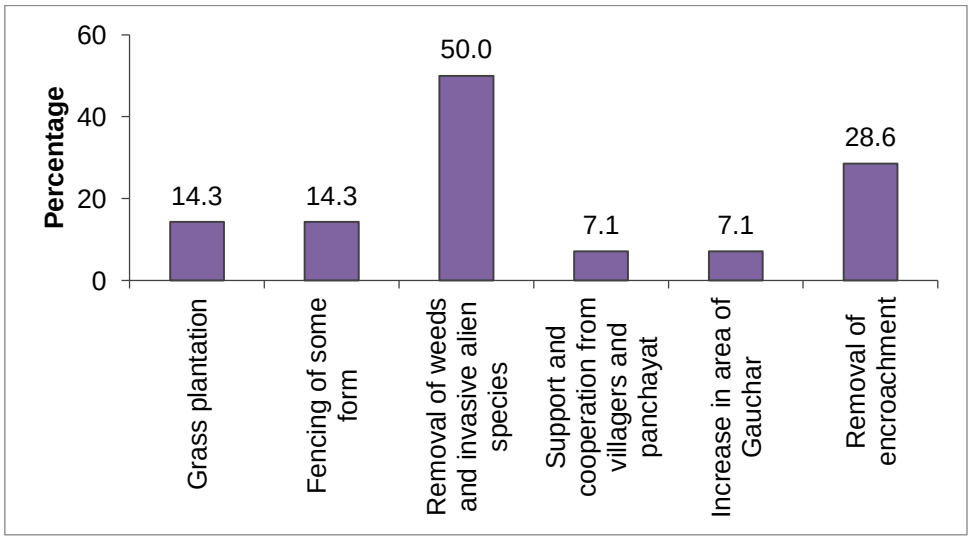

Figure 2.1.11: Percentage representation of improvement measures suggested by *Gir Mitras* for *Gauchar* in the project villages

Four villages namely Hiranvel, Moruka, Mandorna and Chitrod do not bear information on wastelands. Amrutvel being a forest settlement village does not hold a wasteland. Based on observations by *Gir Mitras* in the remaining 14 project villages, the majority wastelands are in an average condition (Figure 2.1.12).

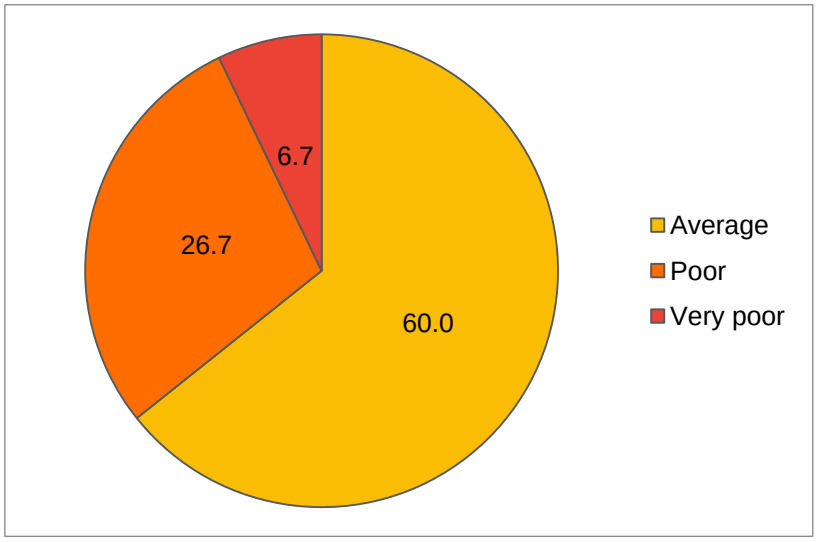

Figure 2.1.12: Percentage representation of the reported condition of Wastelands in the project villages

The reasons for the reported condition include rocky substratum (28.6%), illegal mining (28.6%), poor management (21.4%), soil erosion (14.3%), invasion by alien floral species (14.3%), and deforestation (7.1%).

The invasive alien species reported from these *vidis* include *Senna tora, Senna uniflora, Prosopis juliflora, Lantana camara* and *Parthenium hysterophorus.* Of these, *Lantana camara* and *Senna uniflora* showed the least and *Senna tora* showed the highest occurrences (Figure 2.1.13). Some of the *Gir Mitras* also collected information on the locations of the invasive alien species in their villages. These details are furnished in Table 2.1.1.

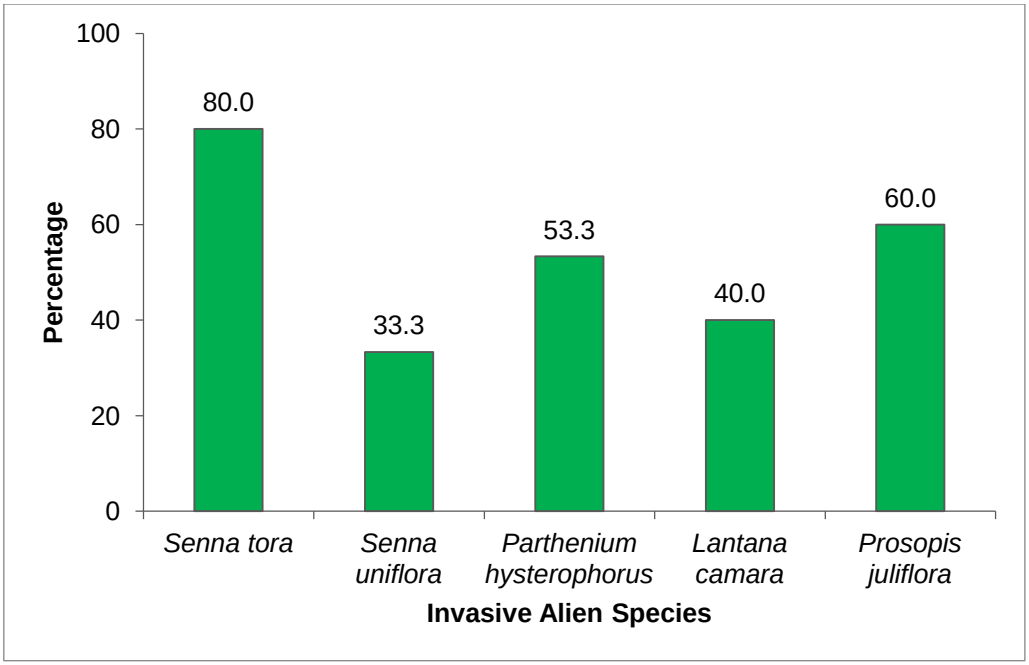

Figure 2.1.13: Percentage representation of occurrence of Invasive Alien Species reported from Wastelands in the project villages

Table 2.1.2: Details of locations of Invasive Alien Species in the project villages

Sr. No.	Name of the Village	GPS Location		Approximate area covered by the invasive alien species (m^2)	Nearby landmark
		Latitude (Degree Decimal)	Longitude (Degree Decimal)		
Senna tora					
1	Hiranvel	21.13967417	70.50749139	20	Hanuman temple
2		21.14127083	70.50909861	50	Pirbapa temple
3		21.14132278	70.51138944	15	Dhobi ghat
4		21.14098083	70.51172417	10	Samadhi
5		21.14056583	70.511015	5	School
6		21.13944167	70.51170111	5	Hand pump
7		21.13947861	70.50846444	20	Residence
8	Devgam	21.1404375	70.47539139	48	Ramapir temple
9		21.14145028	70.47299639	42	Panchayat
10		21.13916917	70.47252972	225	Bus stand
Senna uniflora					
1	Mandorna	21.01361111	70.6725	1600	Human habitation
2		21.00027778	70.66583333	120	Human habitation
3		21.01361111	70.6725	270	Human habitation
4		21.00611111	70.67388889	150	Human habitation

5		21.01027778	70.67527778	12500	Wasteland, Drainage
6		21.01472222	70.6725	1500	Human habitation
7	Kenedipur	21.27851778	70.48673361	300	Human habitation
8		21.2786175	70.48736778	100	Water tank
9		21.27852583	70.48762472	400	Gaushala
10		21.27835361	70.48858083	300	Village pond
11		21.27794028	70.48971194	500	Village pond
12		21.27815333	70.49039167	300	Village pond
13		21.27905778	70.48807222	300	Gaushala
14		21.27959361	70.48657583	250	Devipujak area
15		21.28008556	70.48564111	225	Momin kabrastan
16		21.27974083	70.48568028	400	Momin kabrastan
17		21.27544722	70.48391	10000	Dhobi ghat
18		21.2755725	70.4840325	100	Water trough
19	Haripur	21.150735	70.53557778	30	School
20		21.15132861	70.535745	15	Human habitation
21		21.15249167	70.53858722	10	Human habitation
22		21.15219528	70.53969639	17	Human habitation
23		21.151175	70.53969639	5	Samadhi
24		21.15199722	70.555055	30	Bus stop
25		21.15165167	70.535525	5	Blacksmith's shop
26		21.15249694	70.53579333	15	Human habitation
27		21.15244389	70.53564833	5	Human habitation
28		21.15196722	70.53710028	5	Human habitation
29		21.15167667	70.537395	2	Dairy
30	Bhalchhel	21.17843194	70.57390917	1200	Gadhaniya area
31		21.17956972	70.57431444	600	Gadhaniya area
32		21.17946361	70.57395806	1200	Helipad
33		21.17959528	70.57336861	2000	Bus stop
34		21.18021472	70.5731775	5000	Bus stop
35		21.18083333	70.57165278	2000	Khodiyar temple
36		21.17505611	70.57193222	200	Gaushala
37		21.172795	70.57236611	2000	Hiran river road
38		21.17231444	70.572635	2000	Chitrod road
39	Chitravad	21.10799444	70.52146833	15	Panchayat
40		21.10690361	70.52218361	225	Human habitation
41		21.10685806	70.52203972	289	Mobile tower
42		21.10664111	70.52203389	90	Tower
43		21.10695083	70.52182889	100	Tower

44		21.11014833	70.52374778	120	Anganvadi
45		21.11078194	70.52412361	2500	Water trough
46		21.11093861	70.52362	2500	Wasteland
47		21.11218639	70.523495	49	Human habitation
48		21.11318806	70.52394167	96	Poultry centre
49		21.11801778	70.52049444	10	Wasteland
50		21.113505	70.52065333	100	Wasteland
51		21.11357778	70.52029861	1600	Revenue
52		21.11361639	70.52023639	1600	Revenue
53		21.11336528	70.5207125	160	Anganvadi
54		21.11576444	70.52149861	200	Haripur road
55		21.10053611	70.52192389	100	Vasmo water tank
56	Hiranvel	21.13967417	70.50749139	20	Hanuman temple
57		21.14127083	70.50909861	50	Pir bapa
58		21.14132278	70.51138944	15	Dhobi ghat
59		21.14098083	70.51172417	10	Samadhi
60		21.14056583	70.511015	5	School
61		21.13944167	70.51170111	5	School
62		21.13947861	70.50846444	20	Human habitation
63	Sangodra	21.12564722	70.561165	100	Karim nagar
64		21.12610972	70.5604575	10	Karim nagar
65		21.12524639	70.5603475	10	Slum
66		21.11930361	70.55982528	256	Slum
67		21.12541667	70.55949389	900	Chakli dhar
68		21.12531333	70.55883056	1225	Chakli dhar
69		21.12974139	70.56187306	10	Charan ness
70	Bherala	20.98805556	70.47444444	4800	Human habitation
71		20.99111111	70.47583333	1500	Kabrastan
72		20.99083333	70.4675	225	Human habitation
73		20.99111111	70.475	1500	Wasteland
74		20.99055556	70.47416667	1000	Wasteland
75		20.99055556	70.47361111	9075	Wasteland
76		20.99	70.47361111	3000	Human habitation
77	Ladudi	21.10534361	70.45533417	30	Primary school
78		21.10697778	70.45246667	100	Bus stop
79		21.10693889	70.45225833	2500	Human habitation
80		21.10820556	70.45259722	400	Devgam road
81		21.10829611	70.45271611	500	Main road
82	Jalandhar	21.16529722	70.47666472	5058	Amrapur road

83		21.16980667	70.47691111	350	Brahmin samaj
84		21.16990694	70.47621167	150	Mobile tower
85		21.17030611	70.47597306	100	Smashaan
86		21.17032028	70.47608833	500	Smashaan on the river bank
87		21.17032	70.474345	3035	Khodiyar temple
88		21.17235167	70.47622444	100	Drainage
89		21.17128667	70.47554611	200	River bank
90		21.169295	70.47374556	150	Bavaji Ni Samadhi
91		21.16906806	70.47348333	200	Human habitation
92	Devgam	21.13682806	70.4734075	20	Tower chowk
93		21.13693722	70.47381472	150	School
94		21.14014417	70.4751525	25	Raiya dhar
95		21.13858917	70.47283194	12	Bus stop
96	Devgam	21.14053	70.47266833	220	Pandav shop
97		21.13683972	70.47438806	8	
98		21.13916917	70.47252972	225	Bus stand
99		21.14469472	70.47019778	400	Ladudi area
100	Jasapur	21.085455	70.644261	3200	Wasteland
101		21.086574	70.640875	400	Human habitation
102		21.086661	70.64396	250	Wasteland
103		21.088491	70.635915	875	Revenue
Parthenium hysterophorus					
1	Chitravad	21.10788722	70.52144889	1	School
2		21.10664111	70.52203389	90	Mobile tower
3		21.10701222	70.52181472	2	Human habitation
4		21.1085575	70.52300611	5	Diamond bakery
5		21.11053083	70.52410583	50	Dhobi ghat
6		21.11365694	70.5208175	7	Gaushala
7	Sangodra	21.12570694	70.56113667	150	Karim nagar
8		21.12616472	70.56054417	12	Karim nagar
9	Bherala	20.99111111	70.47583333	1500	Kabrastan
10	Jalandhar	21.16980667	70.47691111	100	Brahmin Samaj
11	Devgam	21.137385	70.4735625	80	Primary School
12		21.13676611	70.47282639	48	Amrutalayam
Lantana camara					
1	Haripur	21.15219528	70.53969639	17	Human habitation
2	Bhalchhel	21.17434389	70.5942825	200	Hiran river
3		21.17310833	70.57233056	600	Hiraneshvar temple

4		21.17247944	70.572455	1200	Tapali area
5		21.17247944	70.572455	1200	Tapali area
6		21.17145194	70.56855556	18	Hiraneshvar temple
7		21.17310833	70.57233056	600	Hiraneshvar
8	Bherala	20.99083333	70.47527778	255	Human habitation
9	Devgam	21.13868444	70.47404861	15	Zalavado
10		21.13473972	70.46878	15	Zalavado
11		21.13454611	70.4670125	120	Residence(Govindbhai)
Prosopis juliflora					
1	Kenedipur	21.27906056	70.48821389	15	Gaushala
2		21.27920972	70.48787278	100	Devipujak area
3	Haripur	21.152025	70.53834917	5	Patel samaj
4		21.150735	70.53557778	30	Primary school
5	Bhalchhel	21.18021472	70.57484417	5000	Bus stop
6		21.18058056	70.57252806	900	Momin kabrastan
7		21.18083278	70.57164583	100	Kabrastan
8	Sangodra	21.1253775	70.56035	5	Chakli dhar slum
9		21.12531028	70.55851611	3	Chakli dhar slum
10		21.12974139	70.56187306	10	Charan ness
11		21.13023889	70.56216917	7	Ness
12	Bherala	20.99083333	70.47527778	255	Human habitation
13		20.99	70.47361111	3000	Human habitation
14	Jalandhar	21.16529722	70.47666472	8095	Amrapur main road
15		21.16990694	70.47621167	150	Mobile Tower
16		21.17032083	70.47608833	500	Smashan On the river bank
17		21.17032	70.474345	4857	Khodiyar temple
18	Devgam	21.13838833	70.4752225	10	Dalit area
19		21.13913083	70.47515028	15	Water trough
20		21.13996028	70.47461528	180	Premjibhai residence
21		21.14083111	70.47008028	150	Residence (Bhanjibhai)
22		21.13487667	70.46502528	3	Human habitation
23	Jasapur	21.085455	70.644261	3200	Wasteland
24		21.088491	70.635915	875	Revenue

The livestock are grazed in wastelands belonging to 12 project villages, grazing does not occur in wastelands of Bherala and Jalandhar (Table 2.1.2).

Table 2.1.2: Project villages where livestock grazing occurs in the wasteland

Sr. No.	District	Taluka	Name of the Village
1	Junagadh	Mendarda	Haripur
2			Bhalchhel
3			Kenedipur
4		Malia	Ladudi
5			Amrapur
6			Devgam
7	Gir Somnath	Talala	Vadla
8			Jashapur
9			Mandor
10			Virpur
11			Chitravad
12			Sangodra

The most frequently reported mammals in the wastelands were Asiatic Lion, Indian Leopard, Golden Jackal and Nilgai followed by Wild Pig; Small Indian Civet and Grey Langur were the least reported (Figure 2.1.14).

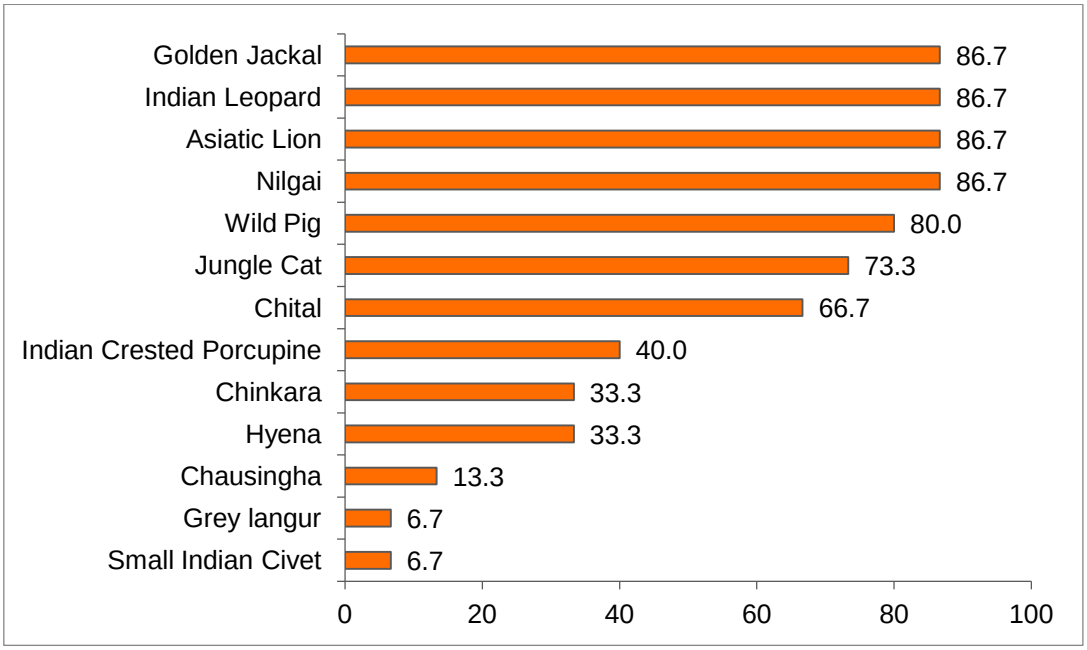

Figure 2.1.14: Percentage representation of mammals observed in wastelands in the project villages

The suggestions for improvement of the wastelands included afforestation, removal of encroachment, prohibition of mining activities, removal of weeds and invasive alien species, augmentation of soil fertility and support from villagers and Panchayat (Figure 2.1.15).

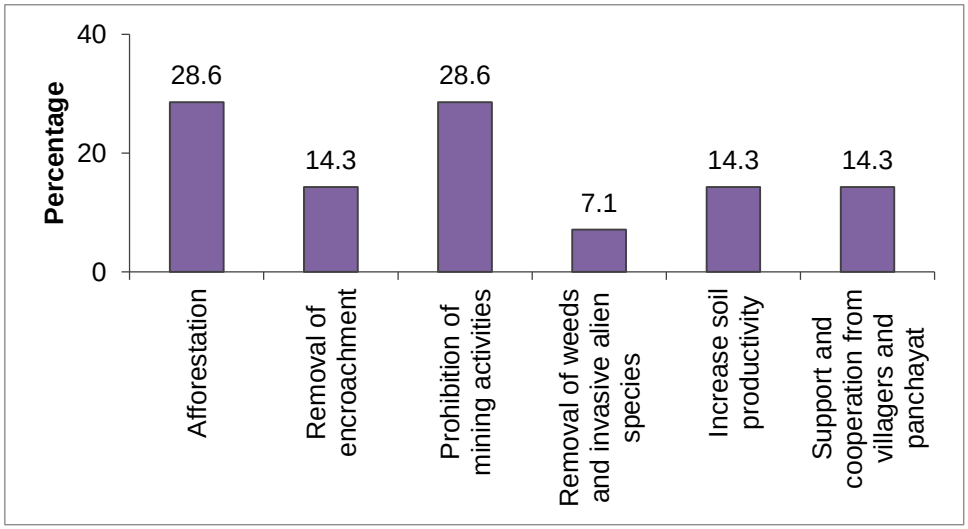

Figure 2.1.15: Percentage representation of improvement measures suggested by *Gir Mitras* for wastelands in the project villages

The generic suggestions for improvement of forested areas included tree plantation, removal of invasive alien species, prevention of illegal logging, prevention of illegal grazing by livestock, preventive mitigation measures for Human-Wildlife Conflict and prevention of trash disposal in the forested areas (Figure 2.1.16).

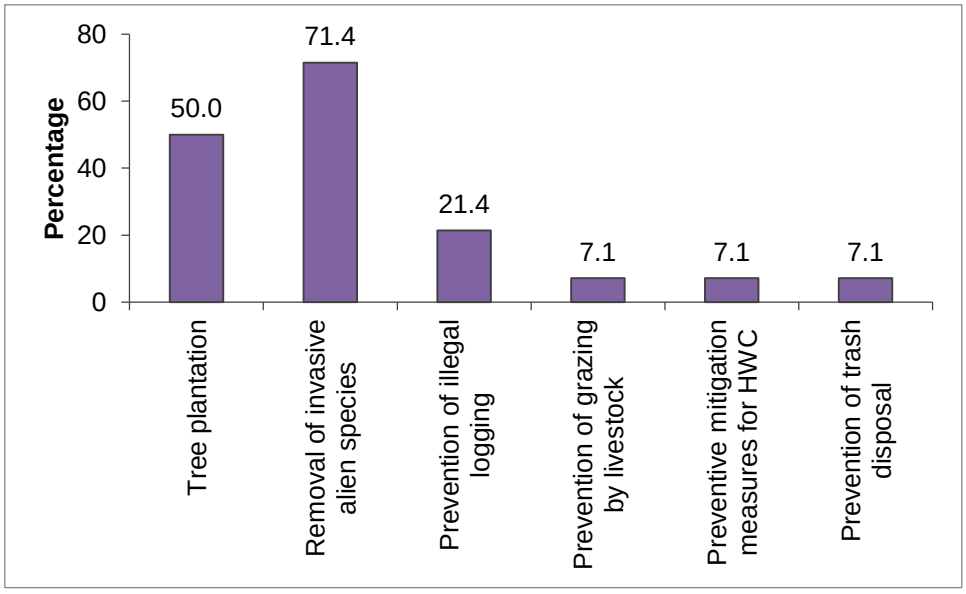

Figure 2.1.16: Percentage representation of improvement measures suggested by *Gir Mitras* for forested areas in the project villages

3.2.2 Senior Citizen Surveys

The data regarding changes in floristic composition in the project villages was obtained by conducting questionnaire surveys with senior citizens to understand their perceptions. A total of 570 respondents were interviewed from 19 villages except Shirvan. Most of the respondents were men (84.2%) (Figure 2.2.1).

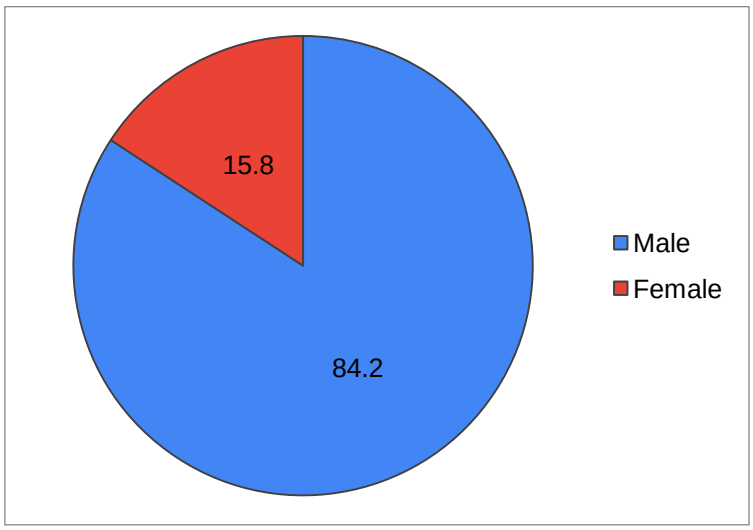

Figure 2.2.1: Percentage representation of the gender of senior citizen respondents in the project villages

Out of 570 respondents, the majority (n=399) belonged to the age class of 60-70 years (Figure 2.2.2).

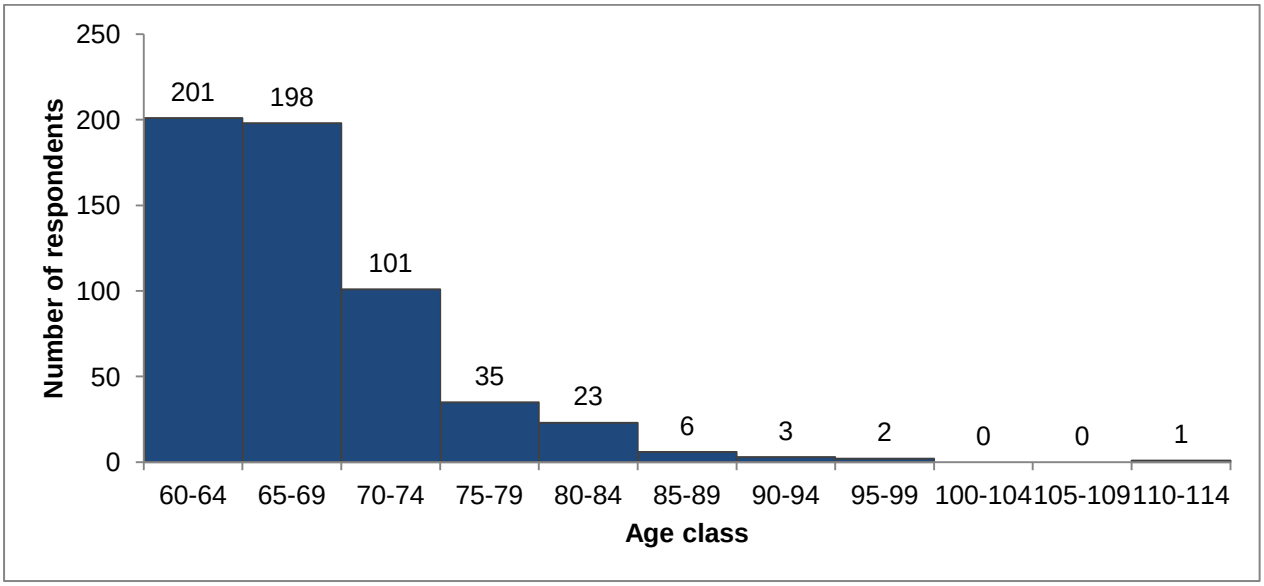

Figure 2.2.2: Age Class wise number of senior citizen respondents in the project villages

Majority of these respondents were occupied in farming (57%), followed by animal husbandry (24.2%), labour work (11.4%), business (1.6%) and small business (0.2%) (Figure 2.2.3). Some were retired (26.7%) and the women were housewives (4.7%).

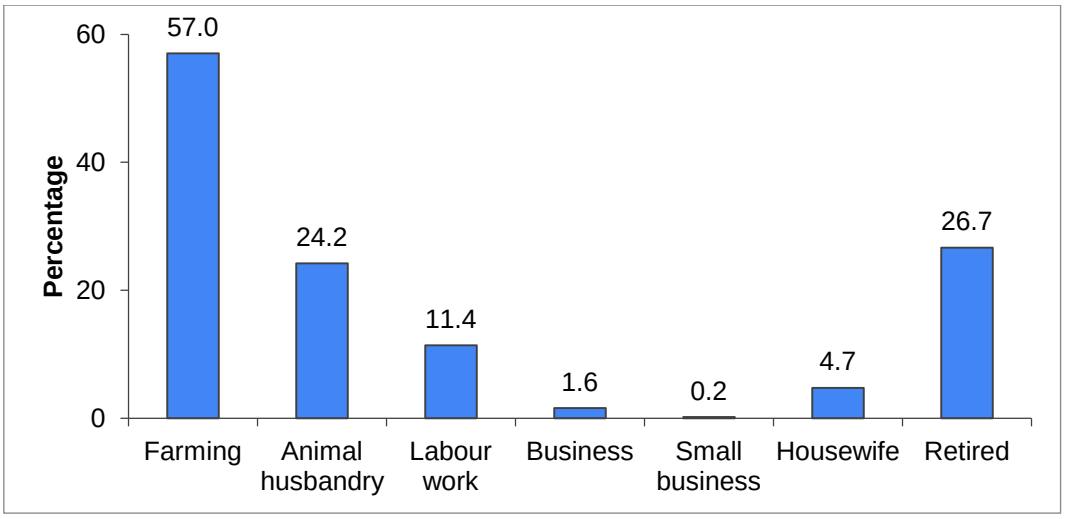

Figure 2.2.3: Percentage representation of occupation of senior citizen respondents in the project villages

The majority (88.1%) of the respondents opined that there was a change in the floristic composition in the project villages (Figure 2.2.4).

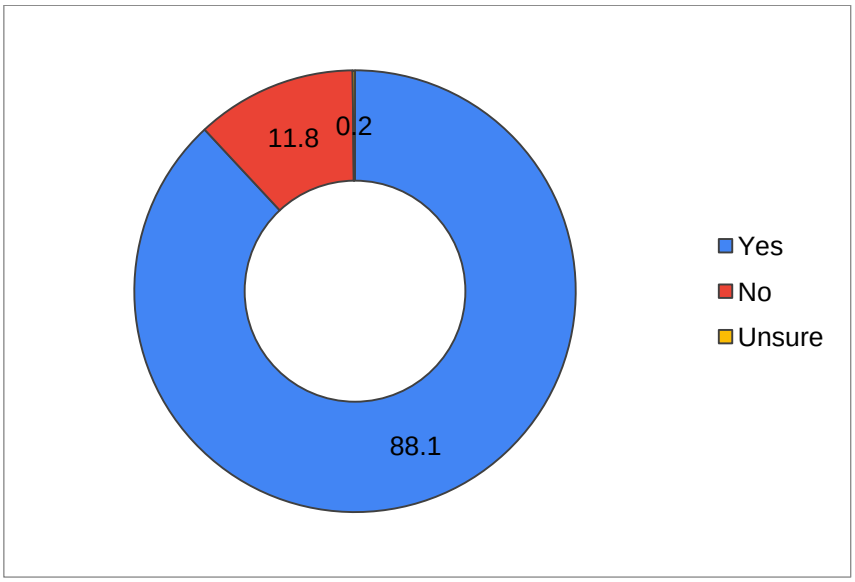

Figure 2.2.4: Percentage representation of senior citizen opinions on change in the floristic composition in the project villages

This change according to the majority of the respondents was good (77.0%). 18.2% respondents opined that this change was bad, while the remaining 4.7% respondents were unsure (Figure 2.2.5).

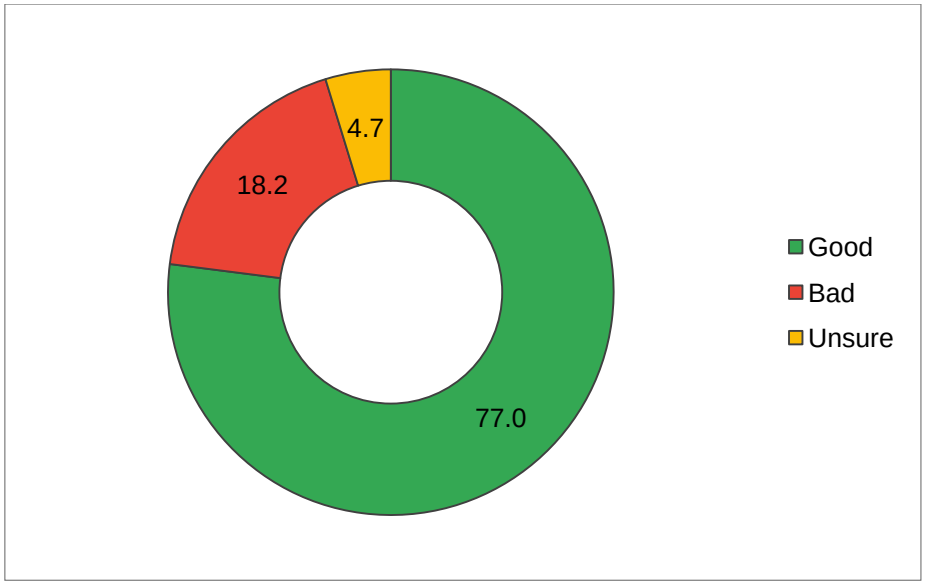

Figure 2.2.5: Percentage representation of the opinions of the respondents regarding the change in the floristic composition in the project villages

The factors contributing to the changes in the floristic composition in their opinion included anthropogenic disturbances (47.7%), climate change (37.2%), indiscriminate use (33.7%), poor management practices (27.9%), ill decided plantations (25.1%) and overgrazing (18.8%). 0.4% of the respondents were unsure (Figure 2.2.6).

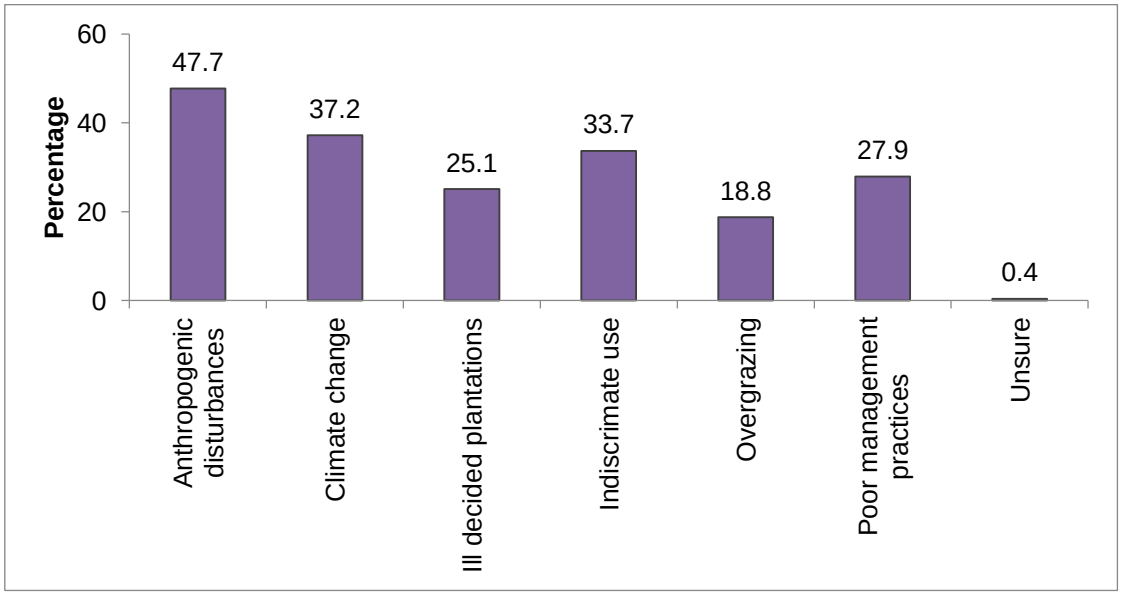

Figure 2.2.6: Percentage representation of various factors contributing to changes in floristic composition as per senior citizen respondents in the project villages

Information regarding the vegetation that was observed during the childhood of the senior citizen respondents was obtained. Since these data were exclusively obtained in the form of local names of the flora from the respondents, some species could not

be identified to their scientific names. The details and percentage frequency of these different species recorded during the interviews are enlisted in Tables 2.2.1 to 2.2.6.

Table 2.2.1: List of the tree species observed earlier in the Gir landscape with their percentage frequencies as reported by the senior citizens in the project villages

Sr. No.	Local Name	Scientific Name	Percentage Frequency
1	Aagathiyo	*Sesbania grandiflora*	0.35
2	Aal/Rangari	*Morinda tinctoria*	5.44
3	Aambo	*Mangifera indica*	1.40
4	Aamla	*Phyllanthus emblica*	0.18
5	Aankol	*Alangium salvifolium*	1.58
6	Ambli	*Tamarindus indica*	4.91
7	Arjun/Safed sadad	*Terminalia arjuna*	8.25
8	Asopalav	*Polyalthia longifolia*	0.53
9	Asundro	*Bauhinia racemosa*	0.53
10	Babar kher	*Acacia ferruginea*	0.70
11	Badam	*Terminalia catappa*	0.70
12	Baheda	*Terminalia bellirica*	11.58
13	Baval	*Acacia nilotica*	2.11
14	Bili	*Aegle marmelos*	0.18
15	Biyo	*Pterocarpus marsupium*	2.28
16	Bordi	*Ziziphus glabrata*	3.68
17	Borsalli	*Mimusops elengi*	0.18
18	Bush	*Milingtonia hortensis*	0.18
19	Champo	*Plumeria alba*	4.21
20	Chandan	*Santalum album*	3.33
21	Charel	*Holoptelea integrifolia*	2.63
22	Chiku	*Manilkara zapota*	0.18
23	Dadam	*Punica granatum*	0.53
24	Dhavdo	*Anogeissus latifolia*	1.23
25	Dhraman	*Grewia tilaeifolia*	1.93
26	Dudhlo	*Wrightia tinctoria*	12.46
27	Ekalkanto/Monj	*Bridelia retusa*	1.23
28	Gangedi	*Xeromphis uliginosa*	3.68
29	Garmalo	*Cassia fistula*	11.93
30	Ghut bordi	*Ziziphus xylopyrus*	8.25
31	Gorad	*Acacia senegal*	0.70
32	Gugal	*Commiphora wightii*	0.18
33	Gulmohar	*Delonix regia*	0.53

34	Gundee	*Cordia sinensis*	5.09
35	Gundo	*Cordia dichotoma*	4.74
36	Jaifal	*Myristica fragrans*	0.18
37	Jambu	*Syzygium salicifolium*	0.88
38	Kadayo	*Firmiana simplex*	3.16
39	Karanj	*Derris indica*	1.05
40	Karukhdo	*Holarrhena pubescens*	3.68
41	Kat gunda	*Cordia monoica*	4.56
42	Kerda	*Capparis decidua*	0.35
43	Khajuri	*Phoenix slyvestris*	0.35
44	Khakhro	*Butea monosperma*	0.70
45	Khijdo	*Prosopis cinererea*	5.26
46	Limbudi	*Citrus limon*	0.18
47	Limdo	*Azadirachta indica*	1.40
48	Madhit/Mordudhiyo	*Dichrostachys cinerea*	1.58
49	Mahudo	*Madhuca indica*	0.53
50	Markho/Mokh	*Schrebera swietenioides*	0.18
51	Mayurpankh	*Platycladus orientalis*	0.18
52	Moveda	*Lannea coromandelica*	0.35
53	Nevri	*Ixora arborea*	0.18
54	Nilgiri	*Eucalyptus globulus*	2.63
55	Panarvo	*Erythrina indica*	2.11
56	Papaya	*Carica papaya*	0.70
57	Paras piplo	*Thespesia populnea*	1.23
58	Parijat	*Nyctanthes arbortristis*	0.53
59	Pilo khakhro	*Butea monosperma var. yellow*	0.18
60	Piludi	*Salvadora persica*	0.70
61	Pipar	*Ficus rumphii*	2.28
62	Piplo	*Ficus religiosa*	4.39
63	Pragvad	*Ficus microcarpa*	1.93
64	Prahli/Prans	*Tamarix gallica*	20.00
65	Ragatrohido	*Tecomella undulata*	1.40
66	Rambaval	*Parkinsonia aculeata*	0.18
67	Ravna	*Syzygium cuminii*	2.28
68	Rayan	*Manilkara hexandra*	3.51
69	Rohan	*Soymida febrifuga*	7.02
70	Saag	*Tectona grandis*	1.40
71	Sadad	*Terminalia crenulata*	0.18

72	Safed Kesudo	*Butea monosperma var. lutea*	4.04
73	Sajad	*Terminalia crenulata*	9.82
74	Saptaparni	*Alstonia scholaris*	0.35
75	Saragvo	*Moringa oleifera*	2.81
76	Saru	*Casuarina equisetifolia*	1.23
77	Savan	*Gmelina arborea*	3.51
78	Setur	*Morus alba*	0.88
79	Shemlo	*Bombax ceiba*	4.56
80	Shisham	*Dalbergia latifolia*	7.72
81	Sopari	*Areca catechu*	0.35
82	Timbarvo	*Diospyros melanoxylon*	9.47
83	Umbh/Umbteti	*Miliusa tomentosa*	4.21
84	Umro	*Ficus glomerata*	9.47
85	Vad	*Ficus benghalensis*	5.79

Table 2.2.2: List of the shrub species observed earlier in the Gir landscape with their percentage frequencies as reported by the senior citizens in the project villages

Sr. No.	Local Name	Scientific Name	Percentage Frequency
1	Aankdo	*Calotropis procera*	4.39
2	Aavad	*Senna auriculata*	11.75
3	Ardusi	*Adhatoda vasica*	7.72
4	Bapsi	*Lantana camara*	1.05
5	Dhaturo	*Datura metel*	5.09
6	Eranda	*Ricinus communis*	2.11
7	Gando baval	*Prosopis juliflora*	0.53
8	Hathaliyo thor	*Opuntia elatior*	0.18
9	Jasud	*Hibiscus rosasinensis*	15.44
10	Jipto	*Triumfetta rotundifolia*	4.39
11	Kanthari	*Capparis sepiaria*	24.74
12	Karamdi	*Carrisa congesta*	9.47
13	Karen	*Nerium indicum*	2.81
14	Ketki	*Agave americana*	0.18
15	Kevdo	*Pandanus odoratissimus*	8.25
16	Mahendi	*Lawsonia inermis*	8.07
17	Mardasing/Aantedi	*Helicteres isora*	4.91
18	Nagod	*Vitex negundo*	1.58
19	Pili Karen	*Thevetia peruviana*	8.07
20	Popti	*Physalis minima*	2.11
21	Ratrani	*Cestrum nocturnum*	1.58
22	Safed Aankdo	*Calotropis gigantea*	1.75
23	Safed Karen	*Nerium oleander*	3.86

24	Shenvi	*Securinega leucopyrus*	2.11
25	Shingadiyo	*Periploca aphylla*	0.88
26	Surajmukhi	*Helianthus annuus*	0.88
27	Thor	*Euphorbia nivulia*	1.75

Table 2.2.3: List of the herb species observed earlier in the Gir landscape with their percentage frequencies as reported by the senior citizens in the project villages

Sr. No.	Local Name	Scientific Name	Percentage Frequency
1	Adavi	*Colocasia esculenta*	1.58
2	Aloevera	*Aloe barbadensis*	0.18
3	Aghedo	*Achyranthes aspera*	5.79
4	Ajmo	*Trachyspermum ammi*	2.46
5	Ashwagandha	*Withania somnifera*	2.63
6	Balbij	*Abutilon indicum*	0.18
7	Barmasi	*Catharanthus roseus*	3.16
8	Beet	*Beta vulgaris*	0.18
9	Bhang	*Cannabis sativa*	0.18
10	Bhangaro/Bhringraj	*Eclipta prostrata*	1.58
11	Bhopatri	*Elephantopus scaber*	0.18
12	Bhoringani	*Solanum surattense*	1.40
13	Chameli	*Jasminum officinale*	1.58
14	Congress ghas	*Parthenium hysterophorus*	3.16
15	Darudi	*Argemone mexicana*	6.32
16	Desi Kuvadiyo	*Senna tora*	2.11
17	Gadariyu	*Xanthium strumarium*	3.33
18	Gajar	*Daucus carota*	0.18
19	Galmahendi	*Impatiens balsamina*	3.16
20	Gandharovaj	*Acorus calamus*	0.18
21	Gokhru	*Tribulus terrestris*	5.26
22	Gulab	*Rosa sp.*	2.28
23	Guvar/Gamguvar	*Cyamopsis tetragonoloba*	0.70
24	Jheel	*Indigofera oblongifolia*	7.54
25	Kadiyatu	*Andrographis echioides*	3.51
26	Kalijeeri	*Vernonia anthelmintica*	0.70
27	Kalu Kadiyatu	*Haplanthus verticillatus*	1.75
28	Khapat	*Abutilon glaucum*	0.18
29	Khatiyo	*Rumex vesicarius*	1.40
30	Lepro	*Celosia argentea*	1.05
31	Luni	*Portulaca quadrifida*	0.18
32	Mamejo	*Enicostema hyssopifolium*	1.93
33	Mandvi/Magfali/Vakhedi	*Arachis hypogea*	0.35
34	Mogro	*Jasminum sambac*	2.63
35	Palak	*Spinacia oleracea*	0.35
36	Pandadiyo	*Desmodium triflorum*	0.18

37	Panfuti	*Bryophyllum pinnatum*	0.53
38	Pankando/Jungli Dungli	*Urginea indica*	0.18
39	Phudino	*Mentha viridis*	0.53
40	Rajagro	*Amaranthus hybridus*	0.35
41	Rajko/Gadabh	*Medicago sativa*	5.79
42	Ringan	*Solanum melongena*	0.35
43	Satavari	*Asparagus racemosus*	0.18
44	Sheshmul	*Commelina nudiflora*	0.88
45	Sonasali	*Vicoa indica*	1.58
46	Soya bean	*Glycene max*	1.05
47	Surpankho	*Tephrosia purpurea*	2.28
48	Takmariya	*Ocimum americanum*	10.88
49	Tandaljo	*Amaranthus tricolor*	1.58
50	Tilaktulsi	*Coleus scutellarioides*	3.68
51	Tulsi	*Ocimum sanctum*	1.93
52	Vajaradanti	*Barleria prionitis*	0.35
53	Vantulsi	*Ocimum canum*	1.05
54	Vicks tulsi	*Ocimum tenuiflorum*	0.35
55	Videshi tulsi	*Ocimum tenuiflorum*	0.35
56	Vinchiya	*Martynia annua*	4.21

Table 2.2.4: List of the climber species observed earlier in the Gir landscape with their percentage frequencies as reported by the senior citizens in the project villages

Sr. No.	Local Name	Scientific Name	Percentage Frequency
1	Galo	*Tinospora cordifolia*	0.18
2	Khirvel	*Holostemma annularium*	0.18
3	Koyli	*Mucuna prurita*	0.88
4	Malkagni	*Celastrus paniculatus*	0.18
5	Tadak tumdi/Chanak chibhdi	*Mukia maderaspatana*	9.47

Table 2.2.5: List of the grass species observed earlier in the Gir landscape with their percentage frequencies as reported by the senior citizens in the project villages

Sr. No.	Local Name	Scientific Name	Percentage Frequency
1	Bajariyu	*Arundinella metzii*	4.74
2	Bajri	*Pennisetum glaucum*	0.88
3	Baru	*Sorghum halapense*	9.65
4	Bhangoru	*Apluda mutica*	0.18
5	Dabh	*Saccharum spontaneum*	7.72
6	Dangar/Kamod	*Oryza sativa*	1.58
7	Dharu	*Dactyloctenium aegyptium*	0.35
8	Dhrokad/Dholi Dhrokad	*Cynodon dactylon*	7.37
9	Dhundh	*Panicum antidotale*	5.79
10	Foflu	*Eragrostis sp.*	0.70

11	Garolu	*Chionachne gigantea*	2.81
12	Ghabajariyu	*Typha eliphantina*	0.18
13	Ghaulo	*Iseilema laxum*	3.68
14	Jhinjhvo	*Alloteropsis cimicina*	24.56
15	Jowar	*Sorghum bicolor*	0.88
16	Khariyu/Aariyu Khariyu	*Dinebra retroflexa*	2.98
17	Makai	*Zea mays*	0.53
18	Marvo	*Dicanthium caricosum*	4.21
19	Ratad	*Themeda cymbaria*	7.02
20	Saiyo	*Fimbristylis miliacea*	11.23
21	Samo	*Echinochloa colonum*	2.46
22	Shaniyar	*Sehima nervosum*	12.81
23	Sherdi	*Saccharum officinarum*	0.18
24	Vaans	*Dendrocalamus strictus*	0.18
25	Vadhiyu	*Tragus mongolorum*	5.09

Table 2.2.6: List of the unidentified species observed earlier in the Gir landscape with their percentage frequencies as reported by the senior citizens in the project villages

Sr. No.	Local Name	Percentage Frequency
1	Adhogadho	4.21
2	Bharni	0.35
3	Bhuko	2.63
4	Desi ghaas	0.88
5	Dhoriyo	3.33
6	Dhundhali	0.53
7	Gadardi	10.00
8	Hiramahi	2.81
9	Kadli	0.35
10	Kaghesho	11.93
11	Kangadu	0.35
12	Kharasvu	0.35
13	Mashundri	0.35
14	Mothu	0.18
15	Naylon ghass	13.33
16	Noru	0.70
17	Sadhajadi	0.18
18	Shil	0.18
19	Shirdandali	0.18
20	Sondharu	4.74
21	Survadi	1.23

22	Tadtadiyu	0.18
23	Thoriyu	1.75
24	Vahli	1.93

Information regarding the vegetation currently observed but previously not recorded from the villages was obtained from the senior citizen respondents. Some of the plant species mentioned by the respondents could not be identified to their scientific names. The details and percentage frequency of these different species recorded during the interviews are enlisted in Tables 2.2.7 to 2.2.12.

Table 2.2.7: List of the tree species currently observed in the Gir landscape with their percentage frequencies as reported by the senior citizens in the project villages

Sr. No.	Local Name	Scientific Name	Percentage Frequency
1	Aal/Rangari	*Morinda tinctoria*	0.53
2	Aambli	*Tamarindus indica*	3.68
3	Aambo	*Mangifera indica*	4.91
4	Aankol	*Alangium salvifolium*	7.72
5	Asopalav	*Polyalthia longifolia*	0.70
6	Asundro	*Bauhinia racemosa*	0.18
7	Babarkher	*Acacia ferruginea*	0.35
8	Badam	*Terminalia catappa*	0.35
9	Bangali baval/Subaval	*Leucaena leucocephala*	2.11
10	Baval/Desi Baval	*Acacia nilotica*	15.09
11	Bijoru	*Citrus medica*	1.40
12	Bili	*Aegle marmelos*	0.35
13	Biyo	*Pterocarpus marsupium*	0.88
14	Bordi	*Ziziphus glabrata*	5.96
15	Borsalli	*Mimusops elengi*	12.63
16	Champo	*Plumeria alba*	0.70
17	Chandan	*Santalum album*	0.35
18	Charel	*Holoptelea integrifolia*	1.05
19	Chiku	*Manilkara zapota*	0.35
20	Dadam	*Punica granatum*	0.88
21	Dhraman	*Grewia tilaeifolia*	0.35
22	Dudhlo	*Wrightia tinctoria*	1.40
23	Ekalkanto/Monj	*Bridelia retusa*	1.58
24	Fanas	*Artocarpus heterophyllus*	1.58
25	Garmalo	*Cassia fistula*	0.70
26	Ghut bordi	*Ziziphus xylopyrus*	1.23
27	Gorad	*Acacia senegal*	0.18
28	Gorasambli	*Pithecellobium dulce*	1.40

29	Gulmohar	*Delonix regia*	17.54
30	Gunda	*Cordia dichotoma*	3.68
31	Harmo	*Acacia leucophloea*	0.35
32	Ingori	*Balanites aegyptiaca*	0.18
33	Jambu	*Syzygium salicifolium*	7.19
34	Jamfali	*Psidium guajava*	0.70
35	Kaju	*Anacardium occidentale*	3.51
36	Karanj	*Derris indica*	0.70
37	Karapti	*Garuga pinnata*	1.05
38	Karukhdo	*Holarrhena pubescens*	0.70
39	Kel	*Musa acuminata*	0.18
40	Khakhro	*Butea monosperma*	9.47
41	Kharek	*Phoenix dactylifera*	2.98
42	Kher	*Acacia catechu*	11.93
43	Khijdo	*Prosopis cinererea*	0.53
44	Limbudi	*Citrus limon*	6.67
45	Limdo	*Azadirachta indica*	10.53
46	Mahudo	*Madhuca indica*	0.18
47	Mayurpankh	*Platycladus orientalis*	1.23
48	Mindhol	*Xeromphis spinosa*	0.18
49	Nariyeli	*Cocos nucifera*	1.05
50	Nilgiri	*Eucalyptus globulus*	3.51
51	Panarvo	*Erythrina indica*	0.18
52	Papaya	*Carica papaya*	0.53
53	Parijat	*Nyctanthes arbortristis*	1.75
54	Pipar	*Ficus rumphii*	0.18
55	Pipli	*Ficus drupacea*	0.18
56	Piplo	*Ficus religiosa*	10.53
57	Pleto	*Peltophorum pterocarpum*	1.05
58	Pragvad	*Ficus microcarpa*	0.88
59	Prahli/Prans	*Tamarix gallica*	1.75
60	Rain tree	*Samanea saman*	0.18
61	Ram baval	*Parkinsonia aculeata*	4.21
62	Ramfal	*Annona reticulata*	1.75
63	Ravna	*Syzygium cuminii*	0.70
64	Rayan	*Manilkara hexandra*	0.53
65	Rubber vad/American Vad/Videshi Vad	*Ficus elastica*	3.86
66	Saag	*Tectona grandis*	0.18
67	Safed Sajad	*Terminalia arjuna*	0.70
68	Sajad	*Terminalia crenulata*	3.86
69	Santaru	*Citrus reticulata*	0.53
70	Saptaparni	*Alstonia scholaris*	12.98
71	Saragvo	*Moringa oleifera*	0.88
72	Saru	*Casuarina equisetifolia*	2.98

73	Savan	*Gmelina arborea*	1.05
74	Setur	*Morus alba*	2.28
75	Shemlo	*Bombax ceiba*	1.05
76	Shisham	*Dalbergia latifolia*	0.18
77	Sitafali	*Annona squamosa*	0.70
78	Subaval	*Leucaena leucocephala*	0.35
79	Tadiyo	*Borassus flabellifer*	0.18
80	Timbarvo	*Diospyros melanoxylon*	0.35
81	Tota aambo	*Mangifera indica*	0.18
82	Umro	*Ficus glomerata*	1.05
83	Vad	*Ficus benghalensis*	7.54
84	Videshi papaiyu	*Carica papaya*	0.18
85	Vilayati bawal	*Acacia auriculiformes*	2.11

Table 2.2.8: List of the shrub species currently observed in the Gir landscape with their percentage frequencies as reported by the senior citizens in the project villages

Sr. No.	Local Name	Scientific Name	Percentage Frequency
1	Aankdo	*Calotropis procera*	2.11
2	Aantedi/Mardasing	*Helicteres isora*	3.16
3	Aavad	*Senna auriculata*	9.65
4	Aradusi	*Adhatoda vasica*	4.74
5	Arani	*Clerodendrum multiflorum*	0.18
6	Bapsi	*Lantana camara*	15.09
7	BT kapas	*Gossypium herbaceum*	1.40
8	Chanibor	*Ziziphus nummularia*	0.35
9	Dhaturo	*Datura metel*	0.35
10	Dragon fruit	*Selenicereus undatus*	1.75
11	Gando baval	*Prosopis juliflora*	4.74
12	Hathaliyo thor	*Opuntia elatior*	0.18
13	Jasud	*Hibiscus rosasinensis*	8.07
14	Kapas	*Gossypium herbaceum*	3.33
15	Karamdi	*Carrisa congesta*	0.70
16	Karen	*Nerium indicum*	4.04
17	Kevdo	*Pandanus odoratissimus*	5.26
18	Mahendi	*Lawsonia inermis*	0.53
19	Nagod	*Vitex negundo*	1.23
20	Pili karen	*Thevetia peruviana*	3.51
21	Popti	*Physalis minima*	6.32
22	Ratan jyot	*Jatropha curcas*	1.40
23	Ratrani	*Cestrum nocturnum*	0.70
24	Safed karen	*Nerium oleander*	1.05
25	Thor	*Euphorbia nivulia*	12.28
26	Vasanti	*Tecoma stans*	0.18

Table 2.2.9: List of the herb species currently observed in the Gir landscape with their percentage frequencies as reported by the senior citizens in the project villages

Sr. No.	Local Name	Scientific Name	Percentage Frequency
1	Adavi	*Colocasia esculenta*	0.35
2	Aghedo	*Achyranthes aspera*	0.88
3	Ajamo	*Trachyspermum ammi*	1.75
4	Aloevera	*Aloe barbadensis*	0.35
5	Ashwagandha	*Withania somnifera*	3.68
6	Barmasi	*Catharanthus roseus*	1.05
7	Beet	*Beta vulgaris*	0.35
8	Bhangaro/Bhringraj	*Eclipta prostrata*	4.56
9	Bhoaambli	*Phyllanthus fraternus*	5.09
10	Bhoringani	*Solanum surattense*	0.53
11	Brahmi	*Bacopa monnieri*	0.35
12	Chameli	*Jasminum officinale*	14.21
13	Chini gulab	*Portulaca sp.*	1.05
14	Congress ghas	*Parthenium hysterophorus*	19.47
15	Damro	*Ocimum basilicum*	0.35
16	Desi kuvadio/Aavad kavad	*Senna tora*	7.02
17	Gadariyu	*Xanthium strumarium*	2.46
18	Galgota	*Tagetes erecta*	7.54
19	Galmahendi	*Impatiens balsamina*	2.98
20	Gokharu	*Tribulus terrestris*	0.18
21	Gulab	*Rosa sp.*	6.32
22	Guvar/Gamguvar	*Cyamopsis tetragonoloba*	1.05
23	Jheel	*Indigofera oblongifolia*	0.18
24	Kadiyatu	*Andrographis echioides*	7.89
25	Kalijiri	*Vernonia anthelmintica*	0.18
26	Kuvadiyo	*Senna tora*	18.60
27	Lepro	*Celosia argentea*	2.98
28	Lili haldar	*Curcuma amada*	0.18
29	Luni	*Portulaca quadrifida*	0.18
30	Magfali	*Arachis hypogea*	0.35
31	Mogro	*Jasminum sambac*	0.88
32	Pandadiyu	*Desmodium triflorum*	0.35
33	Patthartod/Panafad	*Tridax procumbens*	0.18
34	Phudino	*Mentha viridis*	2.11
35	Rajagaro	*Amaranthus hybridus*	0.18
36	Rajko/Gadabh	*Medicago sativa*	6.49
37	Ramtulsi	*Ocimum sanctum*	1.23
38	Ranmethi	*Ocimum tenuiflorum*	1.40
39	Ringani	*Solanum melongena*	0.18

40	Satavari	*Asparagus racemosus*	0.18
41	Seshmul	*Commelina nudiflora*	1.05
42	Shyamtulsi	*Ocimum tenuiflorum*	0.18
43	Soya bean	*Glycene max*	2.81
44	Surpankho	*Tephrosia purpurea*	0.35
45	Takmariya	*Ocimum americanum*	0.53
46	Tandaljo	*Amaranthus tricolor*	0.35
47	Tilak tulsi	*Coleus scutellarioides*	8.42
48	Tulsi	*Ocimum sanctum*	5.09
49	Tuver	*Cajanus cajan*	0.53
50	Varsharani	*Monsona senegalensis*	2.81
51	Vicks tulsi	*Ocimum tenuiflorum*	2.46
52	Videshi gulab	*Rosa sp.*	5.61
53	Videshi kuvadiyo	*Senna uniflora*	5.79
54	Videshi tulsi	*Ocimum tenuiflorum*	0.70

Table 2.2.10: List of the climber species currently observed in the Gir landscape with their percentage frequencies as reported by the senior citizens in the project villages

Sr. No.	Local Name	Scientific Name	Percentage Frequency
1	Amarvel	*Cuscuta chinensis*	0.18
2	Dudhali	*Hemidesmus indicus*	6.49
3	Galo	*Tinospora cordifolia*	1.58
4	Madhumalti	*Combretum indicum*	0.35
5	Malkakada	*Celastrus paniculatus*	0.35
6	Marvelo	*Combretum ovalifolium*	0.35

Table 2.2.11: List of the grass species currently observed in the Gir landscape with their percentage frequencies as reported by the senior citizens in the project villages

Sr. No.	Local Name	Scientific Name	Percentage Frequency
1	Bajariyu	*Arundinella metzii*	0.70
2	Bajri	*Pennisetum glaucum*	3.16
3	Banti	*Echinochloa frumentacea*	0.35
4	Baru	*Sorghum halapense*	1.75
5	Bullet ghass	*Panicum repens*	13.33
6	Dabh	*Saccharum spontaneum*	1.05
7	Dabhoriyu	*Aristida adscensionis*	0.18
8	Dhrokad	*Cynodon dactylon*	3.86
9	Foflu	*Eragrostis sp.*	0.35
9	Ghabajariyu	*Typha eliphantina*	0.70
10	Ghaulo	*Iseilema laxum*	0.18
11	Jhinjhvo	*Alloteropsis cimicina*	18.07
12	Jowar	*Sorghum bicolor*	0.35
13	Khariyu khad	*Dinebra retroflexa*	17.89

14	Lawn	*Axonopus sp.*	1.58
15	Makai	*Zea mays*	0.88
16	Marvo	*Dicanthium caricosum*	0.35
17	Nagarmoth	*Cyperus rotundus*	0.35
18	Napier grass	*Cenchrus purpureus*	4.21
19	Netar	*Calamus rotang*	0.35
20	Pilo vaans	*Bambusa vulgaris*	0.18
21	Ratad	*Themeda cymbaria*	4.04
22	Saiyo	*Fimbristylis miliacea*	6.67
23	Sambo	*Echinochloa colonum*	0.88
24	Shaniyar	*Sehima nervosum*	0.88
25	Sherdi	*Saccharum officinarum*	1.40
26	Vaans	*Dendrocalamus strictus*	0.18
27	Vadhiyu	*Tragus mongolorum*	24.04

Table 2.2.12: List of the unidentified species currently observed in the Gir landscape with their percentage frequencies as reported by the senior citizens in the project villages

Sr. No.	Common Name	Percentage Frequency
1	Adhogadho	3.51
2	Ajmeri bordi	0.18
3	Amarodamro	1.05
4	Amod tamod	8.25
5	Bargheli	5.96
6	Deshi ghass	0.70
7	Gadedi	5.61
8	Ghans	0.35
9	Ghod	0.18
10	Godaiya	0.35
11	Gujarat ghas	3.16
12	Haripatti ghas	1.75
13	Hiramahi	5.61
14	Jangli tulsi	5.09
15	Kavad	0.88
16	Lalpan valu khad	1.23
17	Lilukhad	0.35
18	Masundri	0.18
19	Naylon	0.18
20	Noru	1.75
21	Pam	1.05
22	Panjabi ghas	1.58
23	Suvardi	2.46
24	Syari	2.28
25	Tamod	1.75
26	Thoriyu	0.18

27	Timdi	0.18
28	Undhi	0.18
29	Utikuti	5.96
30	Vel	1.93
31	Videshi ghaas	6.32

Many plant species were commonly reported to occur in the past and the present except the ones that have been enlisted as unidentified. Among trees, *Sesbania grandiflora*, *Terminalia bellirica, Milingtonia hortensis, Xeromphis uliginosa, Cordia sinensis, Commiphora wightii, Myristica fragrans, Firmiana simplex, Cordia monoica, Capparis decidua, Phoenix slyvestris, Dichrostachys cinerea, Schrebera swietenioides, Lannea coromandelica, Ixora arborea, Thespesia populnea, Tamarix gallica, Salvadora persica, Soymida febrifuga, Butea monosperma var. lutea* and *Areca catechu* were reported to be observed during the childhood of the senior citizens but were not observed now. Similarly, trees that they had not observed in their childhood that are seen in the villages today included *Citrus medica, Leucaena leucocephala, Pithecellobium dulce, Psidium guajava, Anacardium occidentale, Garuga pinnata, Musa acuminate, Phoenix dactylifera, Xeromphis spinosa, Cocos nucifera, Ficus drupacea, Peltophorum pterocarpum, Samanea saman, Annona reticulata, Ficus elastica, Citrus reticulata* and *Acacia auriculiformes.*

Among shrubs, *Ricinus communis*, *Triumfetta rotundifolia, Capparis sepiaria, Agave americana, Securinega leucopyrus, Periploca aphylla* and *Helianthus annuus* were reported to be observed during the childhood of the senior citizens but were not observed now. Similarly, shrubs that they had not observed in their childhood that are seen in the villages today included *Clerodendrum multiflorum, Ziziphus nummularia, Selenicereus undatus, Gossypium herbaceum, Jatropha curcas* and *Tecoma stans.*

Among herbs, *Abutilon indicum, Cannabis sativa*, *Elephantopus scaber, Argemone mexicana, Daucus carota*, *Acorus calamus*, *Enicostema hyssopifolium, Spinacia oleracea*, *Vicoa indica*, *Barleria prionitis*, *Ocimum canum* and *Martynia annua* were reported to be observed during the childhood of the senior citizens but were not observed now. Similarly, herbs that they had not observed in their childhood that are seen in the villages today included *Phyllanthus fraternus, Portulaca sp., Ocimum basilicum, Tagetes*

erecta, Curcuma amada, Tridax procumbens, Ocimum sanctum, Ocimum tenuiflorum, Cajanus cajan, Monsona senegalensis, Rosa sp. and *Senna uniflora.*

Among climbers, *Holostemma annularium*, *Mucuna prurita* and *Mukia maderaspatana* were reported to be observed during the childhood of the senior citizens but were not observed now. Similarly, climbers that they had not observed in their childhood that are seen in the villages today included *Cuscuta chinensis, Hemidesmus indicus, Combretum indicum* and *Combretum ovalifolium.*

Among grasses, *Apluda mutica, Dactyloctenium aegyptium, Panicum antidotale* and *Chionachne gigantean* were reported to be observed during the childhood of the senior citizens but were not observed now. Similarly, grasses that they had not observed in their childhood that are seen in the villages today included *Echinochloa frumentacea, Panicum repens, Aristida adscensionis, Axonopus sp., Cyperus rotundus, Cenchrus purpureus, Calamus rotang* and *Bambusa vulgaris.*

The senior citizens were also asked to list down the vegetation that was important for people, livestock and wildlife in their opinion. The details and percentage frequency of these different species recorded during the interviews are enlisted in Tables 2.2.13 to 2.2.18.

Table 2.2.13: List of the tree species important for people, livestock and wildlife along with their percentage frequencies as reported by the senior citizens in the project villages

Sr. No.	Local Name	Scientific Name	Percentage Frequency
1	Aal/Rangari	*Morinda tinctoria*	0.35
2	Ambali	*Tamarindus indica*	6.32
3	Ambo	*Mangifera indica*	42.81
4	Amla	*Phyllanthus emblica*	0.35
5	Ankol	*Alangium salvifolium*	0.35
6	Arithi	*Sapindus laurifolius*	0.18
7	Asopalav	*Polyalthia longifolia*	0.18
8	Asundro	*Bauhinia racemosa*	0.18
9	Baval/Desi Baval	*Acacia nilotica*	11.05
10	Bili	*Aegle marmelos*	2.81
11	Biyo	*Pterocarpus marsupium*	0.18
12	Bordi	*Ziziphus glabrata*	25.79
13	Borsalli	*Mimusops elengi*	0.18
14	Champo	*Plumeria alba*	0.53
15	Chandan	*Santalum album*	0.18

16	Charel	*Holoptelea integrifolia*	8.42
17	Chiku	*Manilkara zapota*	14.74
18	Dadam	*Punica granatum*	3.51
19	Dudhlo	*Wrightia tinctoria*	0.35
20	Fanas	*Artocarpus heterophyllus*	0.18
21	Garmalo	*Cassia fistula*	2.46
22	Ghut bordi	*Ziziphus xylopyrus*	0.70
23	Gorad	*Acacia senegal*	2.28
24	Goras Ambli	*Pithecellobium dulce*	0.88
25	Gulmohar	*Delonix regia*	0.18
26	Gundi	*Cordia sinensis*	8.60
27	Gundo	*Cordia dichotoma*	2.98
28	Ingori	*Balanites aegyptiaca*	3.33
29	Jaifal	*Myristica fragrans*	0.18
30	Jambu	*Syzygium salicifolium*	17.72
31	Jamfali	*Psidium guajava*	7.54
32	Kadayo	*Firmiana simplex*	0.35
33	Karanj	*Derris indica*	1.93
34	Karukhdo	*Holarrhena pubescens*	4.21
35	Kel	*Musa acuminata*	5.44
36	Kerda	*Capparis decidua*	3.16
37	Khajuri	*Phoenix slyvestris*	0.18
38	Khakhro/Kesudo	*Butea monosperma*	2.98
39	Kher	*Acacia catechu*	9.65
40	Khijdo	*Prosopis cinererea*	3.16
41	Limbudi	*Citrus limon*	4.56
42	Limdo	*Azadirachta indica*	32.81
43	Markho/Mokh	*Schrebera swietenioides*	0.35
44	Mindhol	*Xeromphis spinosa*	0.18
45	Nariyeli	*Cocos nucifera*	0.88
46	Nilgiri	*Eucalyptus globulus*	0.88
47	Papaya	*Carica papaya*	4.39
48	Pipar	*Ficus rumphii*	1.23
49	Piplo	*Ficus religiosa*	25.79
50	Pragvad	*Ficus microcarpa*	1.58
51	Ram baval	*Parkinsonia aculeata*	0.35
52	Ramfal	*Annona reticulata*	0.35
53	Ravna	*Syzygium cuminii*	7.54
54	Rayan	*Manilkara hexandra*	20.70
55	Saag	*Tectona grandis*	3.51
56	Sadad	*Terminalia crenulata*	0.35
57	Saragvo	*Moringa oleifera*	14.39
58	Saru	*Casuarina equisetifolia*	0.18
59	Savan	*Gmelina arborea*	0.35
60	Setur	*Morus alba*	3.33

61	Shemlo	*Bombax ceiba*	0.70
62	Shikakai	*Acacia concinna*	0.18
63	Shisham	*Dalbergia latifolia*	1.05
64	Sitafali	*Annona squamosa*	11.58
65	Timbarvo	*Diospyros melanoxylon*	26.32
66	Umbh	*Miliusa tomentosa*	0.18
67	Umro	*Ficus glomerata*	17.89
68	Vad	*Ficus benghalensis*	18.95

Table 2.2.14: List of the shrub species important for people, livestock and wildlife along with their percentage frequencies as reported by the senior citizens in the project villages

Sr. No.	Local Name	Scientific Name	Percentage Frequency
1	Aavad/Nani Aavad	*Senna auriculata*	4.56
2	Akdo	*Calotropis procera*	1.40
3	Arani	*Clerodendrum multiflorum*	0.35
4	Ardusi	*Adhatoda vasica*	15.61
5	Bapsi	*Lantana camara*	0.53
6	Chanibor	*Ziziphus nummularia*	21.23
7	Dhaturo	*Datura metel*	0.18
8	Hathaliyo thor	*Opuntia elatior*	0.88
9	Jasud	*Hibiscus rosasinensis*	1.58
10	Kanthari	*Capparis sepiaria*	0.53
11	Kapas	*Gossypium herbaceum*	1.75
12	Karamdi	*Carrisa congesta*	29.82
13	Karen	*Nerium indicum*	1.75
14	Mitho limdo	Murraya koenigii	0.35
15	Nagod	*Vitex negundo*	5.61
16	Rai	Brassica juncea	2.28
17	Ratrani	*Cestrum nocturnum*	0.35
18	Shenvi	*Securinega leucopyrus*	0.53
19	Thor	*Euphorbia nivulia*	21.23

Table 2.2.15: List of the herb species important for people, livestock and wildlife along with their percentage frequencies as reported by the senior citizens in the project villages

Sr. No.	Local Name	Scientific Name	Percentage Frequency
1	Adavi	*Colocasia esculenta*	0.35
2	Aghedo	*Achyranthes aspera*	1.23
3	Ajmo	*Trachyspermum ammi*	6.84
4	Aloevera	*Aloe barbadensis*	0.18
5	Ashwagandha	*Withania somnifera*	1.23
6	Barmasi	*Catharanthus roseus*	2.11
7	Beet	*Beta vulgaris*	0.88
8	Bhangaro/Bhringraj	*Eclipta prostrata*	1.93

9	Bhinda	*Abelmoschus esculentus*	1.75
10	Bhopatri	*Elephantopus scaber*	3.16
11	Bhoringani	*Solanum surattense*	2.28
12	Brahmi	*Bacopa monnieri*	0.53
13	Chameli	*Jasminum officinale*	0.88
14	Chana	*Cicer arietinum*	1.58
15	Choli	*Vigna unguiculata*	1.58
16	Gajar	*Daucus carota*	7.72
17	Galmahendi	*Impatiens balsamina*	0.35
18	Gulab	*Rosa sp.*	4.56
19	Guvar/Gamguvar	*Cyamopsis tetragonoloba*	3.86
20	Ikad	*Sesbania bispinosa*	0.88
21	Jheel	*Indigofera oblongifolia*	0.53
22	Kadiyatu	*Andrographis echioides*	6.67
23	Kali mali ni bhaji	*Chlorophytum tuberosum*	1.93
24	Kalijeeri	*Vernonia anthelmintica*	2.63
25	Kuvadiyo	*Senna tora*	0.18
26	Luni	*Portulaca quadrifida*	1.93
27	Mamejo	*Enicostema hyssopifolium*	3.68
28	Mandvi	*Arachis hypogea*	10.70
29	Marchi	*Capsicum annuum*	1.75
30	Methi	*Trigonella foenum-graecum*	8.77
31	Mung	*Vigna radiata*	4.74
32	Palak	*Spinacia oleracea*	6.49
33	Panafad/Patthartod	*Tridax procumbens*	0.88
34	Panfuti	*Bryophyllum pinnatum*	0.53
35	Phudino	*Mentha viridis*	5.79
36	Raam tulsi	*Ocimum sanctum*	0.18
37	Rajko/Gadabh	*Medicago sativa*	12.81
38	Ringan	*Solanum melongena*	8.42
39	Sadi tulsi	*Ocimum sanctum*	17.19
40	Satavari	*Asparagus racemosus*	0.53
41	Sheshmul/Sahastramul	*Commelina nudiflora*	0.18
42	Sonasali	*Vicoa indica*	0.35
43	Soya bean	*Glycene max*	1.75
44	Surpankho	*Tephrosia purpurea*	0.18
45	Takmariya	*Ocimum americanum*	16.32
46	Tal	*Sesamum indicum*	0.88
47	Tameta	*Solanum lycopersicum*	5.09
48	Tandaljo	*Amaranthus tricolor*	10.18
49	Tilaktulsi	*Coleus scutellarioides*	0.18
50	Tulsi	*Ocimum sanctum*	4.21
51	Turiya	*Luffa acutangula*	0.70
52	Tuver	*Cajanus cajan*	0.18
53	Udad	*Vigna mungo*	1.40

54	Valor	*Lablab purpureus*	0.35

Table 2.2.16: List of the climber species important for people, livestock and wildlife along with their percentage frequencies as reported by the senior citizens in the project villages

Sr. No.	Local Name	Scientific Name	Percentage Frequency
1	Dudhali	*Hemidesmus indicus*	2.28
2	Galka	*Luffa cylindrica*	0.88
3	Galo	*Tinospora cordifolia*	5.26
4	Lasan vel	*Mansoa alliacea*	0.18
5	Mari	*Piper nigrum*	0.35
6	Marvelo	*Combretum ovalifolium*	0.88

Table 2.2.17: List of the grass species important for people, livestock and wildlife along with their percentage frequencies as reported by the senior citizens in the project villages

Sr. No.	Local Name	Scientific Name	Percentage Frequency
1	American makai	*Zea mays*	0.18
2	Bajari	*Pennisetum glaucum*	23.68
3	Banti	*Echinochloa frumentacea*	9.30
4	Baru	*Sorghum halapense*	9.12
5	Dangar/Kamod	*Oryza sativa*	13.51
6	Dharu	*Dactyloctenium aegyptium*	0.35
7	Dhrokad	*Cynodon dactylon*	9.65
8	Foflu	*Eragrostis sp.*	0.35
9	Ghabajariyu	*Typha eliphantina*	7.37
10	Ghau	*Triticum vulgare*	0.35
11	Jhinjhvo	*Alloteropsis cimicina*	25.44
12	Jowar	*Sorghum bicolor*	38.25
13	Kang	*Setaria italica*	15.96
14	Khariyu	*Dinebra retroflexa*	0.35
15	Makai	*Zea mays*	37.54
16	Marvo	*Dicanthium caricosum*	1.05
17	Ratad	*Themeda cymbaria*	9.12
18	Saiyo	*Fimbristylis miliacea*	0.18
19	Samo	*Echinochloa colonum*	18.60
20	Shaniyar	*Sehima nervosum*	4.04
21	Sherdi	*Saccharum officinarum*	15.09
22	Vadhiyu	*Tragus mongolorum*	7.72

Table 2.2.18: List of the unidentified species important for people, livestock and wildlife along with their percentage frequencies as reported by the senior citizens in the project villages

Sr. No.	Local Name	Percentage Frequency
1	Amod Tamod	0.18
2	Baragali	4.21
3	Bhimojado	0.35
4	Darabdi	0.18
5	Desi ghaas	0.88
6	Ghaas	3.51
7	Kagesh	0.18
8	Kundi	0.35
9	Malyo	0.18
10	Pandaliyu ghaas	4.04
11	Suvajadi	0.35

Around 90% respondents were aware that some plants are invasive alien species (Figure 2.2.7).

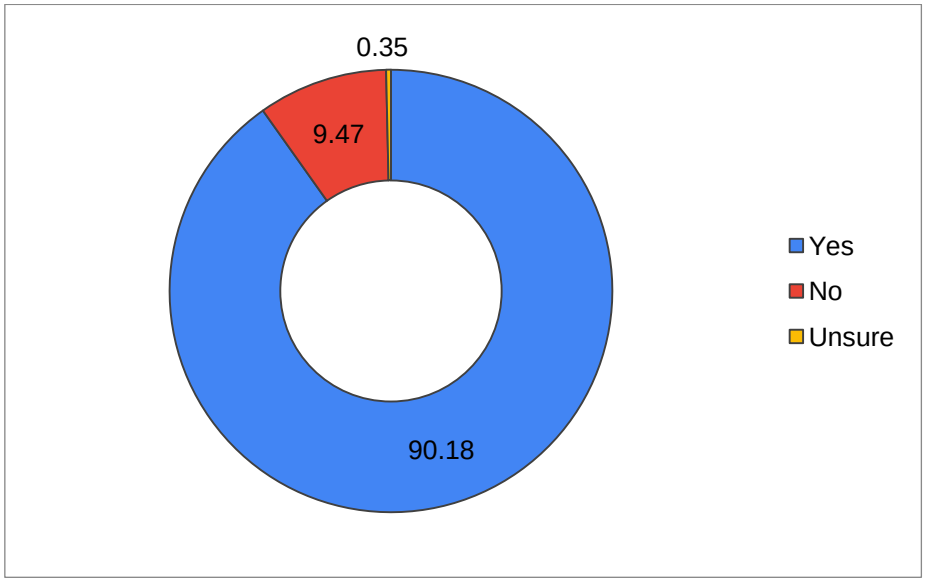

Figure 2.2.7: Percentage representation of awareness among senior citizen respondents regarding some plants being invasive alien species

The senior citizens seemed well aware about the plant species that are considered invasive and alien. Majority of these respondents opined that *Parthenium hysterophorus* and *Senna uniflora* were invasive alien species. However, *Senna tora* was the least reported as an invasive alien species (Figure 2.2.8).

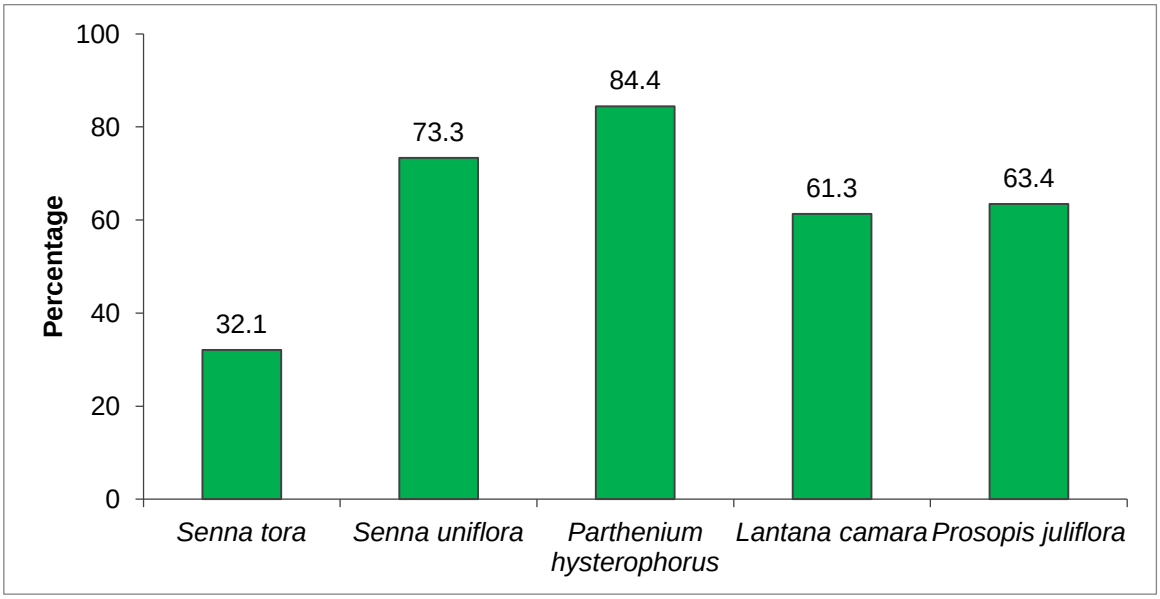

Figure 2.2.8: Percentage representation of opinions of senior citizens regarding invasive alien species in the project villages

54.7% respondents had observed livestock and/or wild animals feeding on plant parts of the invasive alien species. Among these animals, livestock showed a higher frequency as compared to wild animals with buffalo, goat and cattle being the most frequently reported animals (Figure 2.2.9).

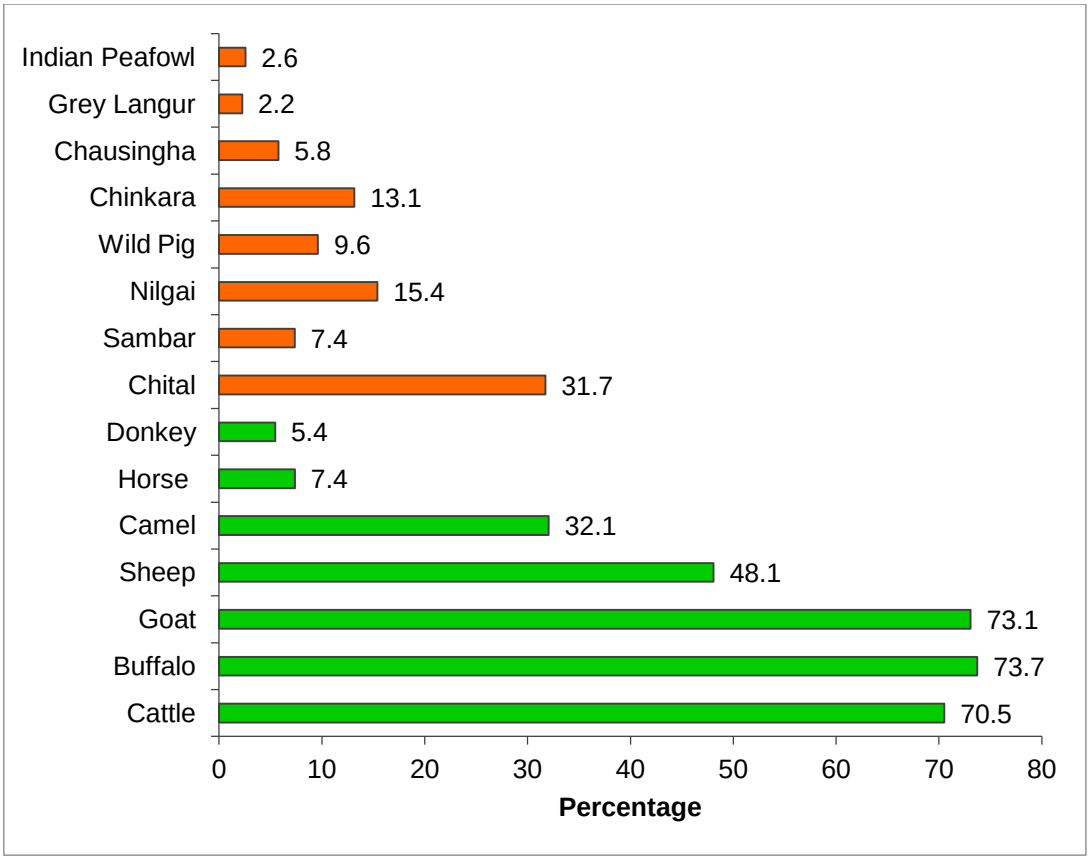

Figure 2.2.9: Percentage representation of different animals feeding on plant parts of invasive alien species as reported by senior citizens in the project villages

The senior citizens from the project villages were also interviewed for gathering information on ethnobotanical uses of various plants in their villages. The details of the plants along with their medicinal uses are listed in Table 2.2.19.

Table 2.2.19: Ethnobotanical uses of various plants in the project villages

Sr. No.	Local Name	Scientific Name	Medicinal uses at the project villages
1	Limdo	*Azadirachta indica*	Used for curing skin diseases, fever and diabetes. Neem leaves and twigs are spread on the bed or tied to the cradle to treat chicken pox among kids. It is also used as *Datun*. The Neem smoke is also used to void away mosquitoes.
2	Aaval	*Senna auriculata*	The paste of the leaves is used to treat muscular inflammations.
3	Aghedo	*Achyranthes aspera*	Used as *Datun,* helps in strengthening the jaw muscles
4	Borsalli	*Mimusops elengi*	Twigs used as *Datun.*
5	Bhoringani	*Solanum surattense*	The roots are crushed and mixed with honey to treat cough.
6	Harde	*Terminalia chebula*	Important to maintain good health. Fruits are used as a laxative.
7	Kunvarpathu	*Aloe barbadensis*	Used to treat constipation. Gel also used as a cosmetic for skin and hair.
8	Viklo	*Maytenus emarginata*	Used to cure jaundice.
9	Mindhol	*Xeromphis spinosa*	Used as a vermicide and in treating dysentery. The paste is applied at the site of snake bite.
10	Bhangro	*Eclipta prostrata*	Used for cosmetic purposes for hair.
11	Takmariya	*Ocimum americanum*	The leaves are used to treat dysentery.
12	Piplo	*Ficus religiosa*	The bark of the tree is mixed in water and applied on the skin to cure dermatitis.
13	Nilgiri	*Eucalyptus globulus*	The essential oil is used to treat cold, fever and pulmonary disorders.
14	Tulsi	*Ocimum sanctum*	Used to cure cough, cold and fever.
15	Ghabajariyu	*Typha eliphantina*	Used to treat physical injuries.

16	Gokhru	*Tribulus terrestris*	Used in treating kidney stones.
17	Aadu	*Zingiber officinale*	Used to treat cough and cold.
18	Nagod	*Vitex negundo*	The leaves are boiled in water and applied to treat headache.
19	Daadam	*Punica granatum*	The fruits are used to treat diarrhoea.
20	Bili	*Aegle marmelos*	Used to make sherbets which promote hydration. Also used to treat dysentery. The leaf paste is applied to the eye waterlines to treat eye diseases.
21	Mardasing, Antedi	*Helicteres isora*	Used to treat dysentery.
22	Mamejo	*Enicostema hyssopifolium*	Used as an anti-diabetic.
23	Garmalo	*Cassia fistula*	Used to treat gastro-intestinal disorders.
24	Galo	*Tinospora cordifolia*	Used to cure gastro-intestinal disorders, diabetes, fever and body ache.
25	Karanj	*Derris indica*	Karanj seed oil is used to cure skin diseases and arthritis. The twigs are used as *Datun.*
26	Kadu Kadiyatu	*Haplanthus verticillatus*	Used to cure diabetes and fever.
27	Vad	*Ficus benghalensis*	The adventitious roots are used as *Datun.*
28	Haldar	*Curcuma longa*	Acts as a blood purifier. The powdered form can be applied to an injury to stop oozing of blood. The paste made from dried powder is applied to treat muscular pain. Turmeric powder mixed in milk is used to cure cough and cold.
29	Sarpgandha	*Rauvolfia serpentina*	The juice made from the leaves is used to treat posterior capsular opacification.
30	Eranda	*Ricinus communis*	The leaves are used to treat fever.
31	Papaya	*Carica papaya*	The leaves are used to treat dengue and constipation.

32	Ardusi	*Adhatoda vasica*	Used to cure cough, tuberculosis and leprosy.
33	Ingori	*Balanites aegyptiaca*	The fruits are used to cure stomach aches in children.
34	Amla	*Phyllanthus emblica*	Used to make pickles and sherbet. Rich source of Vitamin C.
35	Bijoru	*Citrus medica*	The fruit is used to cure kidney stones.
36	Parijatak	*Nyctanthes arbortristis*	Used to cure stomach ache, head ache and leg pain.
37	Satavari	*Asparagus racemosus*	Used as a blood purifier.
38	Saragvo	*Moringa oleifera*	The fruits help in strengthening bones. The concoction of the roots helps in curing kidney stones.
39	Bhopatri	*Elephantopus scaber*	Used in curing indigestion in children.
40	Dhaturo	*Datura metel*	Pods are used to cure asthma.
41	Ajmo	*Trachyspermum ammi*	Used to treat cough.
42	Aritha	*Sapindus emarginatus*	Used in washing hair.
43	Marvo	*Dicanthium caricosum*	Used to cure ear ache.
44	Rukhdo	*Adansonia digitata*	The concoction of the bark is used in treating fever.
45	Methi	*Trigonella foenum-graecum*	It is a highly beneficial plant. The seeds are boiled in water, the consumption of this water helps in curing diabetes.
46	Gaajar	*Daucus carota*	It is good for the eyes.
47	Paalak	*Spinacia oleracea*	The leaves are rich sources of Vitamin A and fibre, which are essential for maintaining good health.
48	Kalijeeri	*Vernonia anthelmintica*	Used for treating diabetes, also used as a vermicide.
49	Limbudi	*Citrus limon*	The fruits boost immunity.
50	Arni	*Clerodendrum multiflorum*	The fragrance of the flowers helps in curing cold and headache. The leaves are used in curing haemorrhoids, piles and constipation.
51	Kerda	*Capparis decidua*	Used in curing cough and cold.
52	Bahedo	*Terminalia bellirica*	Used in curing cough. The paste is used to cure skin irritation.

3.3 Understanding the farming practices and shifts thereof

The data pertaining to farming practices in the project villages was obtained by conducting questionnaire surveys with farmers to understand their perceptions. A total of 647 respondents could be interviewed in 18 villages (Table 3.1).

Table 3.1: Number of responses per project village to understand the farming practices

Sr. No.	Name of the village	Number of responses
1	Amrapur	11
2	Amrutvel	26
3	Bhalchhel	39
4	Chitravad	49
5	Chitrod	40
6	Devgam	40
7	Haripur	38
8	Hiranvel	37
9	Jalandhar	33
10	Jashapur	36
11	Kenedipur	34
12	Ladudi	34
13	Mandor	36
14	Mandorna	39
15	Moruka	45
16	Sangodra	35
17	Vadla	36
18	Virpur	39
	Total	647

Most of the respondents were men (85.7%) (Figure 3.1). Around 1.6% respondents did not want to share their gender during the interviews and 10 responses did not mention the gender.

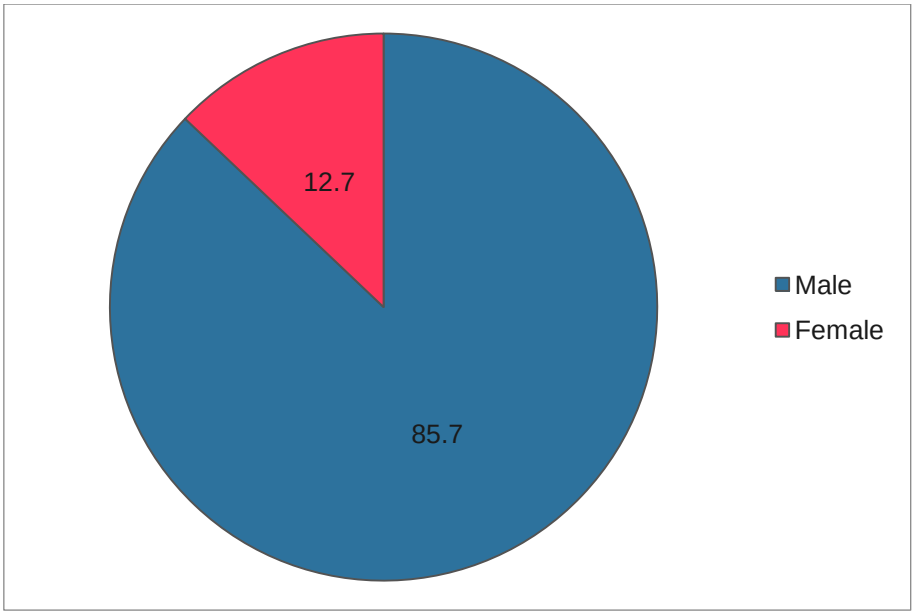

Figure 3.1: Percentage representation of the gender of farmer respondents in the project villages

627 responses collected by the *Gir Mitras* mentioned the age of the farmers. The majority (n=172) belonged to the age class of 41-50 years (Figure 3.2).

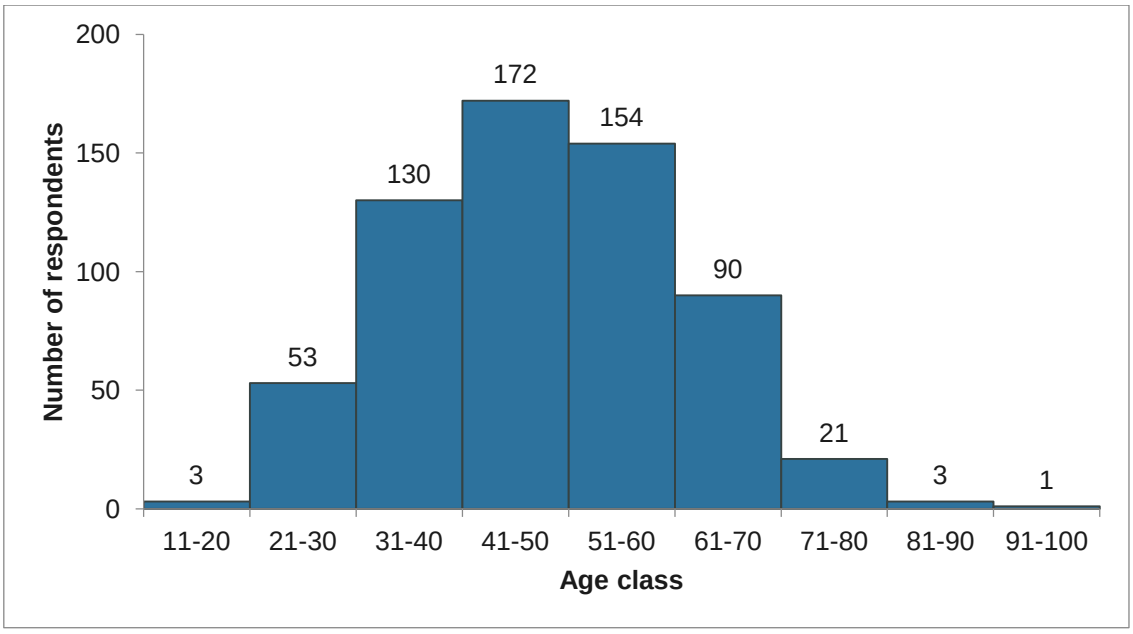

Figure 3.2: Age Class wise number of farmer respondents in the project villages

The majority of the respondents felt that there was a change in the cropping patterns in the past 50 years (Figure 3.3). 25 respondents did not provide any response to the question.

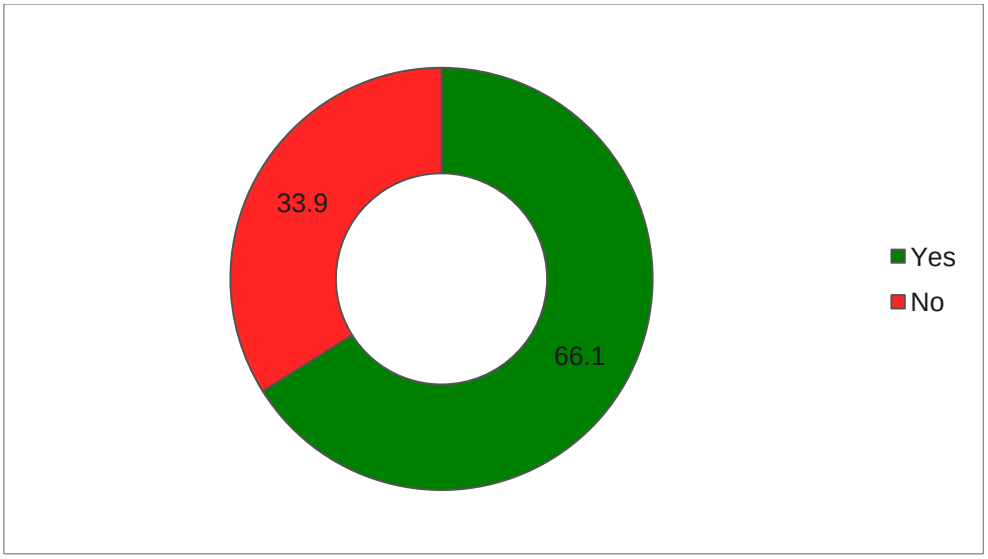

Figure 3.3: Percentage representation of farmers' opinions on change in the cropping patterns in the last 50 years in the project villages

44.7% of the respondents rated the change in cropping pattern as neutral, while 40.8% rated the change as positive (Figure 3.4)

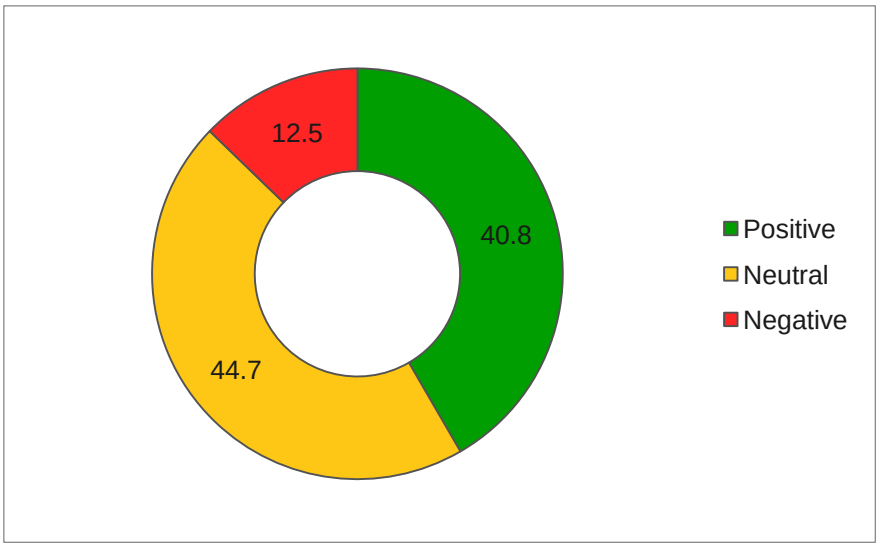

Figure 3.4: Percentage representation of farmers' ratings regarding the change in the cropping pattern in the project villages

Moong, Groundnut and Wheat were the most frequently reported crops that are being cultivated since the last 50 years in the project villages (Figure 3.5). Tree plantations seem to be a recent phenomenon with the least percentage frequency in the responses. A small fraction of farmers mentioned Rice, Black sesame, Sandalwood, Cumin and Sunflower as crops that are being cultivated regularly in the past 50 years.

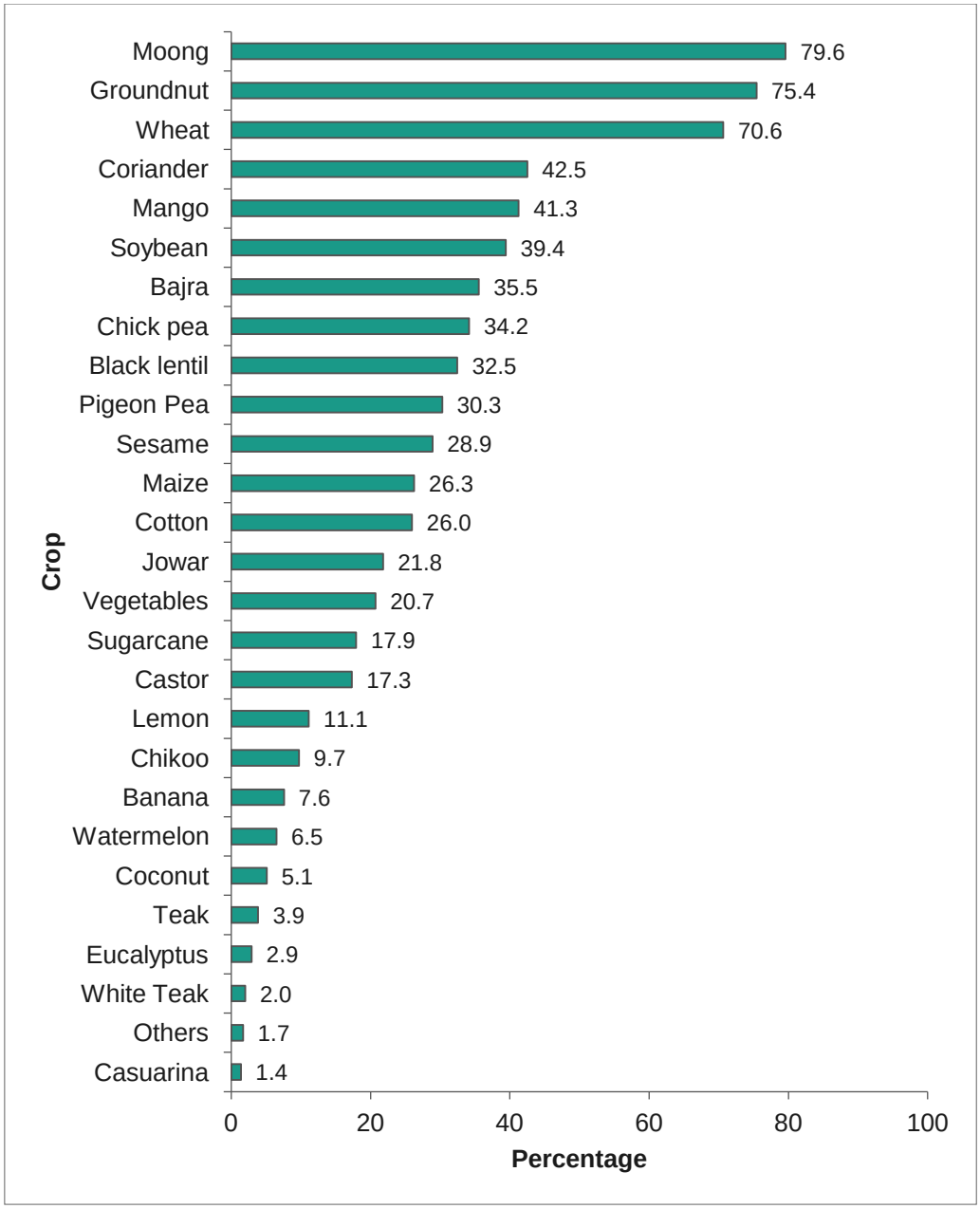

Figure 3.5: Percentage representation of the different crops reported to be regularly cultivated since the past 50 years in the project villages

The crops that were cultivated earlier and discontinued now in the opinion of the farmers included Cotton (15.1%), Black lentil (13.9%), Jowar (8.2%), Sugarcane (8.2%), Castor (7.7%), Groundnut (6.3%), Coriander (5.1%), Pigeon pea (3.2%), Bajra (2.0%), Maize (1.7%), Moong (1.7%), Teak (1.5%), Rice (1.1%), Chick pea (0.8%), Eucalyptus (0.8%), Sesame (0.8%), Casuarina (0.6%), Barley (0.6%), White Teak (0.6%), Wheat (0.6%), Chikoo (0.5%), Jeera (0.5%), Banana (0.3%), Gumguvar (0.3%), Lemon (0.2%) and Watermelon (0.2%).

The major reason for discontinuation of cultivation of these crops was that they were less lucrative (49.4%) (Figure 3.6).

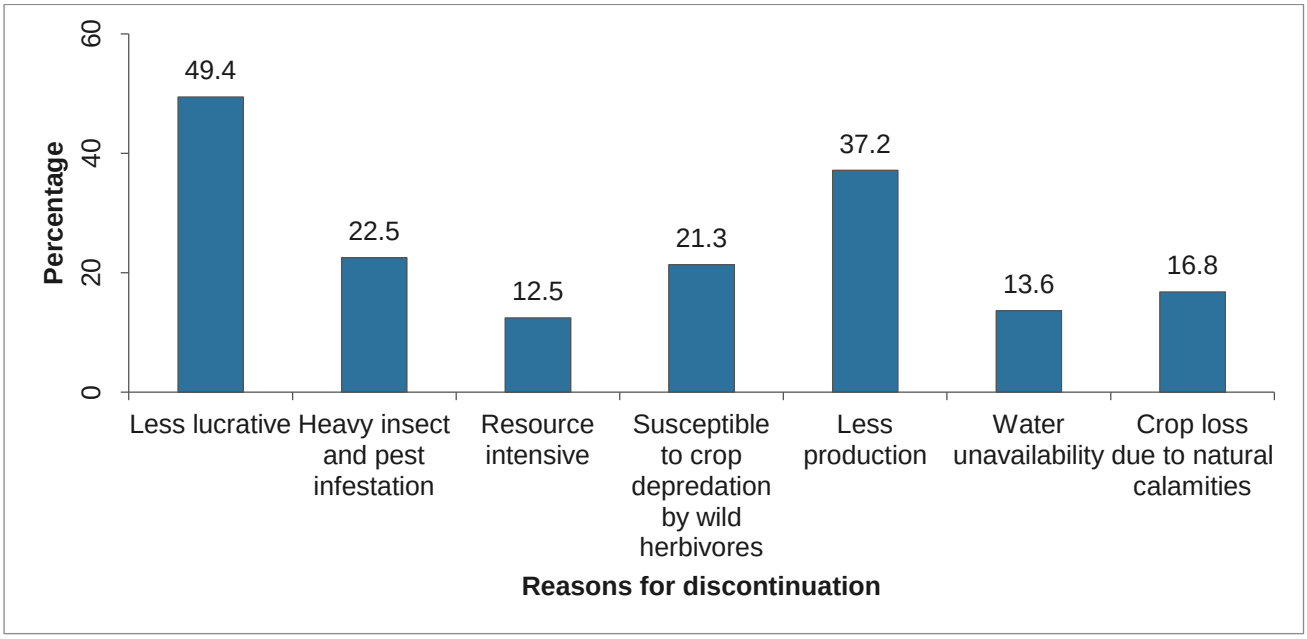

Figure 3.6: Percentage representation of the reasons for discontinuing the cultivation of some crops in the project villages

As per the respondents, the advantages of the current cropping pattern include cost effectiveness (54.2%), less damage by insect pests (11.7%), not water intensive (21.3%), has desired production in a shorter time span (42.7%), crop insurance can be availed (17.4%), retains soil fertility (21.6%) and requires less labour (2.9%) (Figure 3.7).

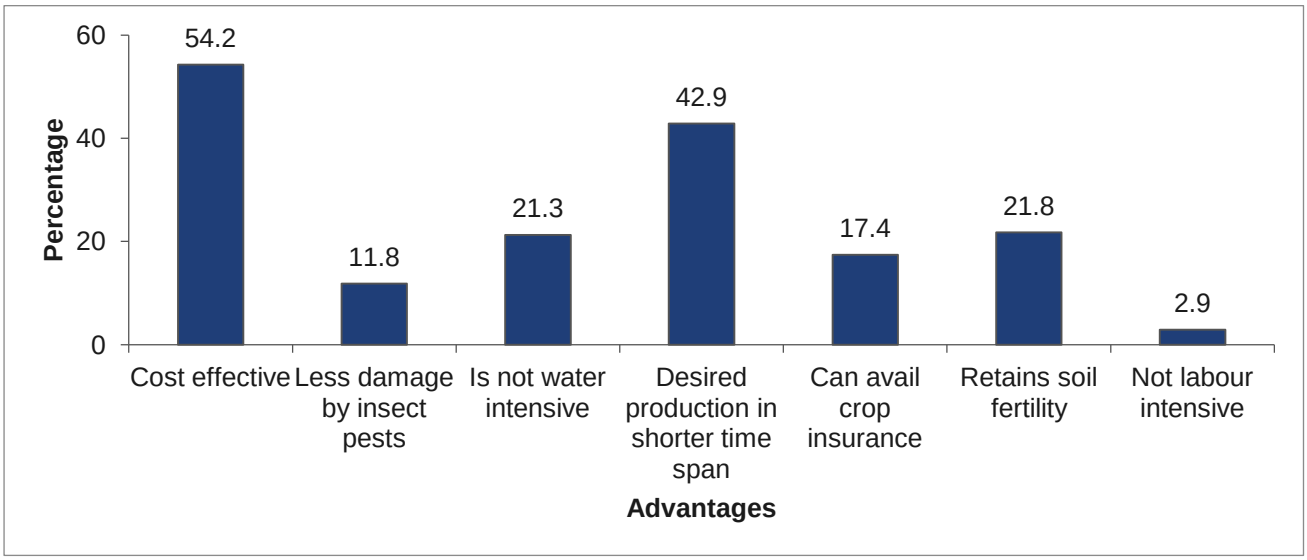

Figure 3.7: Percentage representation of the advantages of the current cropping pattern as per farmers in the project villages

The major disadvantage of the current cropping pattern as per the respondents was reduction of soil fertility (62.8%) (Figure 3.8).

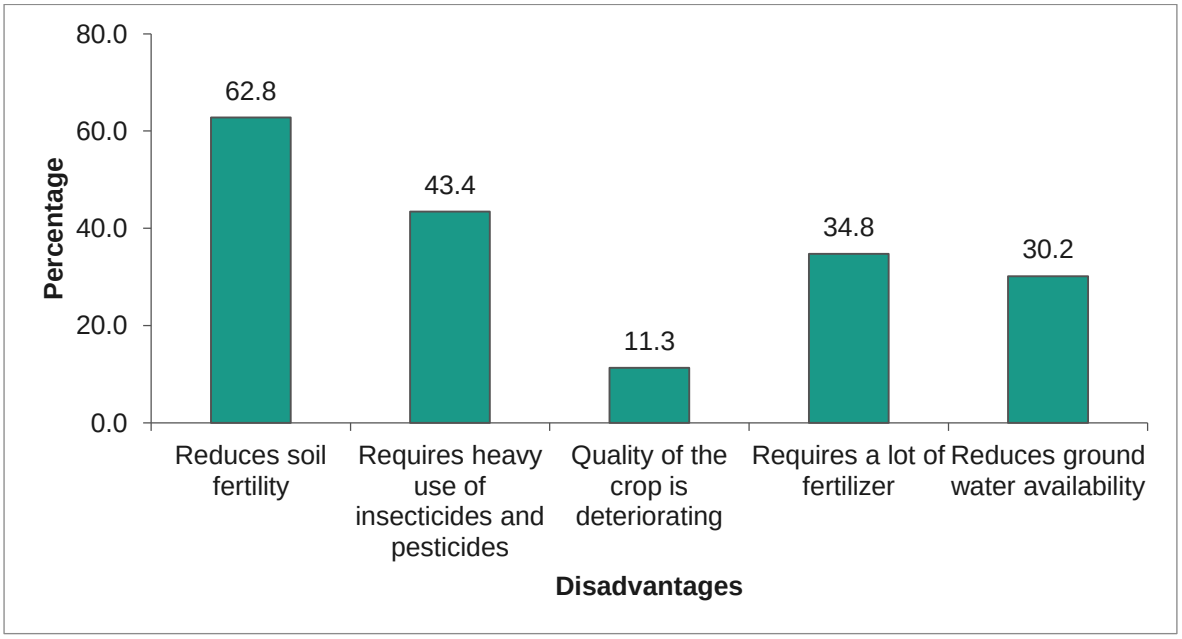

Figure 3.8: Percentage representation of the disadvantages of the current cropping pattern as per farmers in the project villages

Majority of the respondents believed that there was a change in the fertilizers used in the past 50 years (Figure 3.9).

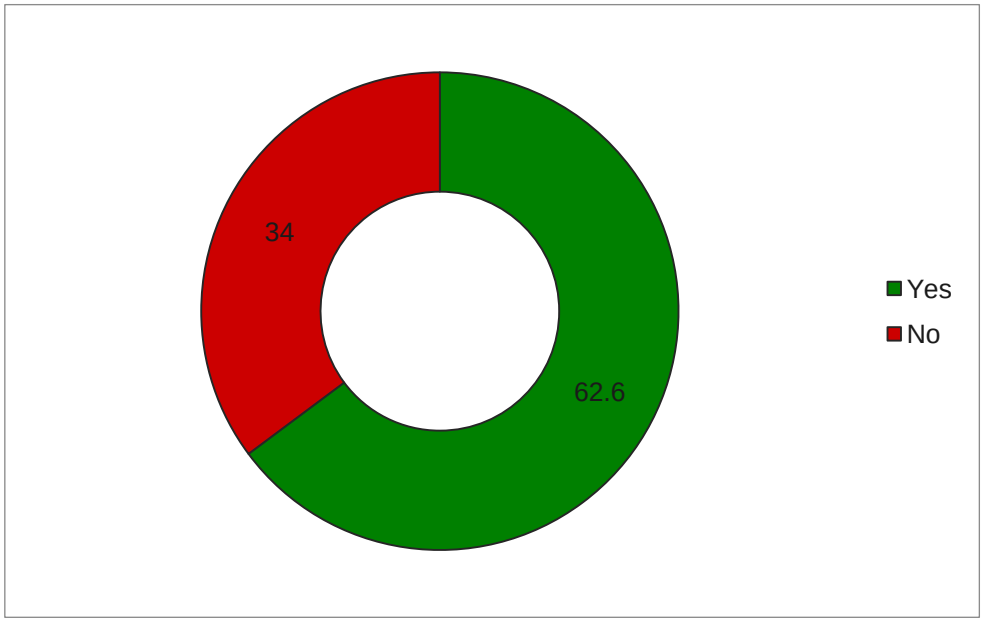

Figure 3.9: Percentage representation of farmer opinions regarding the change in fertilizers used in the past 50 years at the project villages

Majority of the farmers remained neutral regarding the change in the use of fertilizers, while 36% of them felt that this change was positive (Figure 3.10)

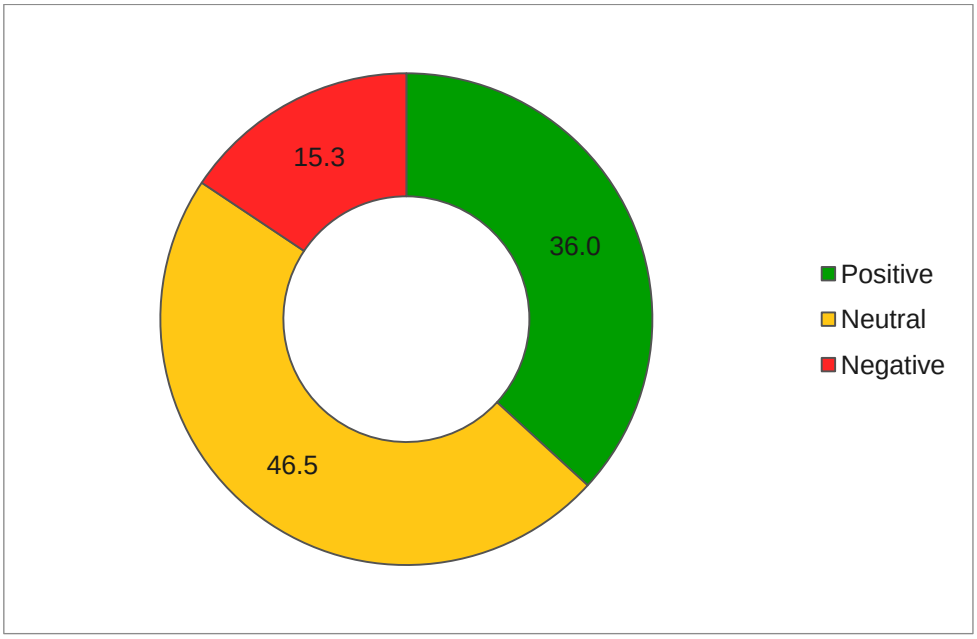

Figure 3.10: Percentage representation of farmers' ratings regarding the change in the fertilizers used in the project villages

A lot of farmers mentioned that chemical fertilizers such as ammonia, urea, DAP, NPK, Potash, Sulphur, etc. were used earlier. Half of the farmers also mentioned that natural fertilizers processed from cow dung, castor plants and other organic matter were used earlier. A small fraction mentioned that no fertilizers were used in the past in their farmlands (Figure 3.11).

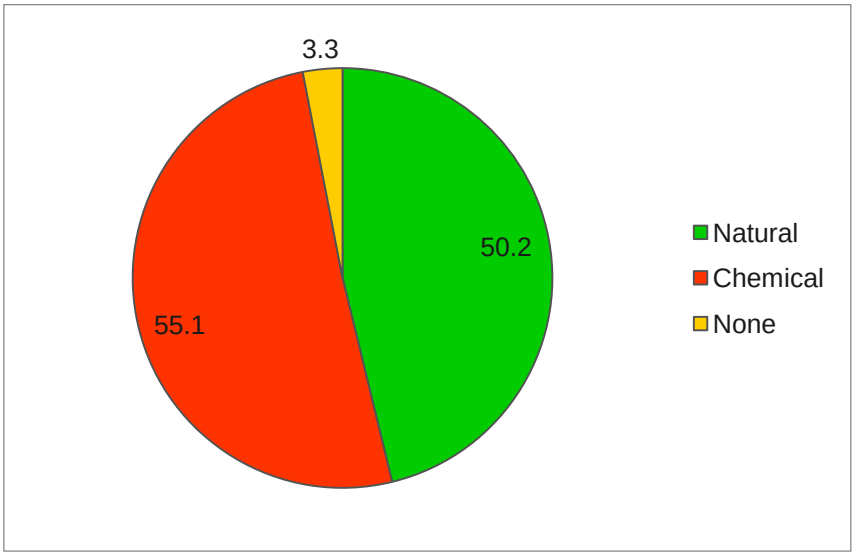

Figure 3.11: Percentage representation of fertilizers used previously in the project villages

The most frequently reported reasons for the discontinuation of these fertilizers included difficulty in availability, less productive, expensive and lengthy process and that they were not suitable for all kinds of crops (Figure 3.12).

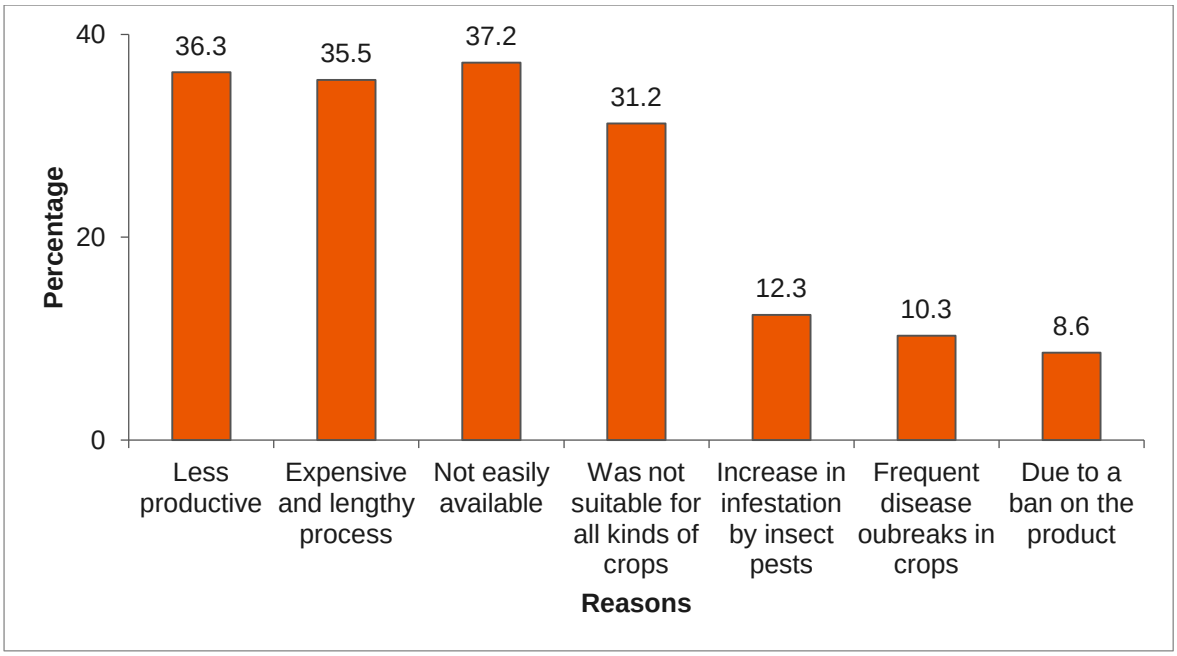

Figure 3.12: Percentage representation of the reasons for discontinuing the use of some fertilizers in the project villages

The primary advantage of the current fertilizers used was easy availability (Figure 3.13).

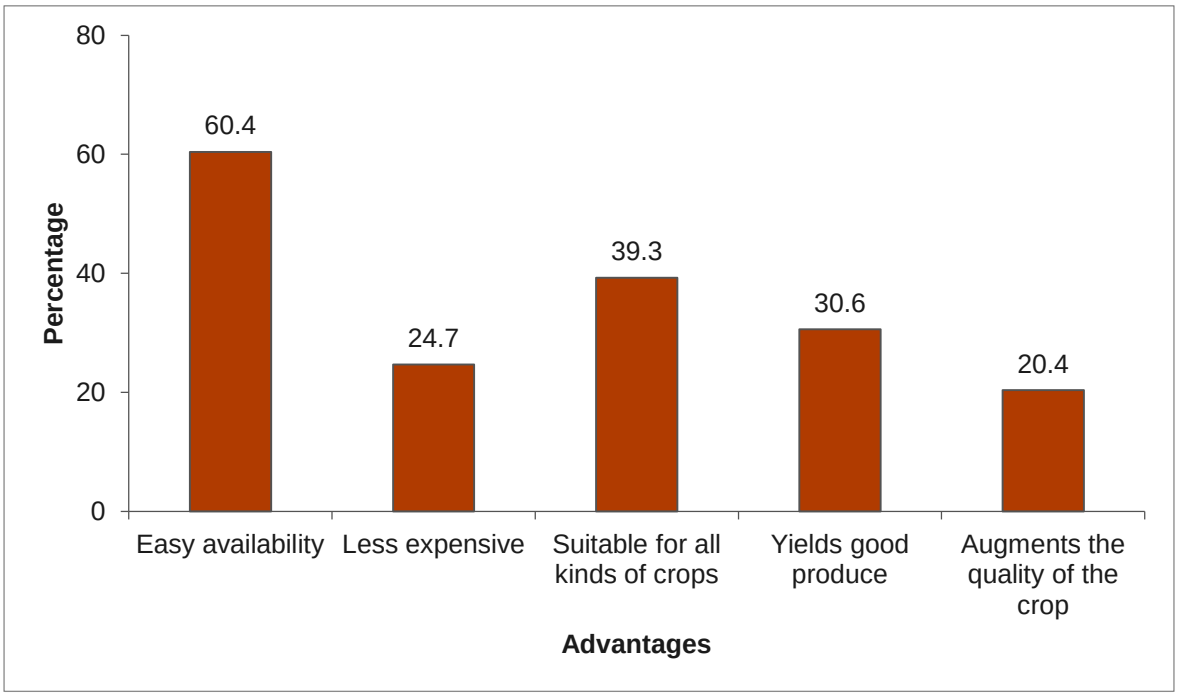

Figure 3.13: Percentage representation of the advantages of the current fertilizers used as per farmers in the project villages

The reported disadvantages of the current fertilizers included reduction of soil fertility (55.9%), expensive (40%), affects season specific cultivation of crops (35.3%) and public health hazard (28.6%) (Figure 3.14).

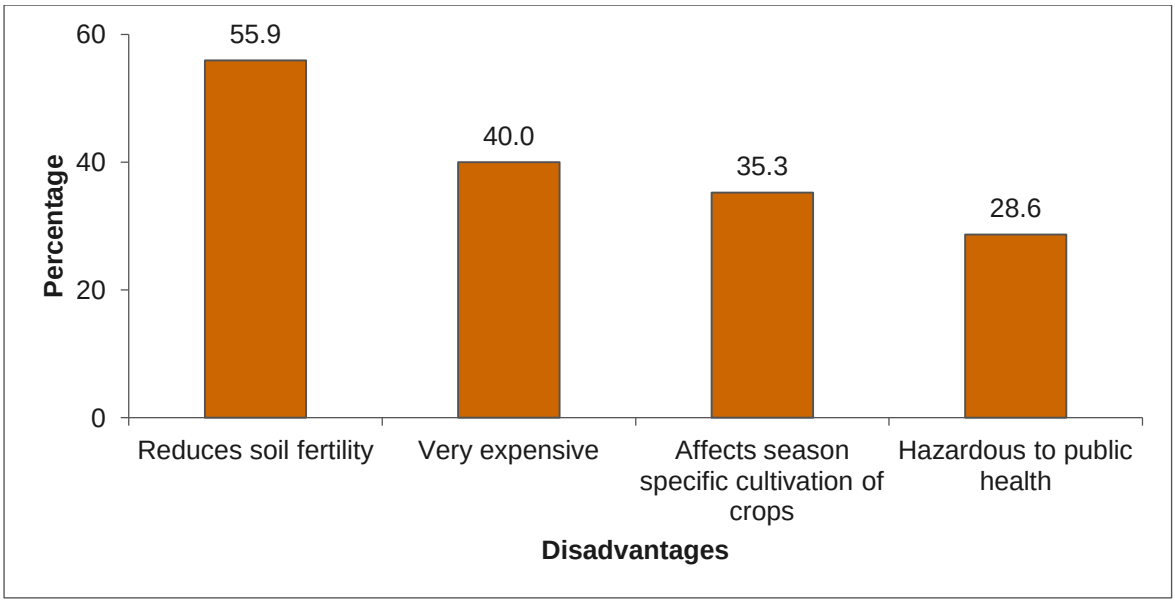

Figure 3.14: Percentage representation of the disadvantages of the current fertilizers as per farmers in the project villages

Larvae of insects, Groundnut white grub and locusts were the most frequently reported insect pests that have been observed recently (Table 3.2). Ants were the least reported as insect pests.

Table 3.2: Insect pests observed recently which were unheard of 20 years ago as reported by the respondents in the project villages

Sr. No.	Local Name	Common Name	Scientific Name	Responses (%)
1	Eeyal	Larva	Multiple genera eg. *Helicoverpa armigera, Spodoptera litura*	23.5
2	Munda	Groundnut White grub	*Holotrichia consanguinea*	22.6
3	Teed	Locust	*Schistocerca gregaria, Locusta migratoria*	22.3
4	Thrips	Thrips	*Thrips tabaci*	16.4
5	Sonmakh	Fruitfly	*Bactrocera dorsalis*	7.7
6	Madhyo	Mango hopper	*Amritodus atkinsoni*	7.4
7	Masi	Fly (Whitefly)	*Bemisia tabaci*	5.0

8	Fudee	Moth	Multiple genera	5.0
9	Fug	Fungus	Multiple genera	4.6
10	Udhai	Termite/ Wheat termite	*Microtermes obesi*	4.0
11	Susiyo	Aphid/Jassid	*Aphis* spp., *Amrasca* spp.	4.0
12	Daliya	Beetles	Multiple genera	3.4
13	Safed Makhi	Whitefly	*Bemisia tabaci*	2.2
14	Gulabi Iyal	Pink bollworm	*Pectinophora gossypiella*	1.5
15	Suko			1.5
16	Ratad	Leaf Spot in cotton	*Alternaria spp.*	1.5
17	Lilo susiyo	Aphid/Jassid	*Aphis gosypii, Amrasca bigutulla bigutulla*	1.2
18	Popti	Jassid	*Amrasca bigutulla bigutulla*	1.2
19	Safed iyal	White coloured larva		0.6
20	Tarkidi			0.6
21	Laal Iyal	Red caterpillar (Hairy caterpillar)	*Amsacta albistriga*	0.3
22	Pila colour ni iyal	Larva	Multiple genera	0.3
23	Sigada cadillac iyal	Larva		0.3
24	Ghoda iyal	Semilooper	*Achaea janata*	0.3
25	Moromasi/Molomasi	Aphid	*Aphis* spp.	0.3
26	Safed Fudee	White moth	Multiple genera	0.3
27	Kidi	Ant	Multiple genera	0.3

Relatively high number of respondents reported locusts to be major pests 50 years ago (Table 3.3). However, Pink Bollworm, and other sucking insect pests *viz.* Aphids and Thrips did not occur in the dataset regarding insect pests occurring 50 years ago, indicating that these pests are relatively recent.

Table 3.3: Insect pests observed 50 years ago as reported by the respondents in the project villages

Sr. No.	Local Name	Common Name	Scientific Name	Responses (%)
1	Eeyal	Larva	Multiple genera eg. *Helicoverpa armigera, Spodoptera litura*	53.1
2	Munda	Groundnut White grub	*Holotrichia consanguinea*	23.6
3	Teed	Locust	*Schistocerca gregaria, Locusta migratoria*	18.1
4	Fug	Fungus	Multiple genera	11.8
5	Udhai	Termite/ Wheat termite	*Microtermes obesi*	6.6
6	Masi	Fly (Whitefly)	*Bemisia tabaci*	3.5
7	Suko			3.1
8	Ratad	Leaf Spot in cotton	*Alternaria spp.*	2.8
9	Fudee	Moth	Multiple genera	1.4
10	Daliya	Beetles	Multiple genera	1.4
11	Sonmakh/Falmakhi	Fruitfly	*Bactrocera dorsalis*	1.4
12	Safed iyal	White coloured larva	Multiple genera	1.0
13	Madhyo	Mango hopper	*Amritodus atkinsoni*	1.0
14	Popti	Jassid	*Amrasca bigutulla bigutulla*	1.0
15	Laal Iyal	Red caterpillar (Hairy caterpillar)	*Amsacta albistriga*	0.7
16	Kali Iyal	Black hairy caterpillar	*Spilosoma obliqua*	0.3
17	Lili iyal	Pod borer (Heliothis)	*Helicoverpa armigera*	0.3
18	Sandhi iyal	Common larva	*Multiple genera*	0.3
19	Ghoda iyal	Semilooper	*Achaea janata*	0.3
20	Tarkidi			0.3
21	Kidi	Ants		0.3

Majority of the respondents believed that there was a change in the use of pesticides in the past 50 years (Figure 3.15).

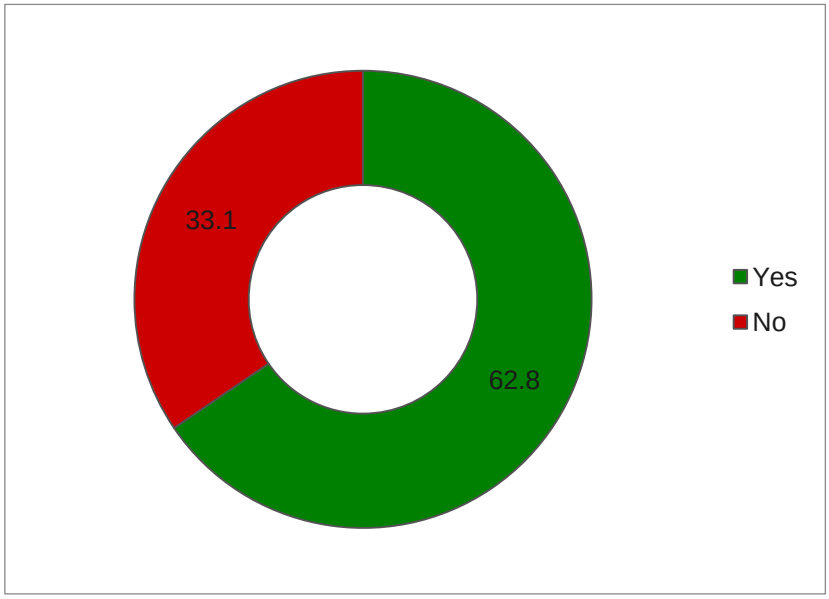

Figure 3.15: Percentage representation of farmer opinions regarding the change in the use of pesticides in the past 50 years at the project villages

Majority of the farmers remained neutral regarding the change in the use of pesticides, while 35.2% of them felt that this change was positive (Figure 3.16)

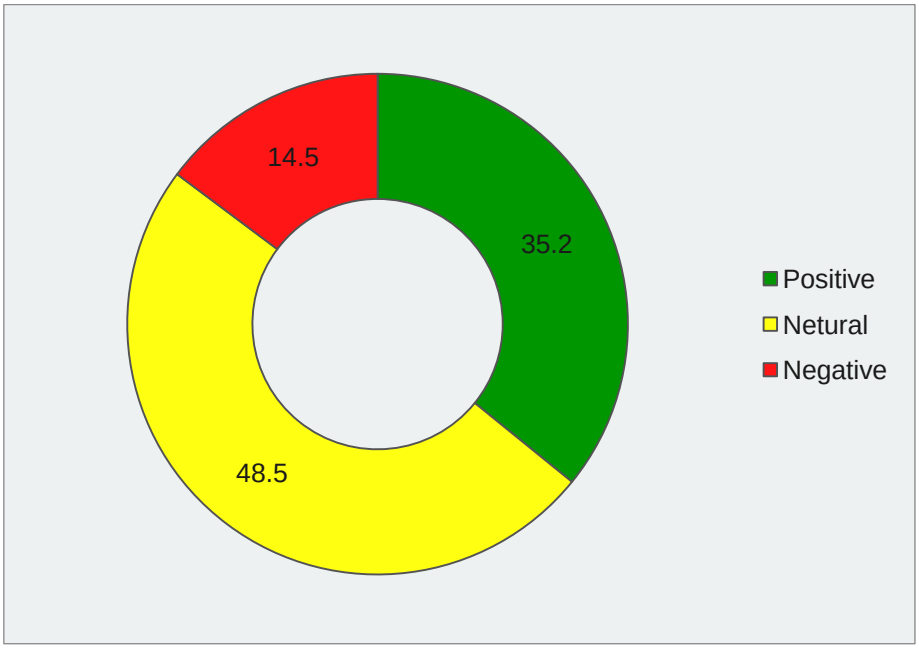

Figure 3.16: Percentage representation of farmers' ratings regarding the change in the pesticides used in the project villages

Rogor was reported as the most frequently reported pesticide to be used earlier (Table 3.4). Some farmers (6.9%) mentioned that no pesticides were used previously, but have to be used now.

Table 3.4: Pesticides previously used in the project villages along with their percentage frequency

Class of pesticide	Name	Percentage Frequency
Insecticide	Rogor	43.5
	Coragen	9.3
	Monochrotophos	8.8
	Biopesticide/Organic	3.2
	AK-56	2.3
	Phorate	2.3
	Trishul	1.9
	Bio Dose	1.9
	Slayer	1.4
	Tracer	1.4
	Acetamiprid	0.9
	Avant	0.9
	BASF	0.9
	Cymbush	0.9
	Dicofol	0.5
	Dichlorvos	0.5
	Phorate 10g	0.5
	Indoxacarb	0.5
	Quinalphos	0.5
	Monostar	0.5
	OCP	0.5
	Cyazypyr	0.5
	Triazophos	0.5
	WSC	0.5
	AK-47	0.5
	Cyper	0.5
Fungicide	Contaf	1.9
Herbicide	Targa super	1.4
	Pendimethalin	0.5
	Stomp	0.5
N/A	None	6.9

The most frequently reported reasons for the discontinuation of these pesticides included non suitability for all crops, health hazard and being expensive (Figure 3.17).

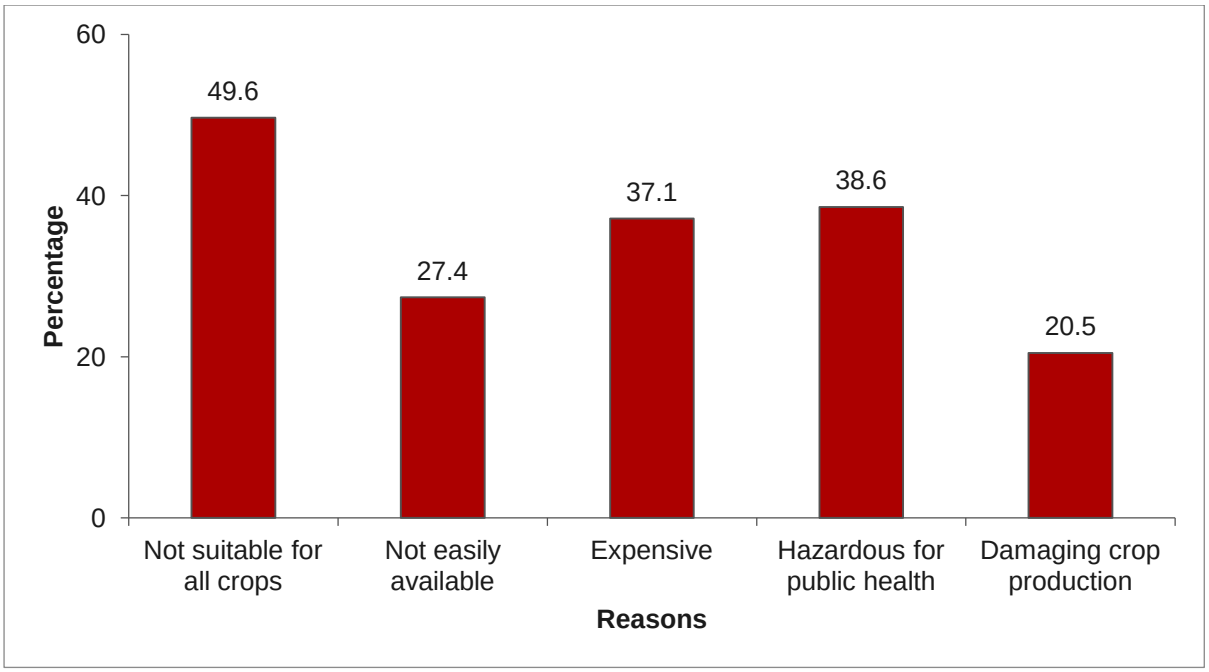

Figure 3.17: Percentage representation of the reasons for discontinuing the use of some pesticides in the project villages

The primary advantage of the current pesticides used was easy availability (Figure 3.18).

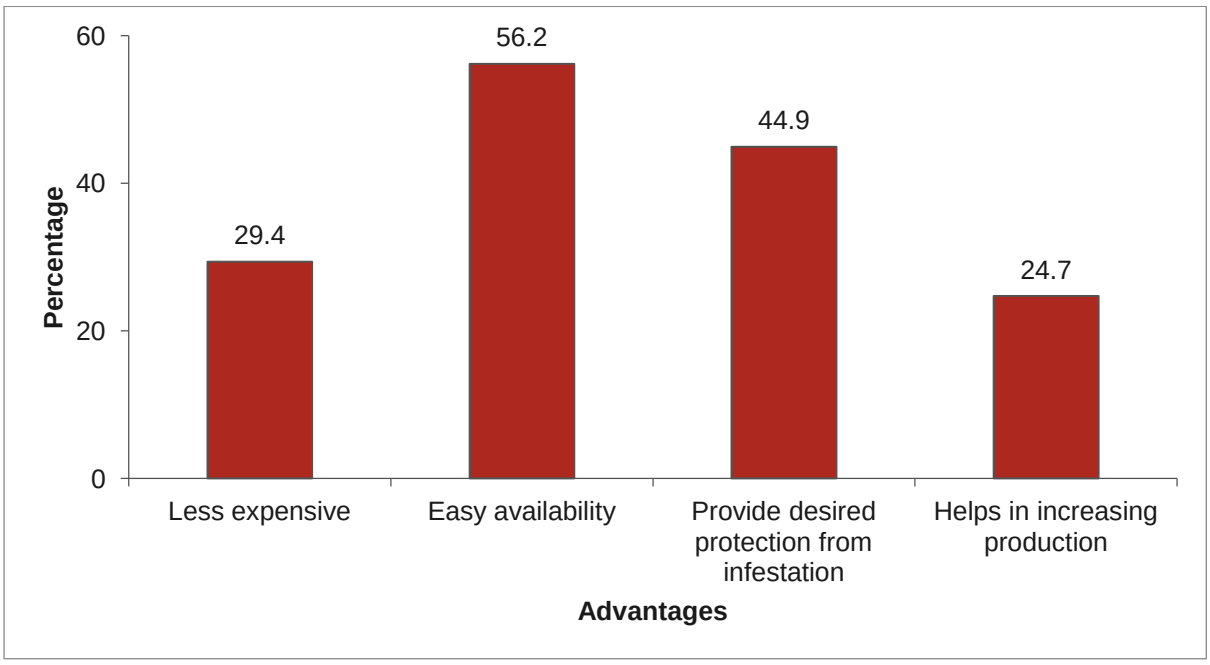

Figure 3.18: Percentage representation of the advantages of the current pesticides used as per farmers in the project villages

The frequently reported disadvantages of the current pesticides included public health hazard (57%) and reduction of soil fertility (45.5%) (Figure 3.19).

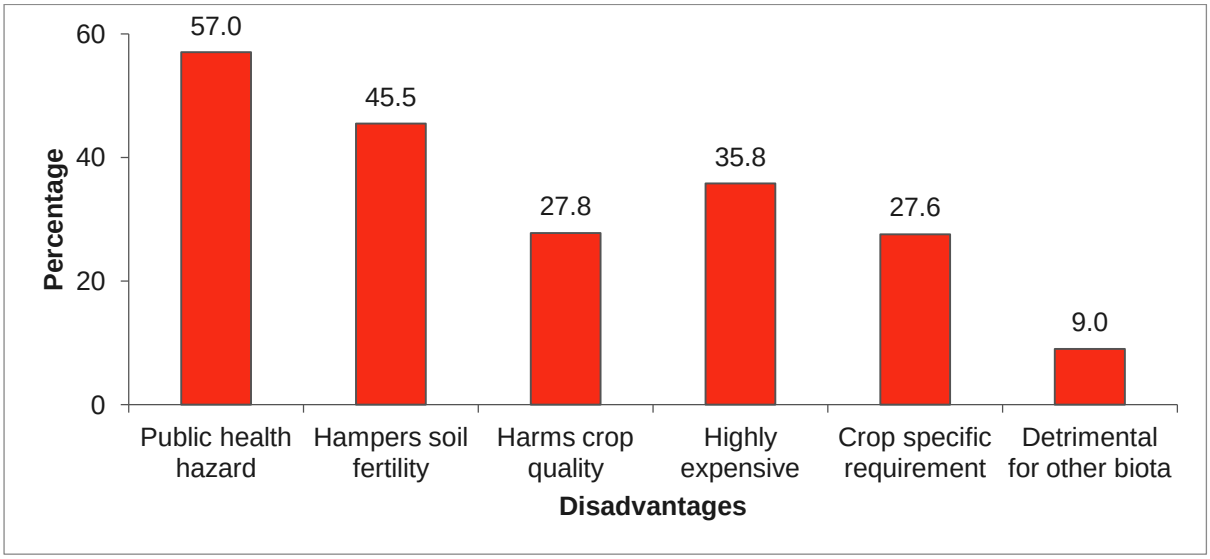

Figure 3.19: Percentage representation of the disadvantages of the current pesticides as per farmers in the project villages

A large majority of the respondents (79.3%) had neither tried organic farming, nor knew anyone who did (68.8%). However, 59.1% respondents had a positive view regarding organic farming and believed that organic farming was good for human health and the soil, and was relatively less expensive and lucrative. Some of the respondents felt that there were both benefits and losses associated with organic farming, only one respondent had a negative opinion regarding organic farming. About 15% farmers did not have an opinion on organic farming (Figure 3.20).

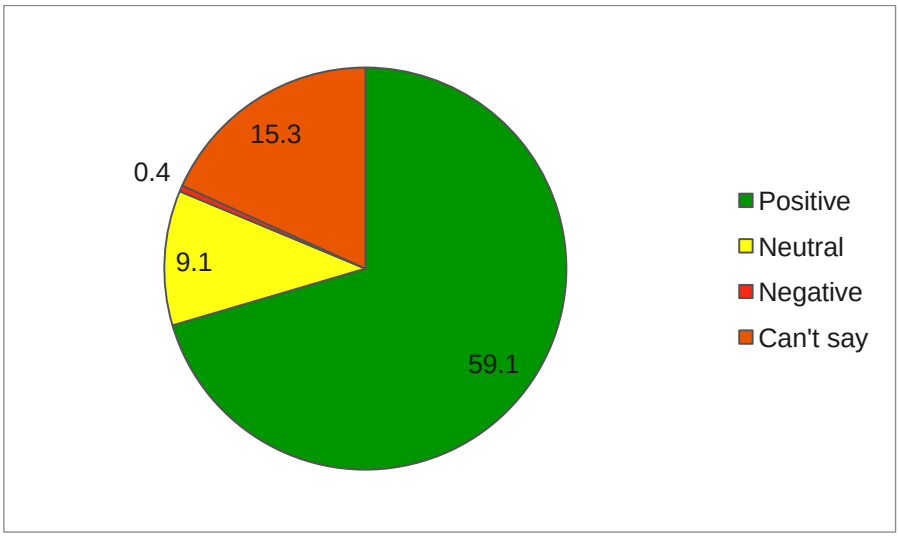

Figure 3.20: Percentage representation of the opinions of the farmers regarding organic farming in the project villages

Most of the respondents (86.2%) felt that the visitation of large mammals had increased in their farmlands in the past 20-30 years. Among these, the Wild Pig was the most frequently encountered large mammal species in the farmlands (Figure 3.21). Around 1% of the respondents mentioned Indian Crested Porcupine and Indian Peafowl visitations to have increased in their farmlands.

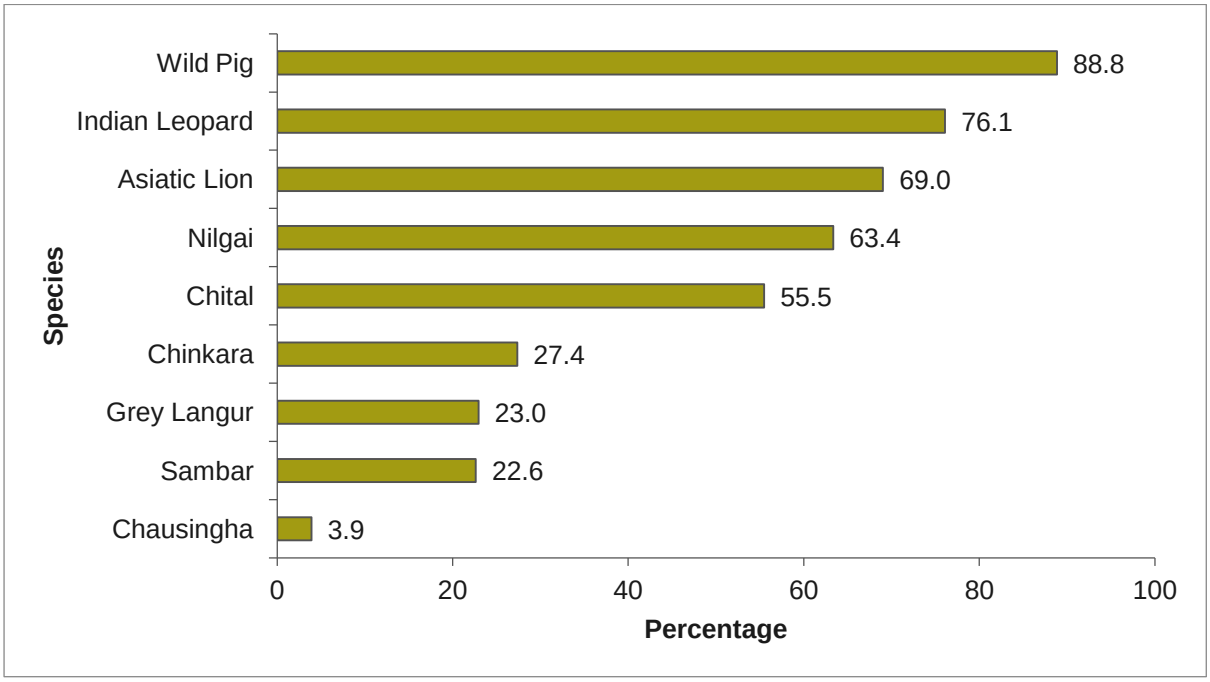

Figure 3.21: Percentage representation of large mammals with increased visitation in the farmlands at the project villages

Among the reasons for the increased visitation, most of the interviewed farmers felt that wild herbivores were attracted to the currently cultivated crops (50.3%) and also attributed it to the loss of natural habitats (39.7%). Some farmers also opined that the current farming practices provide suitable habitats for carnivores (15.9%). Additional reasons included increase in the growth of invasive alien species in the forested areas (14.8%), limited forage availability for wild herbivores due to overgrazing by livestock (22.1%), encroachment (14.4%), increase in the population of wild animals (15.6%) and presence of livestock in the farmland (22.1%) (Figure 3.22).

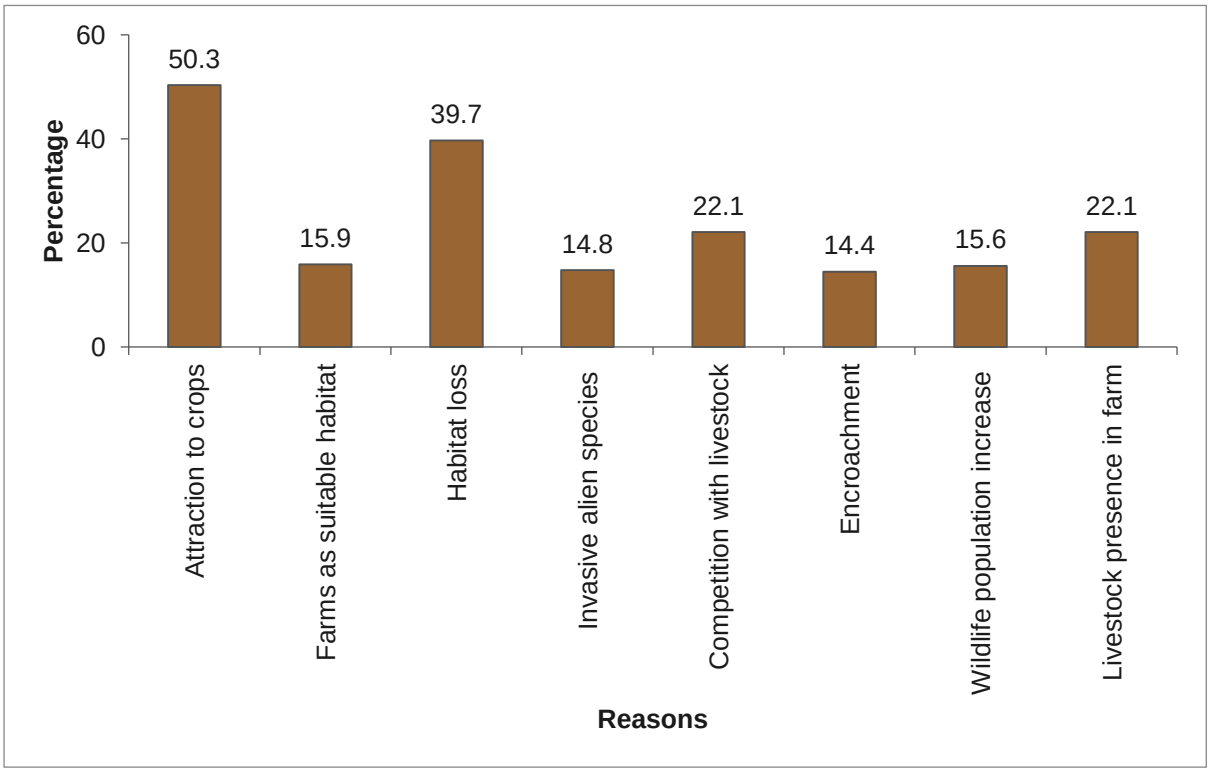

Figure 3.22: Percentage representation of the reasons for increased visitation of wild animals in the farmlands at the project villages

3.4 Identifying the factors that contribute to human-wildlife conflict

The data regarding human-wildlife conflict in the project villages was obtained by conducting questionnaire surveys with the villagers to understand their perceptions on the issue. A total of 606 respondents could be interviewed in 19 villages (Table 4.1).

Table 4.1: Number of responses per project village to assess the human-wildlife conflict

Sr. No.	Name of the Village	Number of responses
1	Amrapur	39
2	Amrutvel	27
3	Bhalchhel	36
4	Bherala	32
5	Chitravad	35
6	Chitrod	36
7	Devgam	32
8	Haripur	36
9	Hiranvel	30
10	Jalandhar	32
11	Jashapur	08
12	Kenedipur	30
13	Ladudi	38
14	Mandor	40
15	Mandorna	35
16	Moruka	34
17	Sangodra	41
18	Vadala	08
19	Virpur	37
	Total	**606**

Most of the respondents were men (84.9%) (Figure 4.1). Around 1.3% respondents did not want to share their gender during the interviews and 8 responses did not mention the gender.

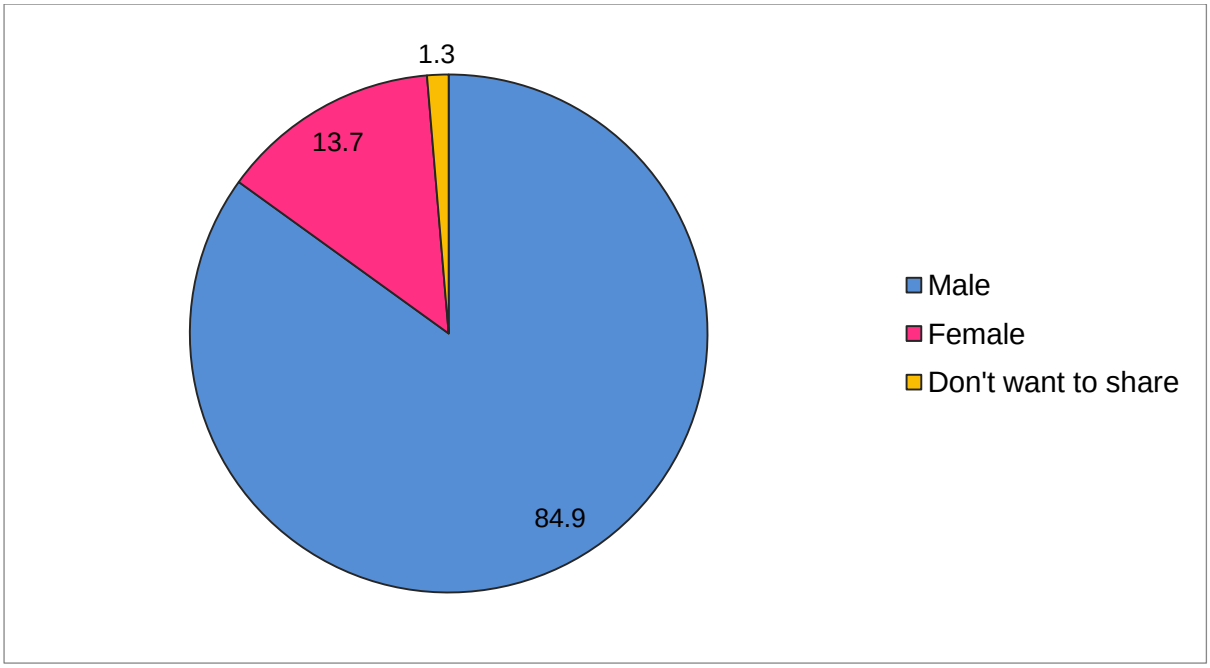

Figure 4.1: Percentage representation of the gender of respondents in the project villages

599 responses collected by the *Gir Mitras* mentioned the age of the respondents. The majority (n=179) belonged to the age class of 38-47 years (Figure 4.2).

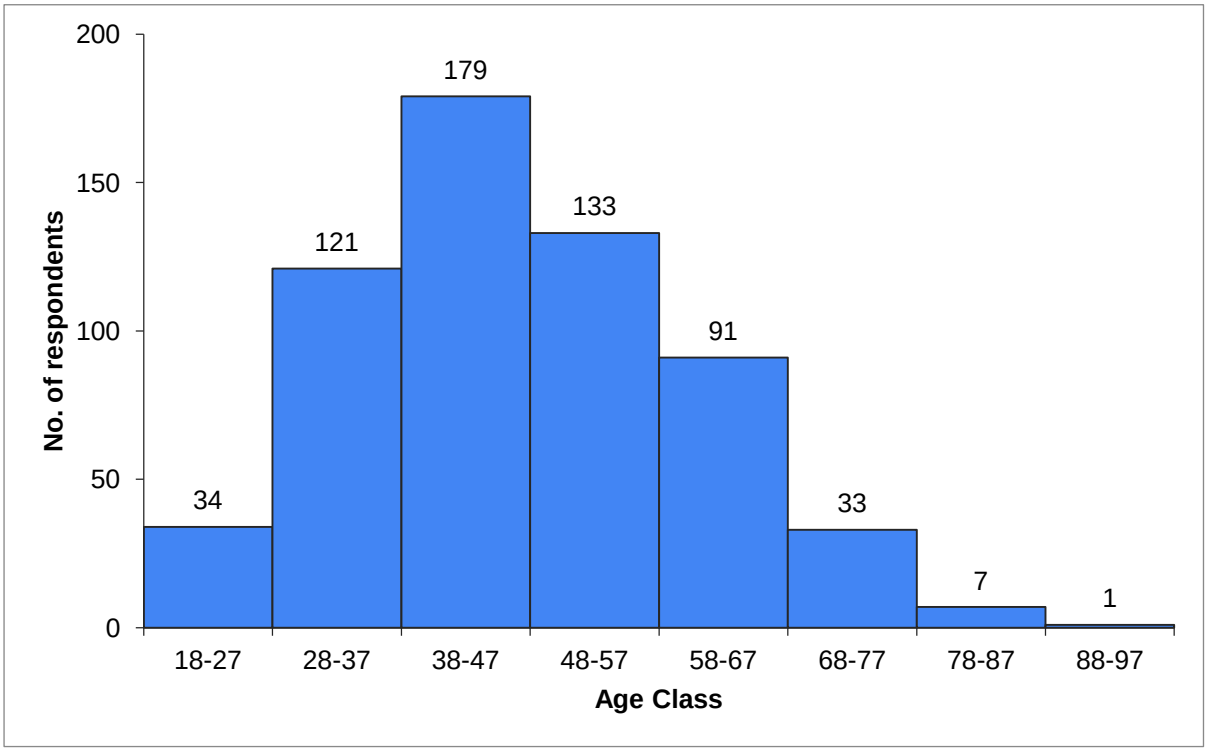

Figure 4.2: Age Class wise number of respondents in the project villages

Most of the respondents belonged to the Koli and Patel castes. Siddi, Lohana, Brahmin and Chaaran were the least represented groups (Figure 4.3).

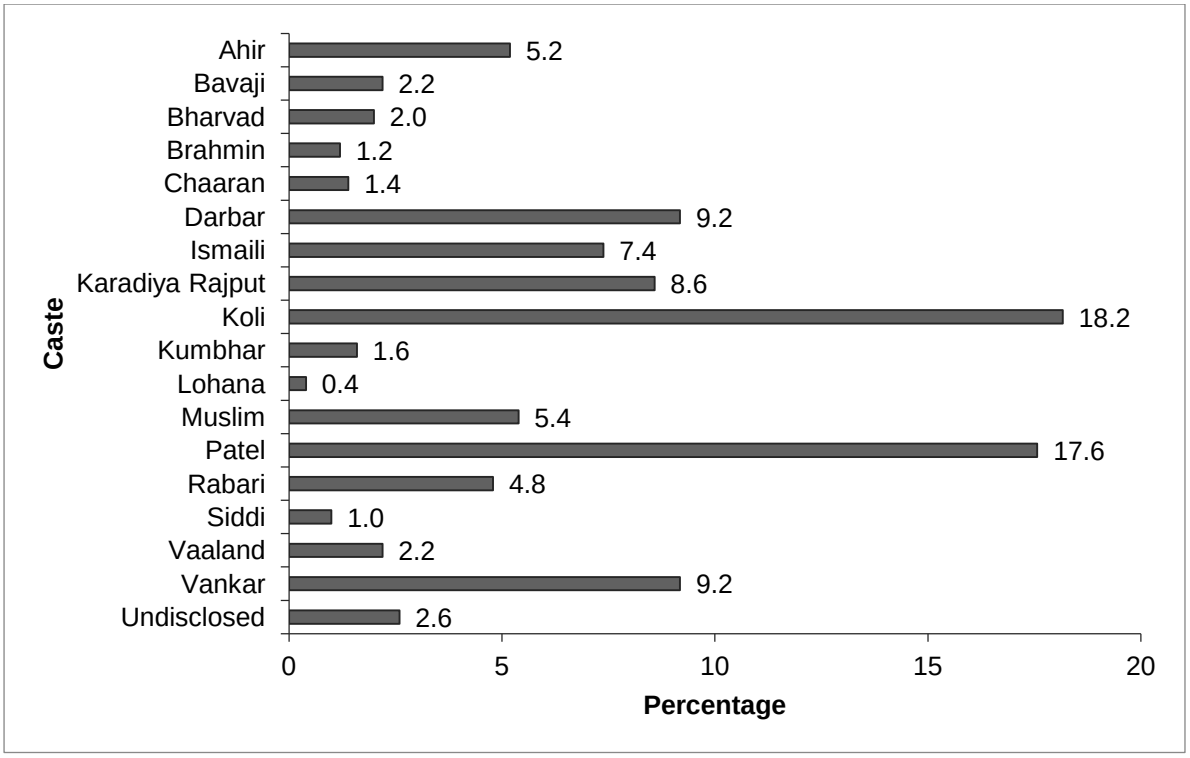

Figure 4.3: Percentage representation of the caste wise number of respondents in the project villages

A large majority (74.1%) of the respondent's adult family members were employed in a single occupation and 19.3% of the respondents had family members employed in two occupations, while 4% of the respondents made up for family members being employed in more than two occupations. Of these, farming was the most dominant occupation among the respondents in the project villages and small business was the least dominant occupation (Figure 4.4).

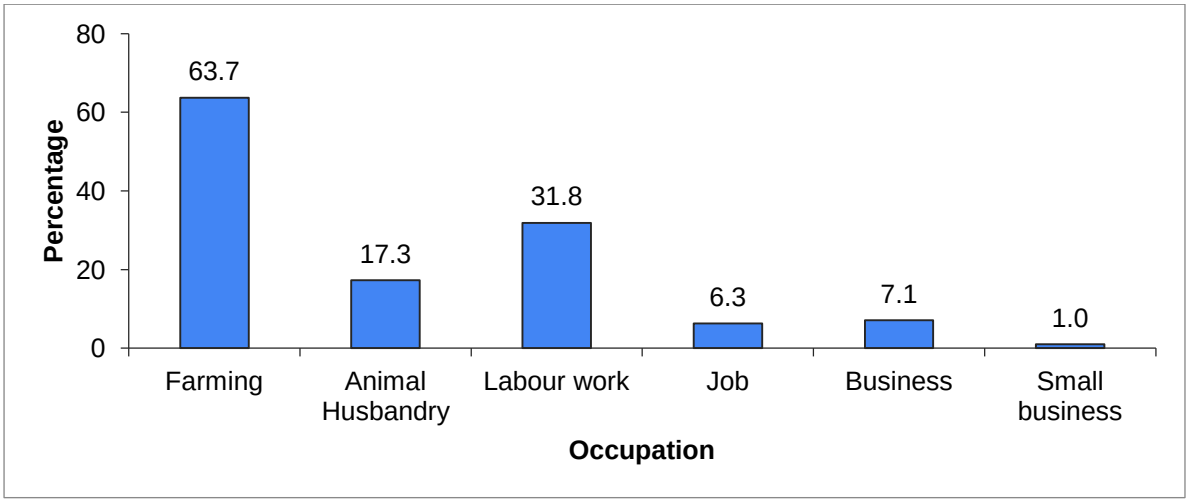

Figure 4.4: Percentage representation of the occupation of respondents in the project villages

In consonance with farming as a dominant occupation, 77.6% respondents owned agriculture land. 4.2% respondents owned both agriculture and non agricultural land. Around 8% of the respondents owned non agriculture land, while 9.5% respondents did not own any land of their own (Figure 4.5).

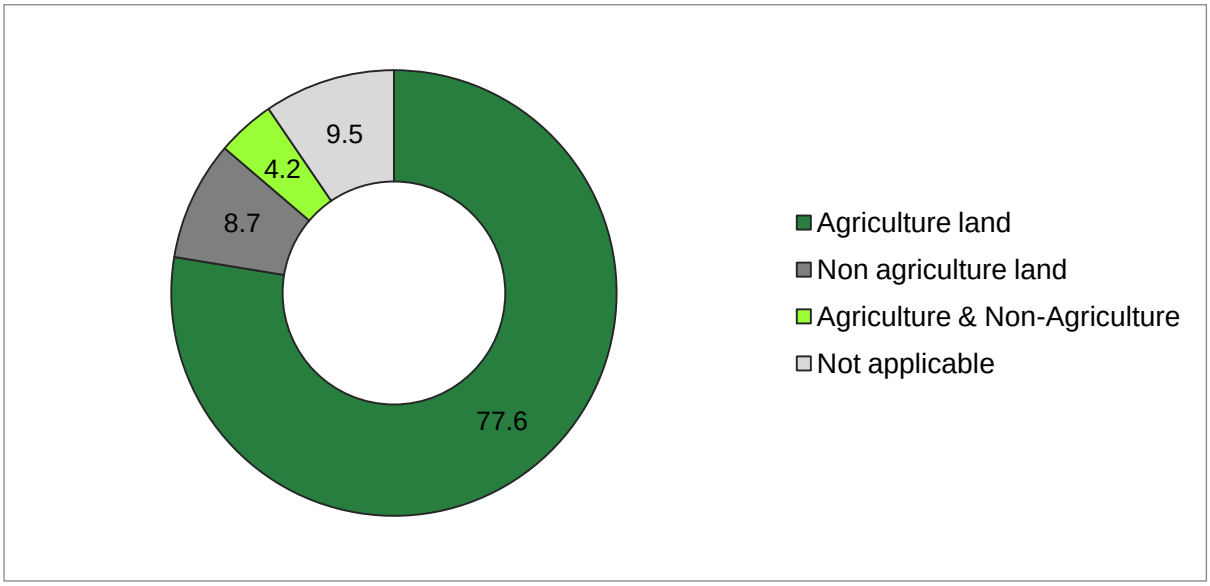

Figure 4.5: Percentage representation of the type of land owned by respondents in the project villages

Most of these respondents owned agricultural land in the size class of 1-10 *bigha*. Around 2% of the respondents owned land more than 30 *bigha* (Figure 4.6).

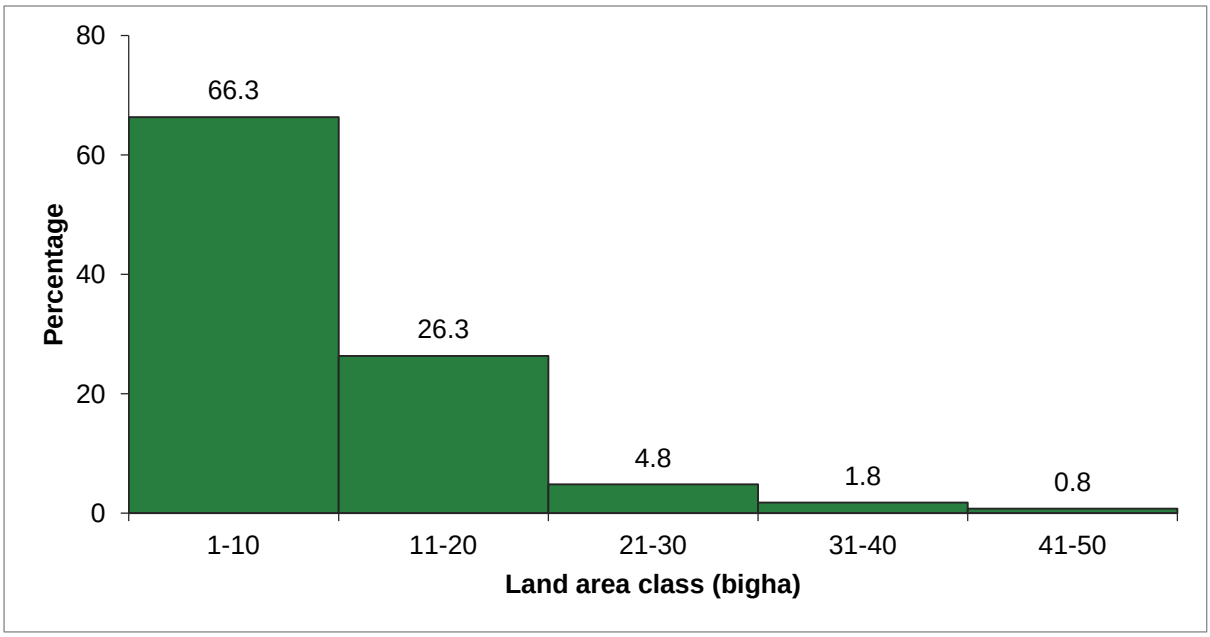

Figure 4.6: Percentage representation of the size of the agriculture land owned by respondents in the project villages

As for the non agriculture land owned, majority of the respondents (55.4%) possessed 1-50 square yards, around 6% of them owned more than 200 square yards (Figure 4.7).

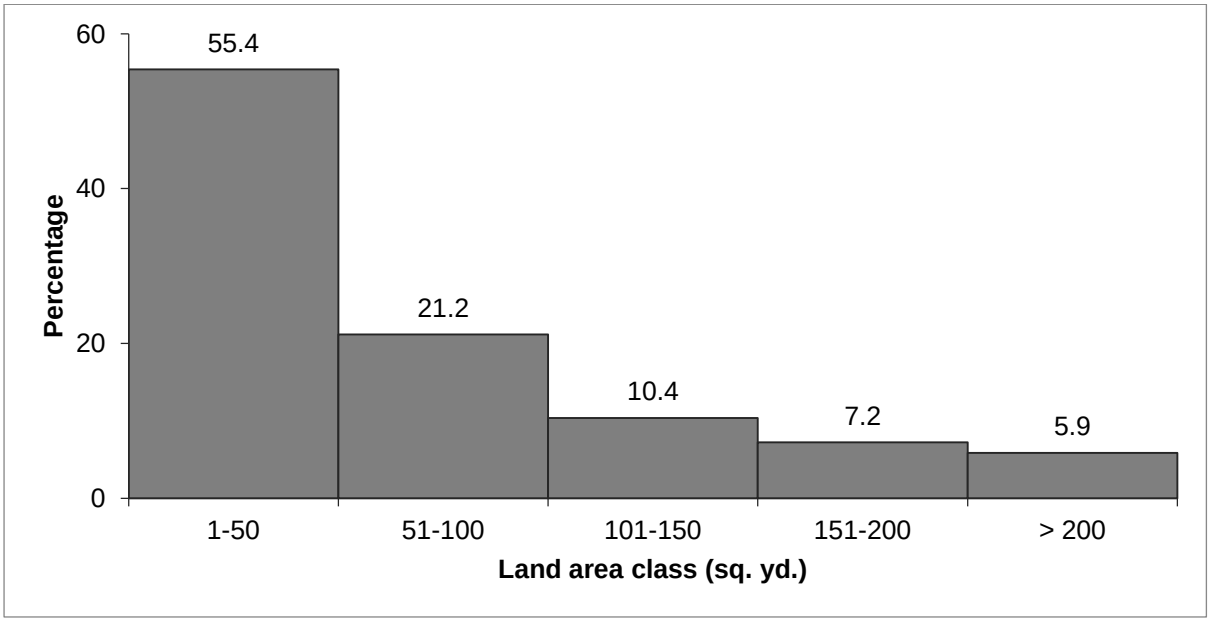

Figure 4.7: Percentage representation of the size of the non-agriculture land owned by respondents in the project villages

Most of the respondents (55.7%) owned a pucca house with a pucca ceiling, while 22% respondents owned a kaccha house (Figure 4.8).

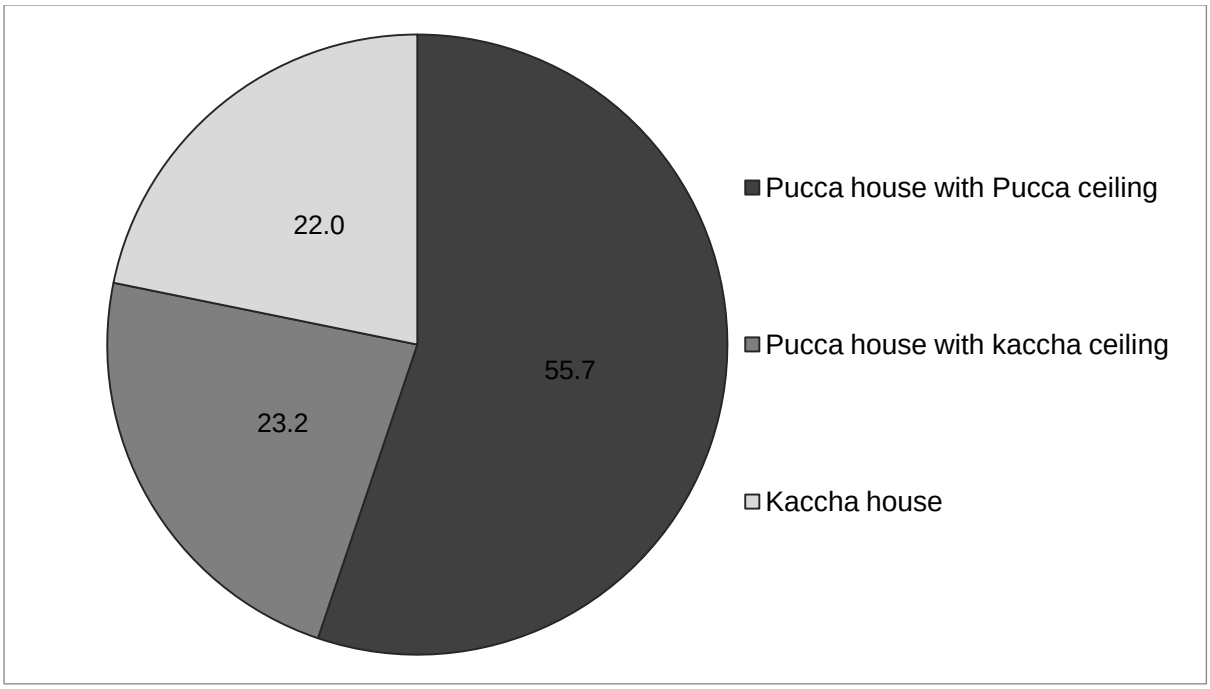

Figure 4.8: Percentage representation of the condition of the house owned by the respondents in the project villages

More than 87% respondents had water storage facility in their houses (Figure 4.9).

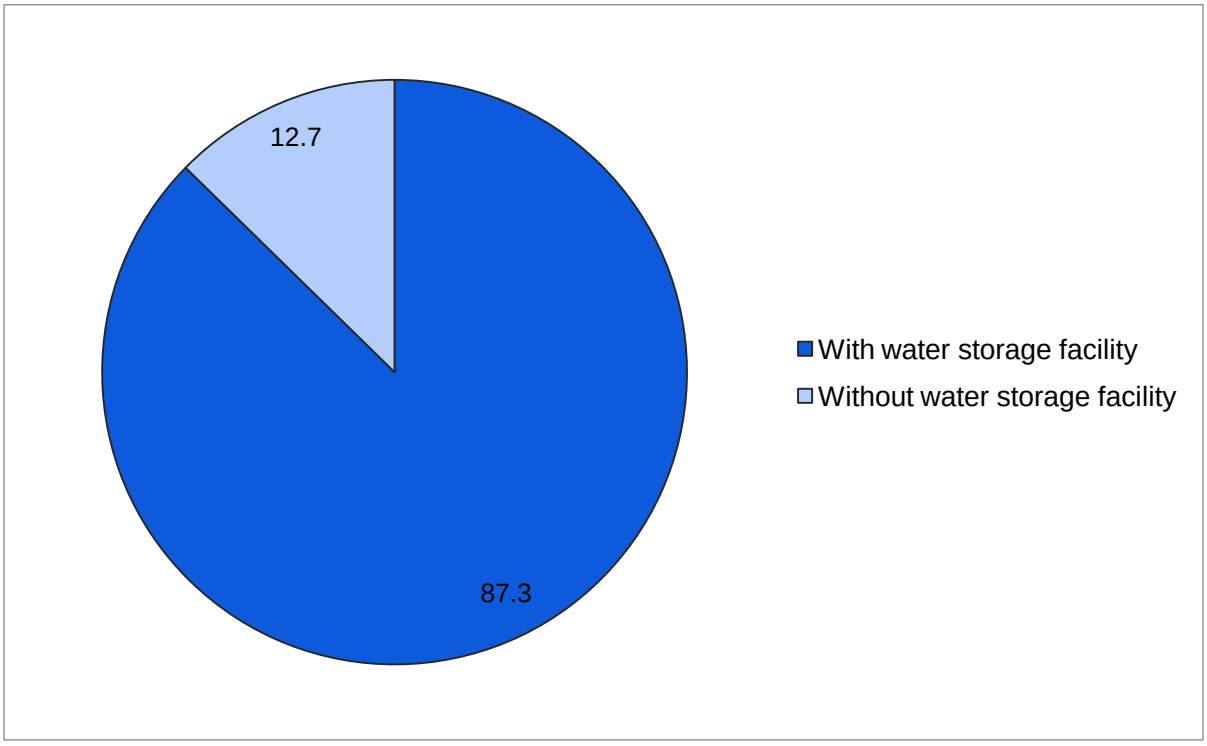

Figure 4.9: Percentage representation of the provision for water storage facility in the house owned by the respondents in the project villages

More than 82% of the respondents had sanitation units within their house premises (Figure 4.10).

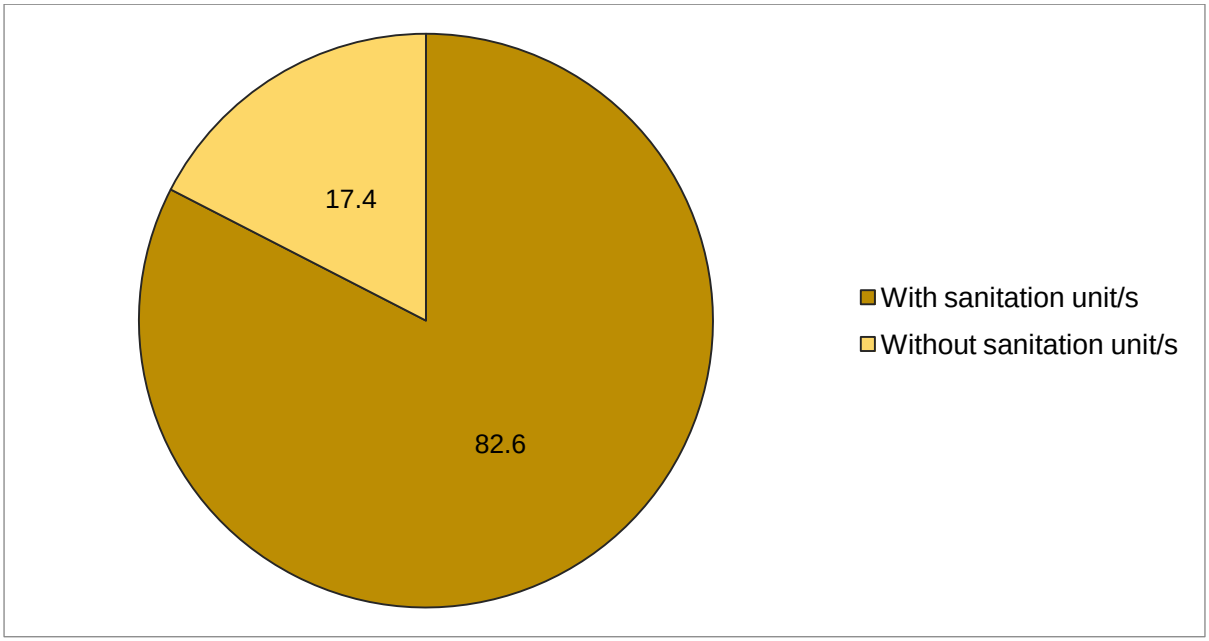

Figure 4.10: Percentage representation of the provision for sanitation units in the house owned by the respondents in the project villages

More than 65% of the respondents reported their monthly family income upto ₹10000. Around 3% of the respondents reported this to be more than ₹50000 (Figure 4.11). 53 responses did not mention the family incomes.

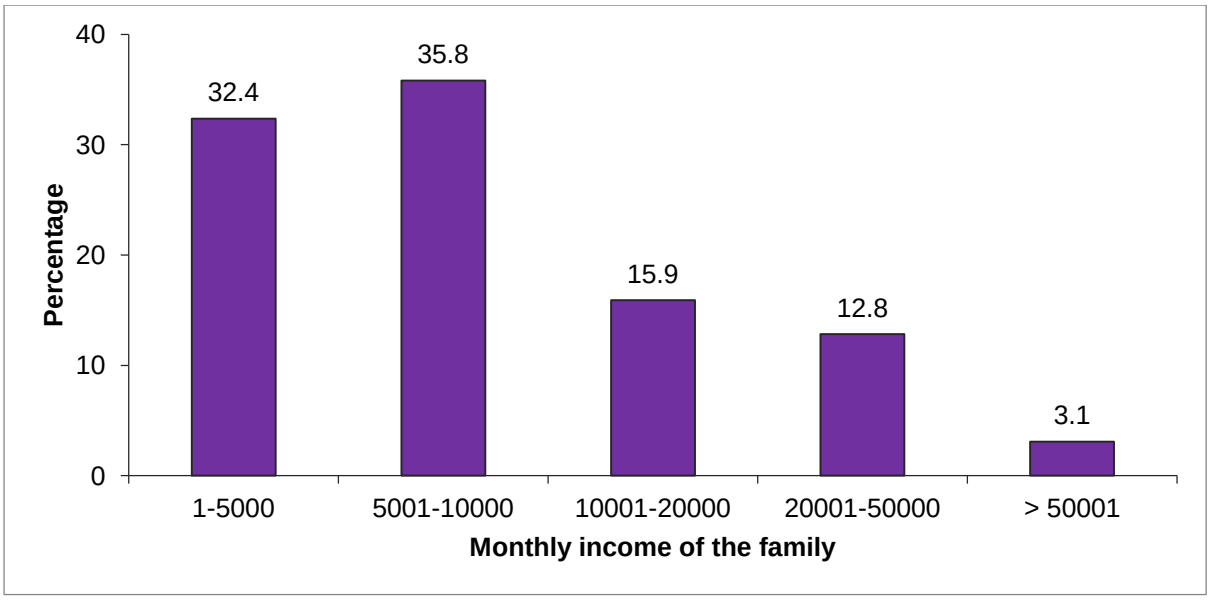

Figure 4.11: Percentage representation of the reported monthly income of the respondent's families in the project villages

More than 70% respondents collected fuel wood from the forests. The other common NTFPs collected included water, fruits and fodder (Figure 4.12). 128 responses did not mention the NTFPs collected by the villagers.

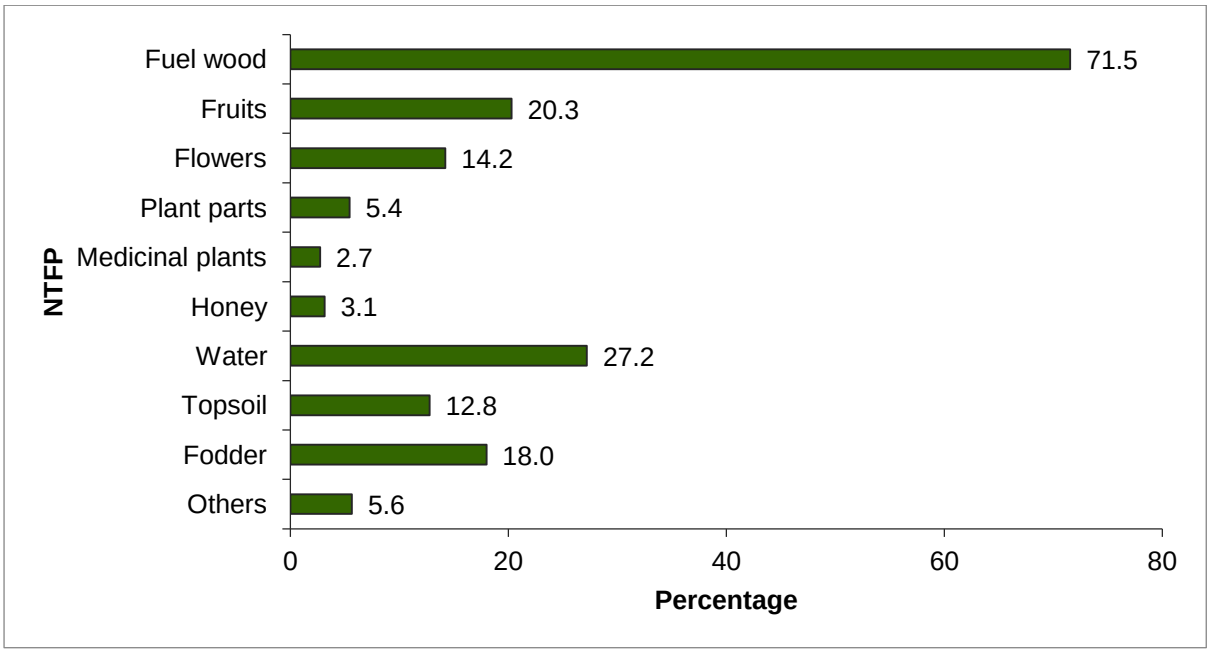

Figure 4.12: Percentage representation of the Non Timber Forest Products (NTFPs) collected by the respondents in the project villages

The average number of livestock owned per household in the project villages was 2.77 ± 0.26 SE. Half of the respondents did not own any livestock. Among the respondents who owned livestock, a large majority possessed 1-10 individuals of livestock (Figure 4.13).

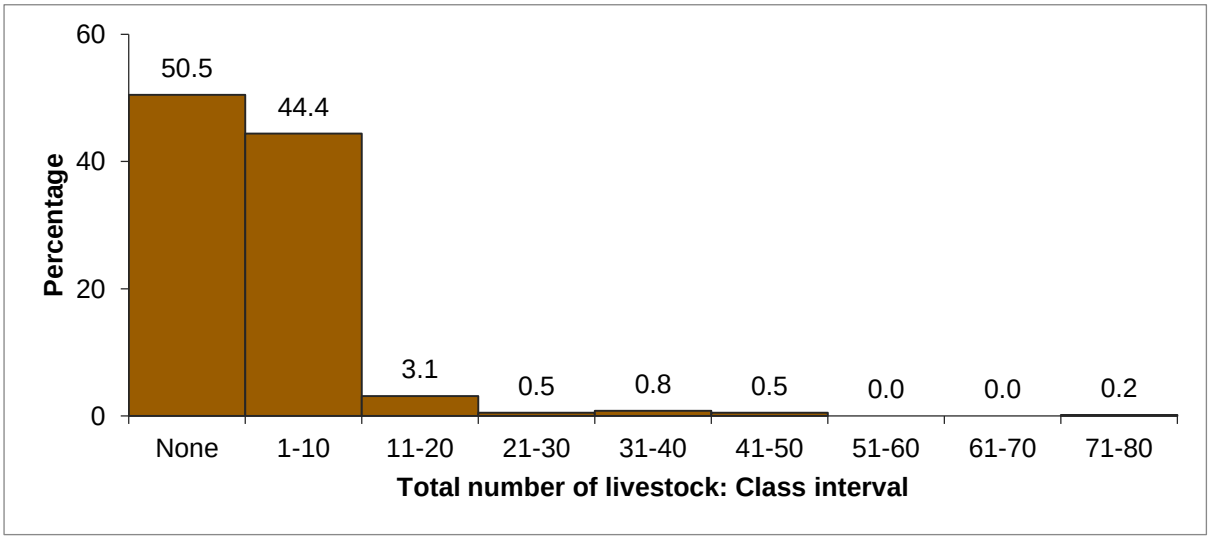

Figure 4.13: Percentage representation of the number of livestock owned by respondents in the project villages

The average number of cows per household in the project villages was 0.73 ± 0.10 SE. Among those respondents who owned livestock, 31.7% did not possess any cows and 66.7% owned 1 to 5 cows (Figure 4.14). The average number of milch cows per household was 0.29 ± 0.02 SE. Among the total number of cows, 58% of the respondents owned 1 milch cow, while around 11% respondents owned two or more milch cows (Figure 4.15)

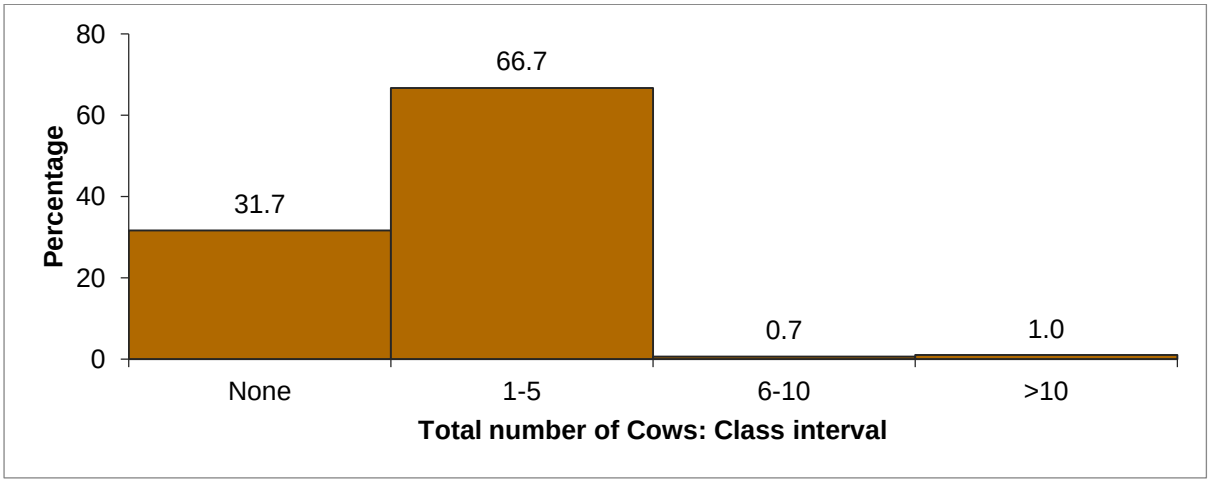

Figure 4.14: Percentage representation of the number of cows owned by respondents in the project villages

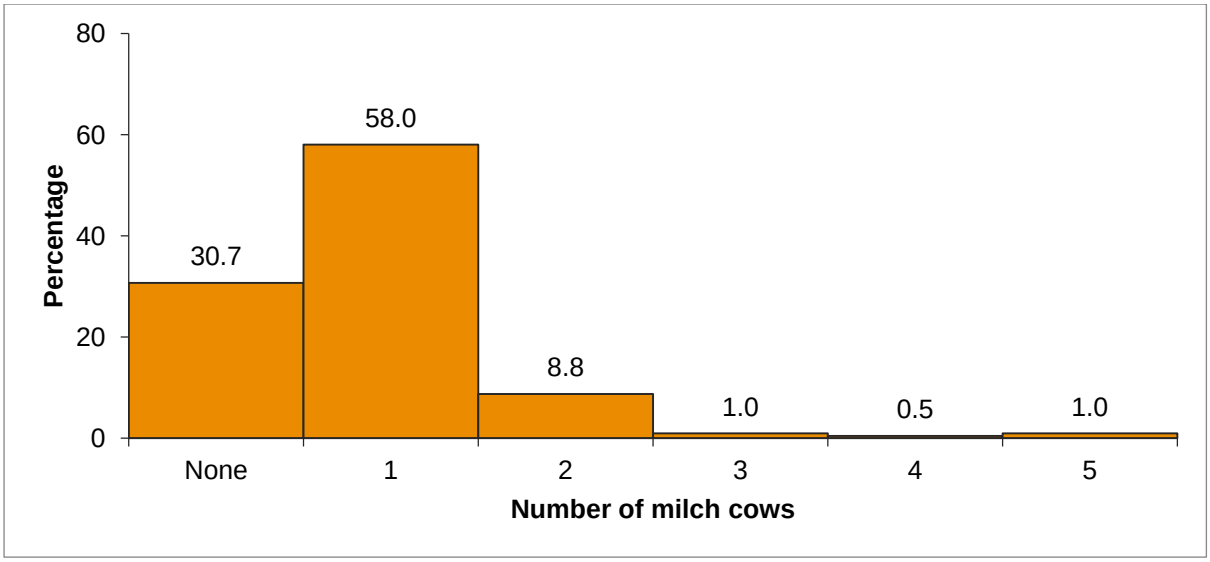

Figure 4.15: Percentage representation of the number of milch cows owned by respondents in the project villages

The average number of bullocks per household in the project villages was 0.29 ± 0.03 SE. 70% of the livestock owners did not possess any bullocks, while 27.7% owned 2 bullocks. 1.7% of the respondents owned 1 bullock and 0.7% owned 3 bullocks.

The average number of buffaloes per household in the project villages was 1.46 ± 0.46 SE. Among those respondents who owned livestock, 31.3% did not possess any buffaloes and 60.3% owned 1 to 10 buffaloes (Figure 4.16). The average number of milch buffaloes per household was 0.61 ± 0.07 SE. Among the total number of buffaloes, 34.5% of the respondents owned 1 milch buffalo, 21.8% owned 2 milch buffaloes while around 29.1% respondents did not own any milch buffaloes (Figure 4.17)

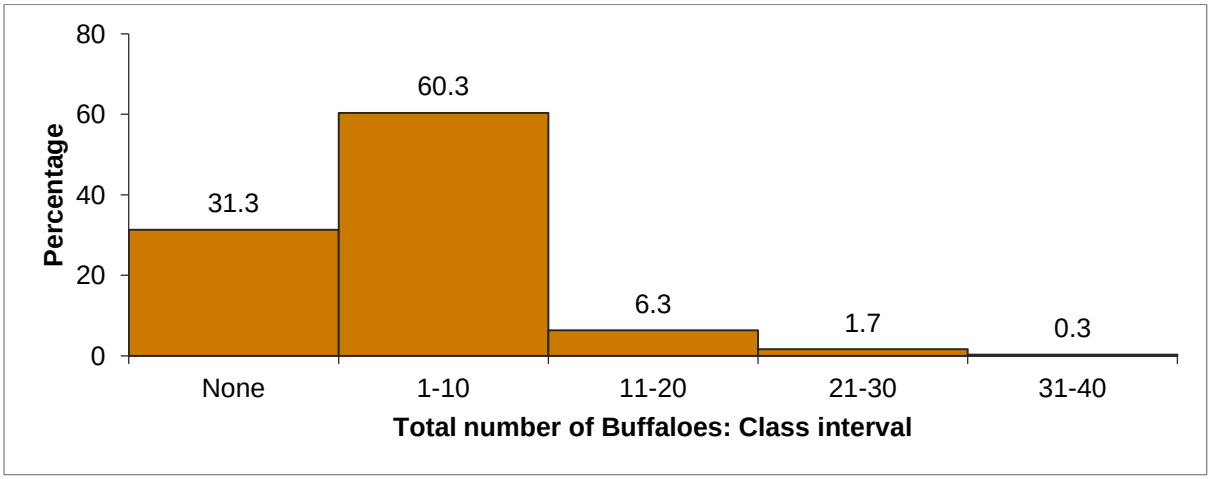

Figure 4.16: Percentage representation of the number of buffaloes owned by respondents in the project villages

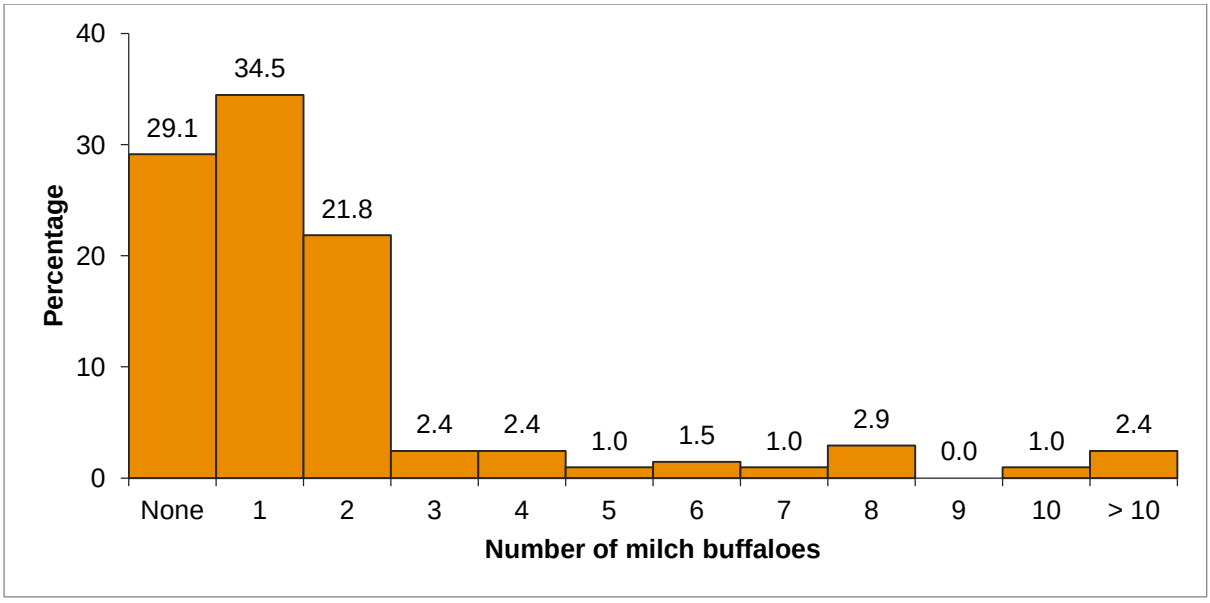

Figure 4.17: Percentage representation of the number of milch buffaloes owned by respondents in the project villages

The average number of goats per household in the project villages was 0.29 ± 0.15 SE. Only three percent of the livestock owners in the project villages possessed goats whose number ranged from 1 to more than 20.

The average number of sheep per household in the project villages was 0.03 ± 0.01 SE. Only 1.3% of the livestock owners in the project villages possessed sheep whose number ranged from 1 to 5.

The average number of horses per household in the project villages was 0.01 ± 0.01 SE. Only 1.7% of the livestock owners in the project villages possessed horses whose number ranged from 1 to 3.

Only one percent of the livestock owners in the project villages possessed a single camel.

The average number of poultry (chicken) per household in the project villages was 0.04 ± 0.02 SE. Only 1.3% of the livestock owners in the project villages possessed poultry (chicken) whose number ranged from 4 to 10.

More than 40% livestock owners mentioned that none of their livestock were vaccinated. Only 13.3% livestock owners had provided vaccinations to all their livestock, 21.7% owners were unsure of the vaccination status (Figure 4.18).

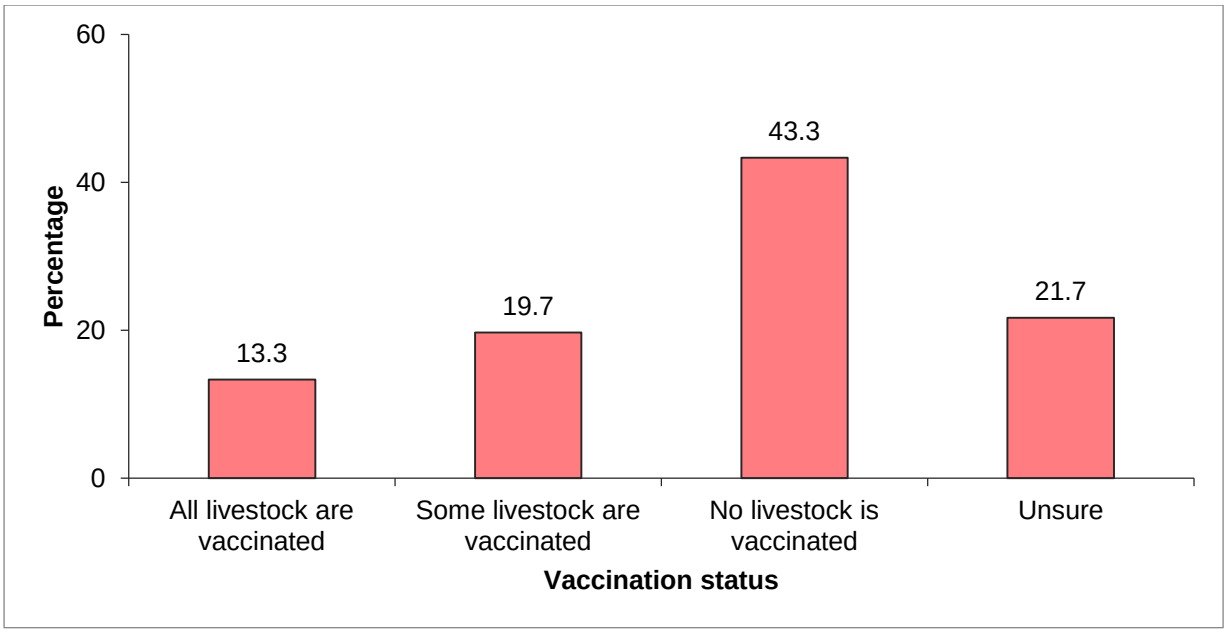

Figure 4.18: Percentage representation of the vaccination status of the livestock in the project villages

45.7 % of the livestock owners stall fed their livestock (Figure 4.19).

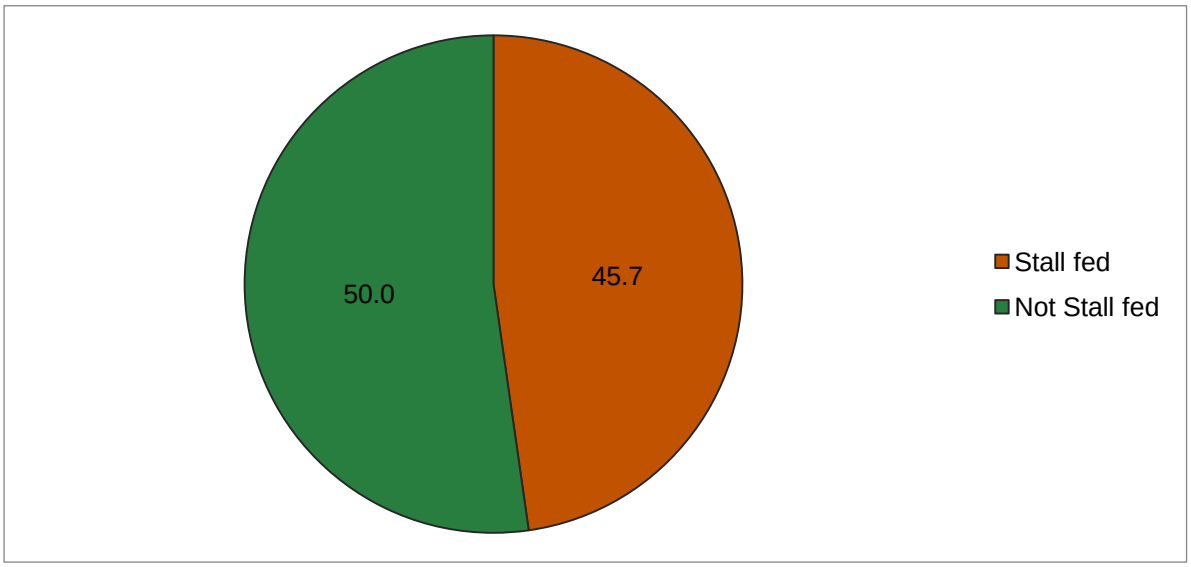

Figure 4.19: Percentage representation of the number of respondents who stall fed their livestock in the project villages

Among the livestock owners who did not stall feed their livestock, 62.7% took their livestock to graze in the fringe areas of the forest and 40% grazed their livestock in their village *gauchar* (Figure 4.20).

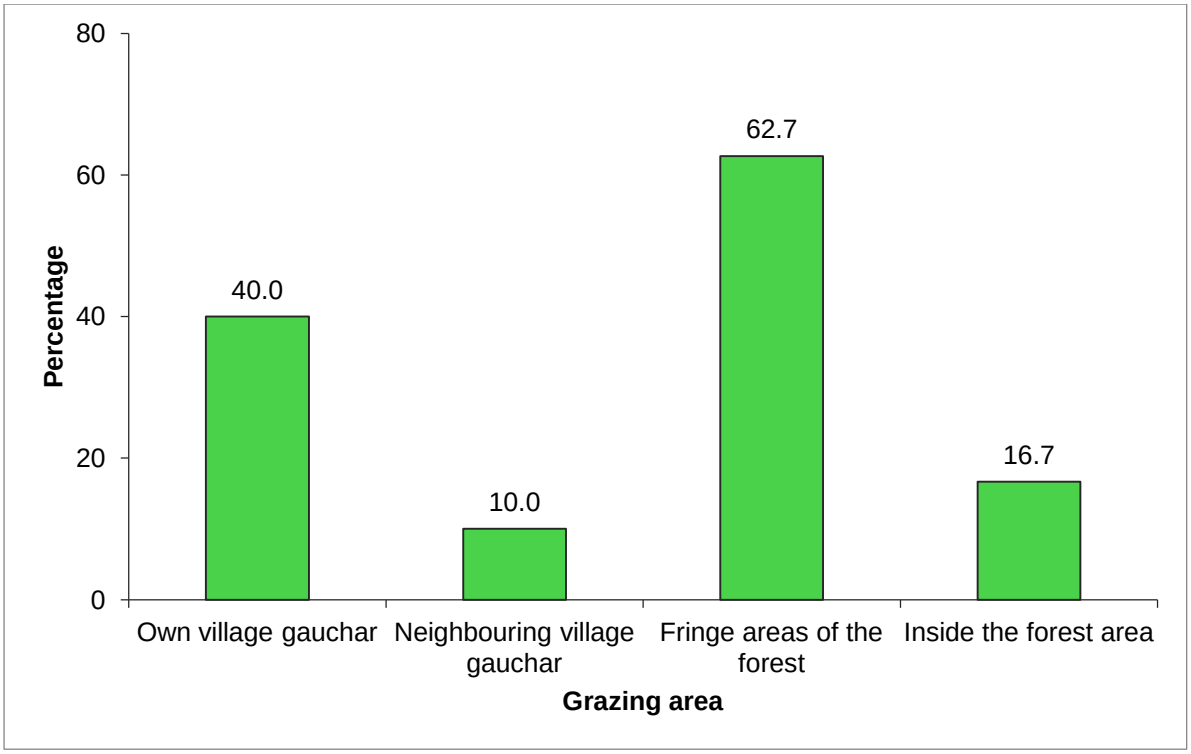

Figure 4.20: Percentage representation of the areas where respondents took their livestock for grazing in the project villages

More than 50% farm owners reported that the wells in their farms were covered with parapet walls (Figure 4.21). Around 4% of the responses did not have information regarding the covering of wells.

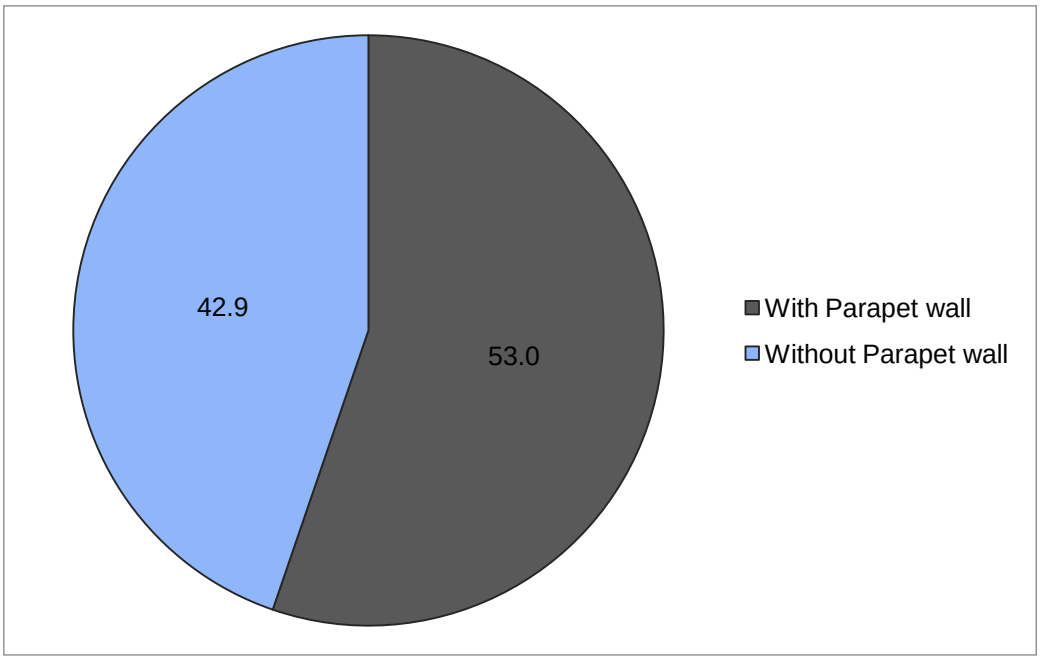

Figure 4.21: Percentage representation of the number of wells covered by a parapet wall in the project villages

Over 45% of the farm owners cultivated crops in all the three seasons, followed by those who cultivated in monsoon & winter (35.1%) and monsoon exclusively (8.8%). A relatively small fraction of the farmers cultivated crops exclusively in summer and winter and six farmers did not provide any response (Figure 4.22).

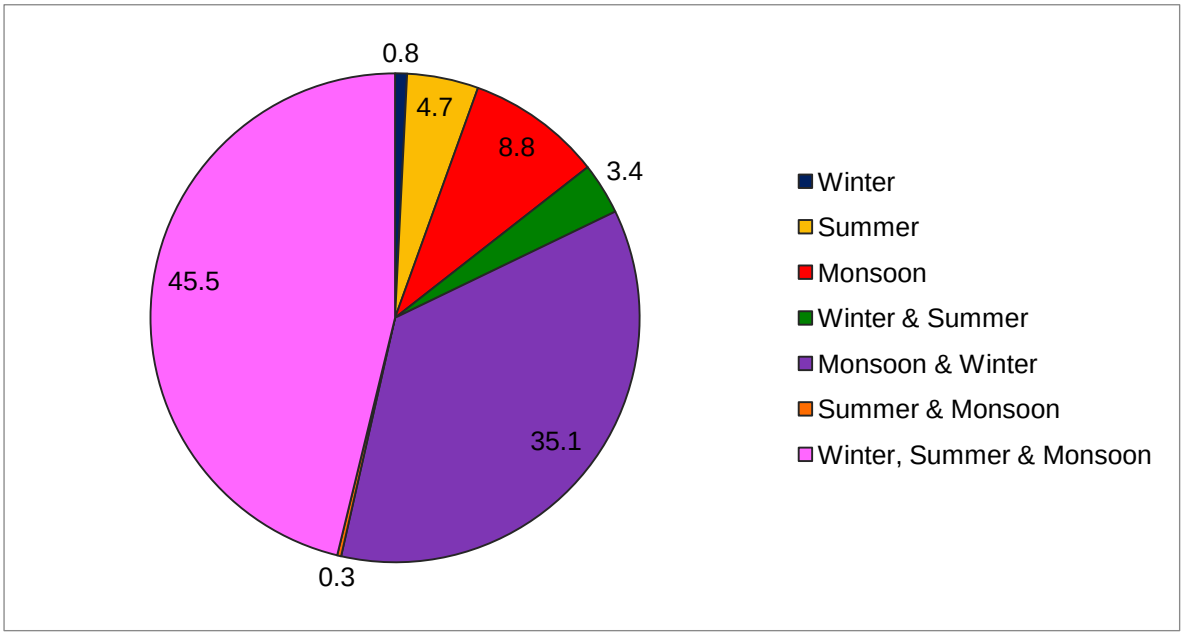

Figure 4.22: Percentage representation of the seasons in which crops are cultivated by the respondents in the project villages

Groundnut was the most dominant crop cultivated in the project villages with over 83% farmers involved in its farming. The second most dominant crop was wheat while the least dominant ones were watermelon and lemon (Figure 4.23). The reported annual yield of most of the crops was between 1 to 50 Quintals per respondent except Cotton, Castor, Jowar and Chikoo (Table 4.2).

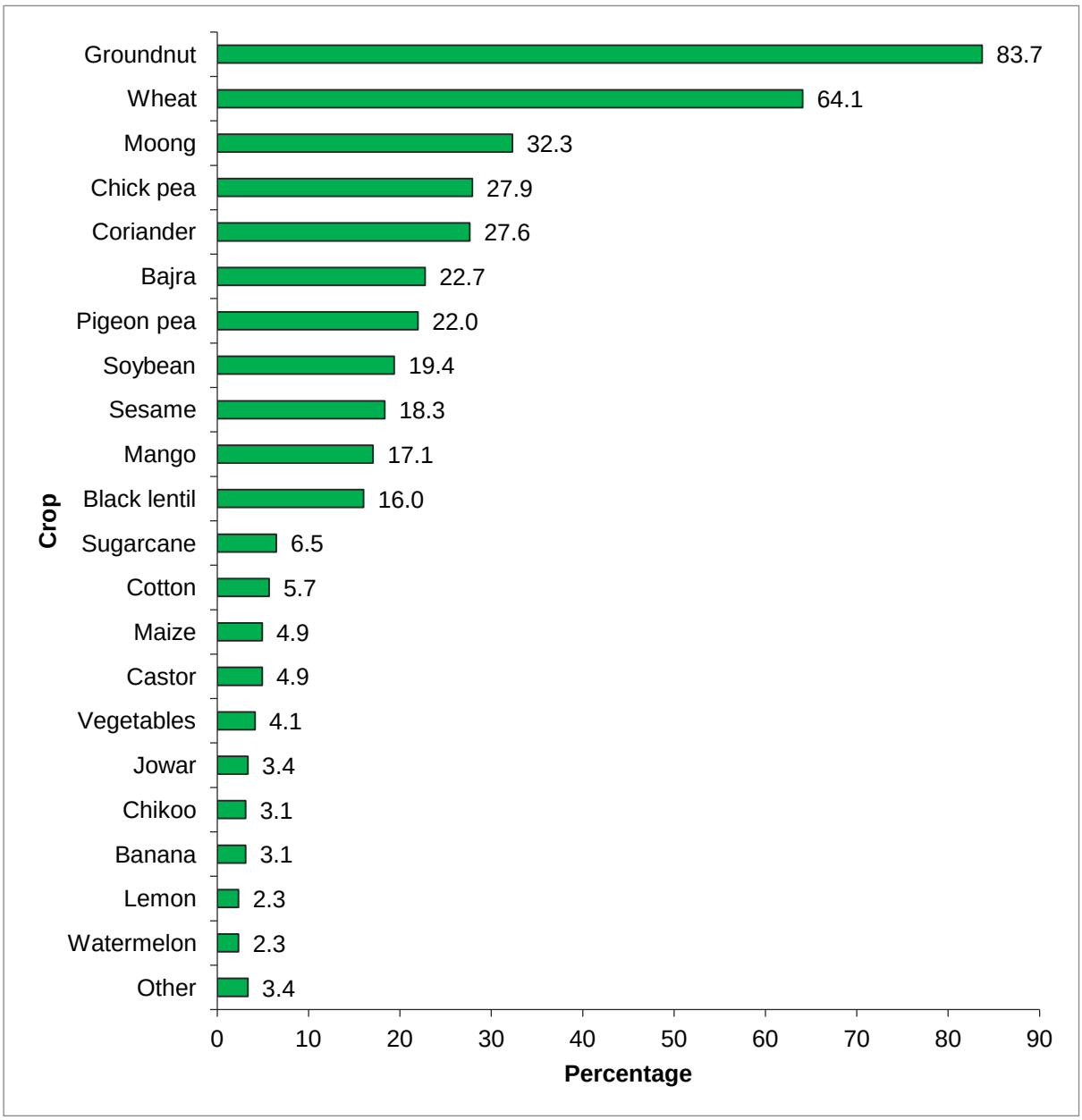

Figure 4.23: Percentage representation of the crops cultivated by the respondents in the project villages

Table 4.2: Percentage representation of annual yield of the crops cultivated by the respondents in the project villages

Crop	1 to 50 Quintals (%)	51 to 100 Quintals (%)	101 to 150 Quintals (%)	151 to 200 Quintals (%)	> 201 Quintals (%)
Groundnut	65.7	22.5	8.3	3.1	0.3
Wheat	58.1	19.4	14.5	6.9	1.2
Moong	60.0	28.8	8.8	1.6	0.8
Chick pea	56.5	25.0	13.9	3.7	0.9
Coriander	49.5	34.6	11.2	4.7	0.0
Bajra	67.0	25.0	6.8	1.1	0.0
Pigeon pea	70.6	18.8	7.1	2.4	1.2
Soybean	60.0	18.7	13.3	8.0	0.0
Sesame	57.7	28.2	9.9	2.8	1.4
Mango	59.1	7.6	13.6	13.6	6.1
Black lentil	53.2	27.4	17.7	1.6	0.0
Sugarcane	28.0	24.0	24.0	24.0	0.0
Cotton	13.6	40.9	36.4	9.1	0.0
Castor	15.8	42.1	31.6	10.5	0.0
Maize	42.1	26.3	26.3	5.3	0.0
Vegetables	43.8	18.8	37.5	0.0	0.0
Jowar	23.1	46.2	30.8	0.0	0.0
Banana	16.7	33.3	25.0	16.7	8.3
Chikoo	33.3	41.7	0.0	8.3	16.7
Watermelon	11.1	22.2	55.6	11.1	0.0
Lemon	11.1	33.3	33.3	22.2	0.0
Other	53.8	23.1	23.1	0.0	0.0

45 respondents were involved in cultivation of coconuts, 51% of whom reported annual production of upto 100 units (Figure 4.24).

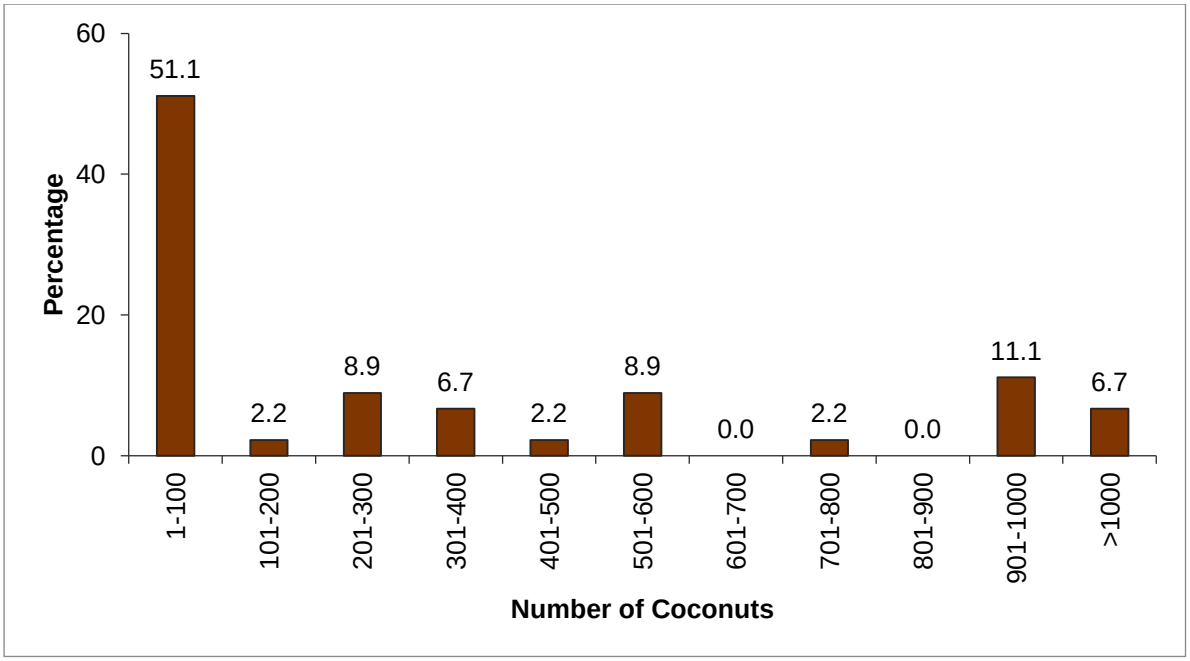

Figure 4.24: Percentage representation of the annual yield of coconuts reported by the respondents in the project villages

Most of the respondents involved in farming reported losses to Groundnut and Wheat (Table 4.3). Most of the reported losses to the different crops were upto 20%. A couple of farmers reported losses to Teak, White Teak, Eucalyptus and Casuarina.

Table 4.3: Percentage representation of the loss through crop damage by wildlife to the annual yield of the crops cultivated by the respondents in the project villages

Crop	1-20% (%)	21-40% (%)	41-60% (%)	61-80% (%)	81-100% (%)
Groundnut	50.0	21.0	18.2	6.2	0.3
Wheat	62.5	21.0	3.6	2.8	0.0
Moong	56.0	24.0	7.2	4.0	0.0
Chick pea	50.0	30.6	8.3	1.9	0.9
Coriander	60.7	19.6	3.7	1.9	0.9
Bajra	35.2	33.0	21.6	1.1	0.0
Pigeon Pea	55.3	17.6	7.1	2.4	0.0
Soybean	48.0	13.3	8.0	5.3	0.0
Sesame	23.9	29.6	16.9	7.0	0.0
Mango	47.0	18.2	7.6	3.0	0.0
Black lentil	56.5	24.2	6.5	1.6	0.0
Sugarcane	12.0	24.0	24.0	32.0	0.0
Cotton	31.8	36.4	22.7	4.5	0.0
Castor	10.5	15.8	36.8	21.1	0.0
Maize	15.8	26.3	21.1	15.8	0.0
Vegetables	18.8	25.0	12.5	31.3	0.0
Jowar	30.8	30.8	23.1	15.4	0.0
Banana	8.3	8.3	33.3	8.3	0.0
Chikoo	0.0	8.3	8.3	0.0	0.0
Watermelon	0.0	33.3	33.3	11.1	0.0
Lemon	11.1	22.2	44.4	22.2	11.1
Coconut	6.7	2.2	0.0	0.0	2.2
Others	7.7	7.7	15.4	7.7	7.7

393 respondents provided information regarding the season when maximum incidences of crop depredation occur. Among these, 31.8% mentioned that these incidences occurred through all the seasons, 25.2% reported winter and monsoon to be the chief seasons (Figure 4.25).

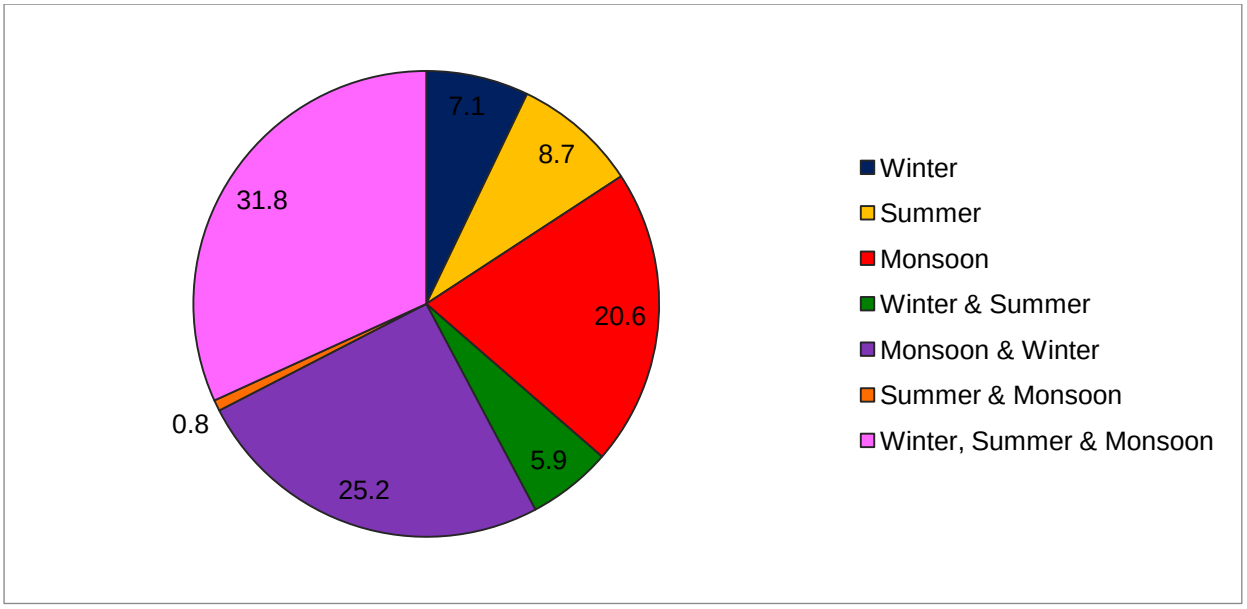

Figure 4.25: Percentage representation of the seasons in which maximum incidences of crop depredation occur as per respondents in the project villages

Wild Pig was the most frequently reported herbivore that caused crop depredation (n=310), followed by Nilgai (n=271), Peafowl (n=145), Chital (n=118), Porcupine (n=65), Chinkara (n=45), other rodents (n=58), Grey langur (n=33), insects (n=32), other birds (n=23), Sambar (n=20) and Chausingha (n=14).

The maximum incidences of crop depredation by Nilgai were reported to occur between 06:00 PM and 02:00 AM (n=326), while those for Wild Pig were reported to be between 06:00 PM and 06:00 AM (n=355). The Grey Langur was reported to be crepuscular in its crop depredation habits and was also reported to be active in the night. Most of the crop depredation events by Chital were reported to occur between 10:00 PM and 06:00 AM (n=101), those by Sambar and Chinkara were reported to mostly occur between 10:00 PM and 02:00 AM (n=10 and 41 respectively) (Figure 4.26). The Chausingha was reported to mostly depredate crops between 06:00 PM and 02:00 AM (n=14), Porcupine was reported to mostly cause damage to crops from 06:00 PM to 06:00 AM (n=110), while the peafowl, other birds, rodents and insects were maximally reported to cause damage between 06:00 PM to 10:00 PM (n=79, 12, 46 and 24 respectively) (Figure 4.27).

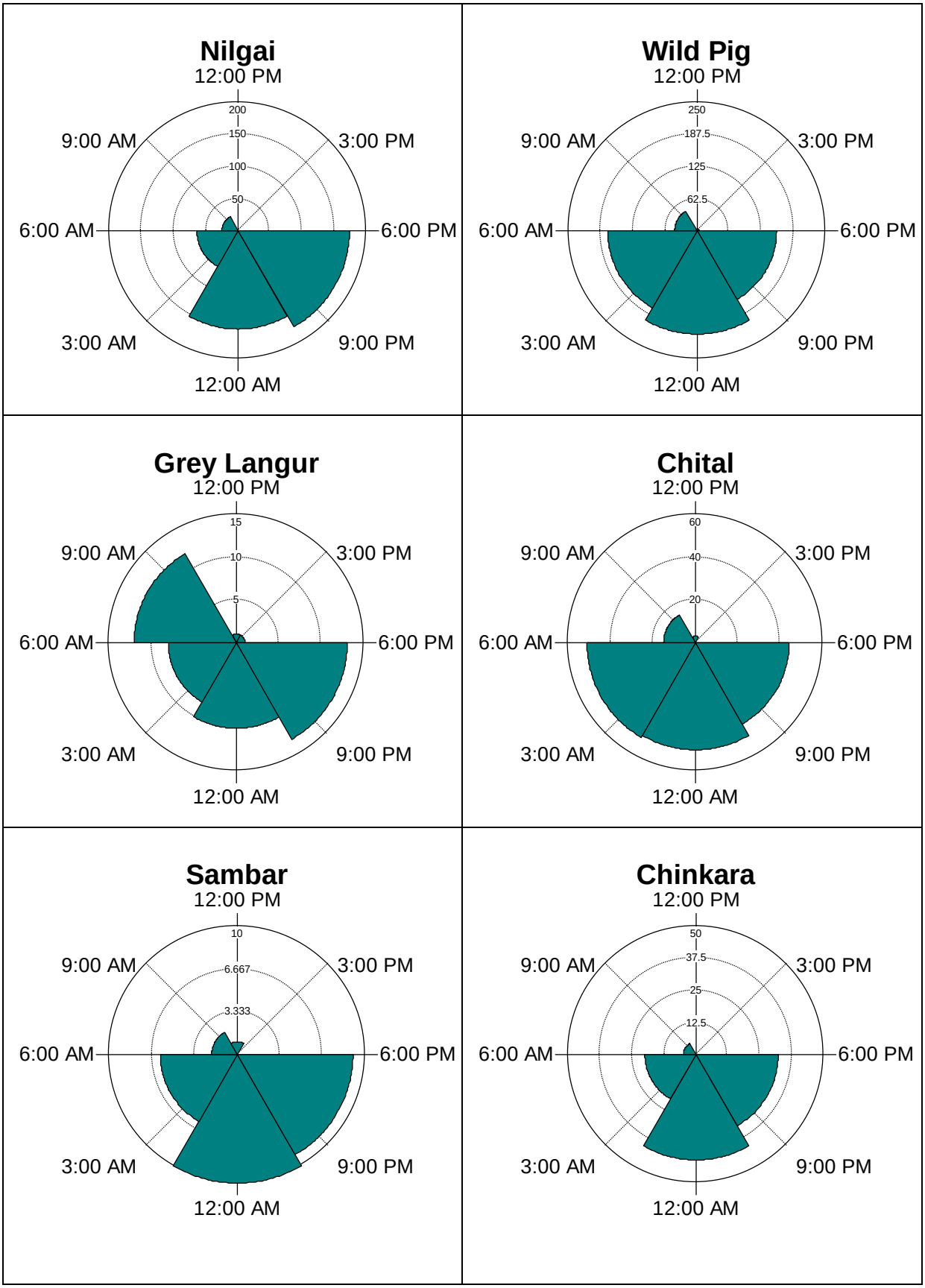

Figure 4.26: Charts depicting the time of crop depredation by wildlife in the project villages. The numbers on the Y-axis represent the frequency of responses.

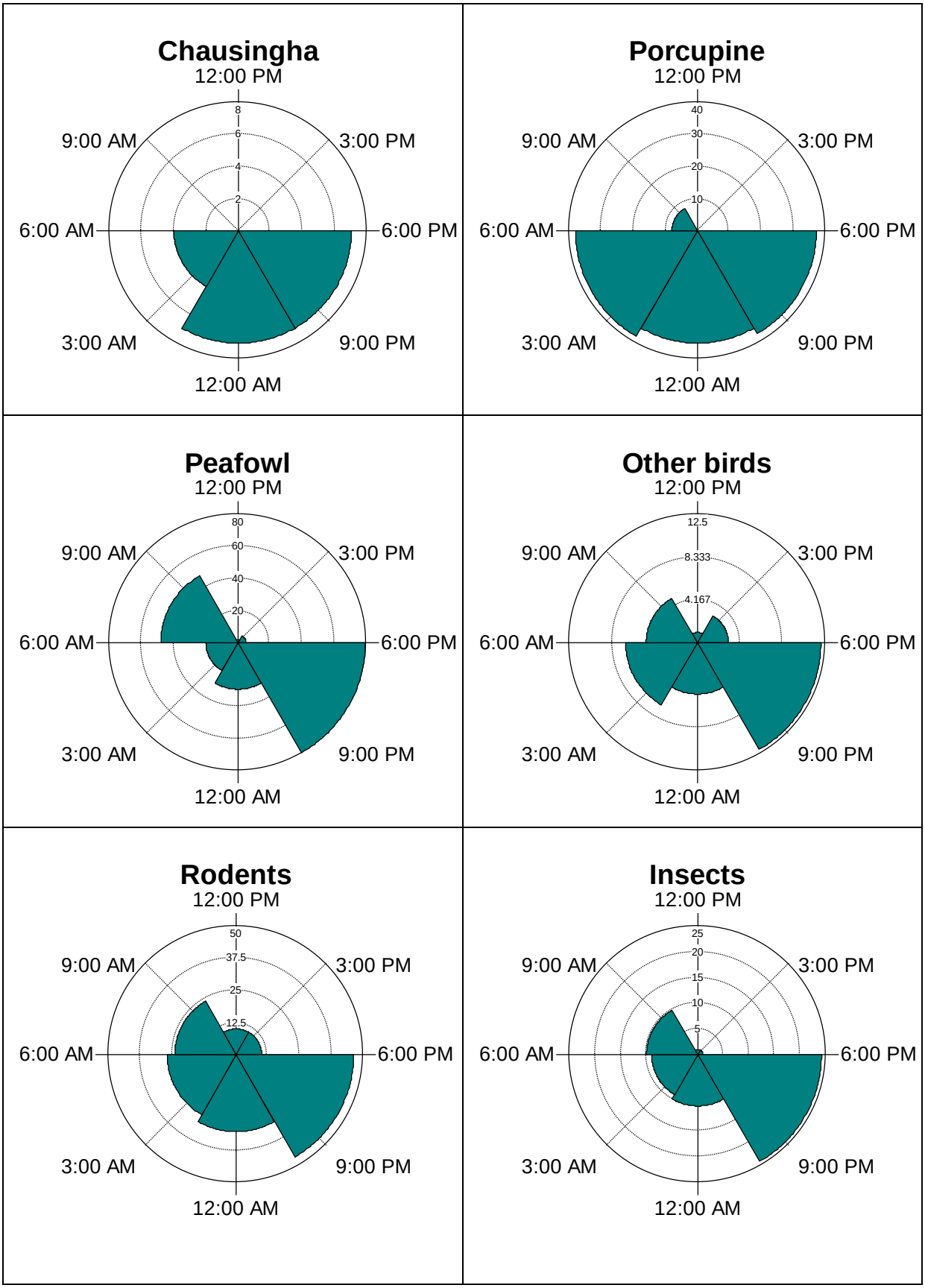

Figure 4.27: Charts depicting the time of crop depredation by wildlife in the project villages. The numbers on the Y-axis represent the frequency of responses.

The responses regarding the number of individuals of species involved in human-herbivore conflict were also recorded. Based on the species specific number of responses and people's perceptions, it was observed that the Wild Pig, Chital and Chinkara mostly occurred in group sizes of 6-10 individuals. The remaining species were recorded to occur mostly in the group sizes of 1-5 individuals (Table 4.4).

Table 4.4: Percentage representation of the group sizes of wildlife involved in human-herbivore conflict in the project villages as reported by the respondents

Species	1-5 (%)	6-10 (%)	11-15 (%)	16-20 (%)	21-25 (%)	26-30 (%)	More than 30 (%)
Nilgai	74.4	18.3	5.5	1.8	0.0	0.0	0.0
Wild Pig	31.7	43.7	13.4	11.2	0.0	0.0	0.0
Grey langur	54.9	18.3	18.3	7.3	1.2	0.0	0.0
Chital	31.7	33.5	24.0	9.6	1.2	0.0	0.0
Sambar	66.7	11.1	20.0	2.2	0.0	0.0	0.0
Chinkara	20.2	49.5	9.1	16.2	1.0	4.0	0.0
Chausingha	51.3	41.0	2.6	5.1	0.0	0.0	0.0
Porcupine	69.8	21.9	7.3	1.0	0.0	0.0	0.0
Peafowl	55.0	32.0	7.7	5.0	0.5	0.0	0.0

Data regarding the sex and age class of these species as observed or perceived by the villagers was also recorded. Based on the responses obtained, adult males of Nilgai, Grey langur, Sambar, Chausingha and Peafowl were more frequently reported. Relatively more number of adult females were reported for Wild Pig, Chital and Chinkara. A relatively large proportion of Porcupines were attributed to the unidentified class (Table 4.5).

Table 4.5: Percentage representation of the sex and age class of wildlife involved in human-herbivore conflict in the project villages as reported by the respondents

Species	Adult Male (%)	Adult Female (%)	Juvenile (%)	Young (%)	Unidentified (%)
Nilgai	39.1	24.7	21.3	8.5	6.4
Wild Pig	28.7	32.5	16.5	15.9	6.4
Grey langur	42.1	21.5	22.4	8.4	5.6
Chital	24.9	36.2	23.0	12.1	3.8
Sambar	51.8	32.1	10.7	5.4	0.0
Chinkara	26.3	33.3	17.5	14.0	8.8
Chausingha	57.9	36.8	5.3	0.0	0.0
Porcupine	29.6	31.6	0.0	5.1	33.7
Peafowl	41.2	28.2	12.2	9.2	9.2

A total of 92 responses were received for data on human-carnivore conflict. 40 GPS locations of the conflict event site were recorded (Figure 4.28 on the next page). Among these responses, 66.3% attributed Asiatic Lion to be the conflict species, followed by leopard (29.3%) and others (4.3%) (Figure 4.29).

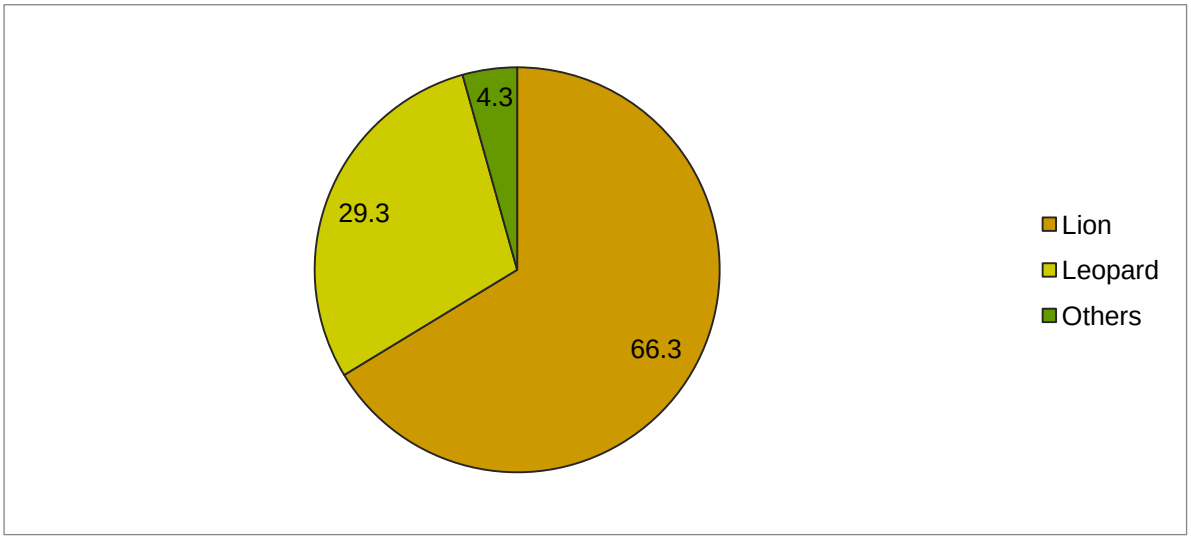

Figure 4.29: Percentage representation of the conflict species reported by respondents in the project villages

Livestock depredation was the most frequently reported type of conflict event, followed by livestock injury, human injury and human death (Figure 4.30). Among the depredated livestock, 44.4% of the cases reported those to be milch animals; however, 5.6% of the respondents did not provide information on the type of livestock

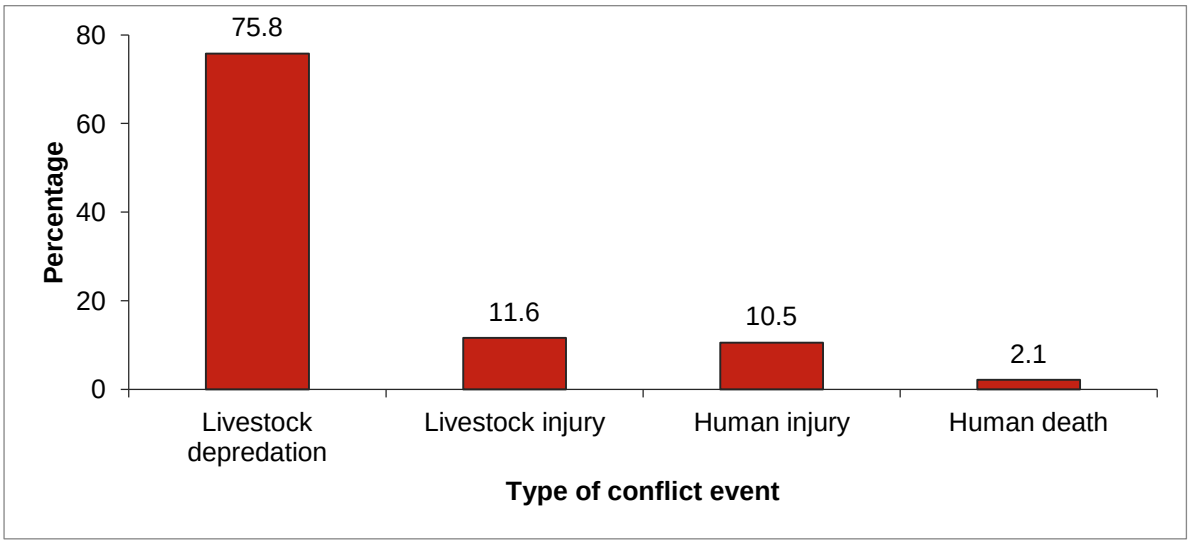

Figure 4.30: Percentage representation of the type of conflict event reported by respondents in the project villages

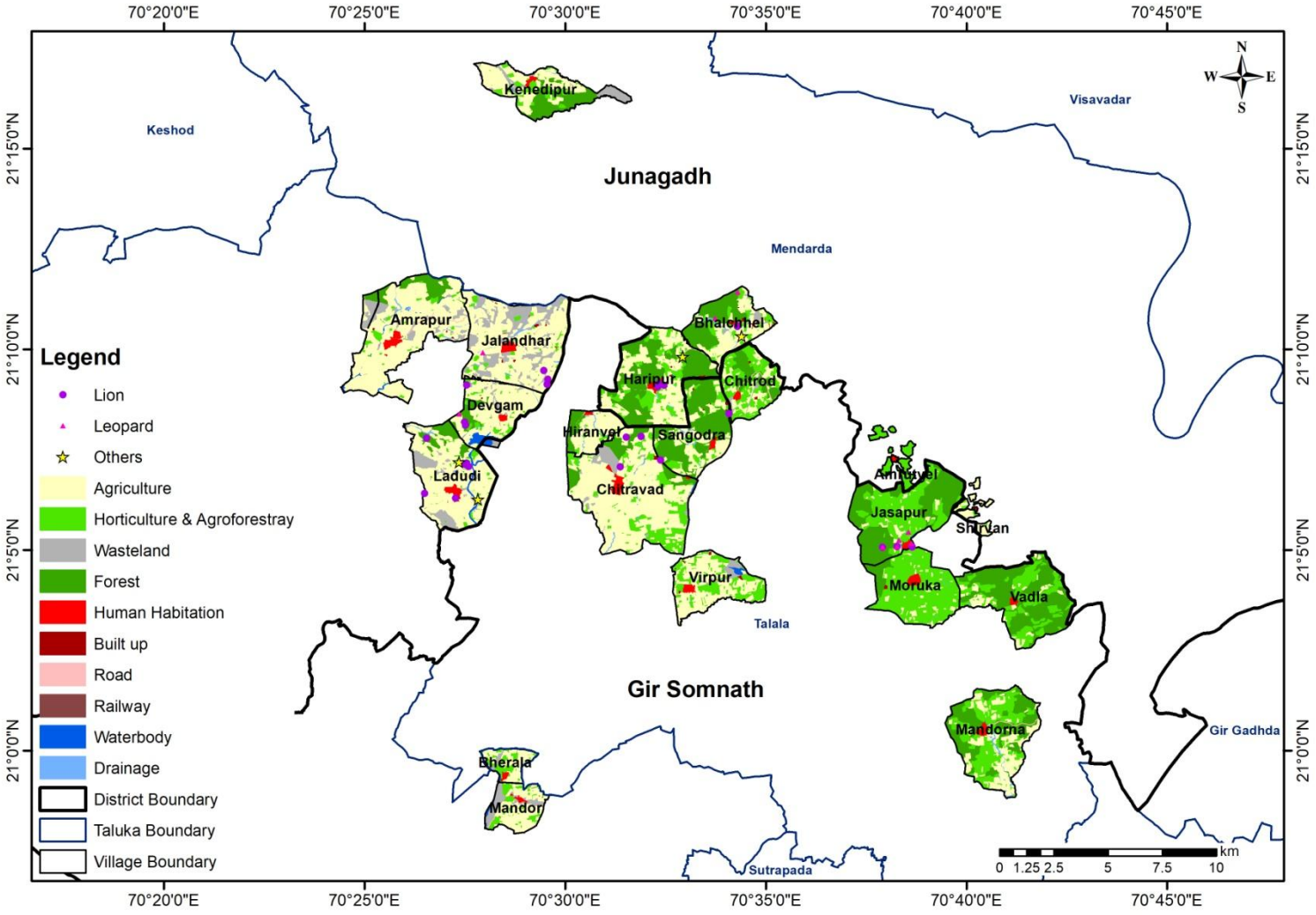

Figure 4.28: Locations of human-carnivore conflict events in the project villages

Most of the conflict events occurred in human habitations and agricultural areas (Figure 4.31). 5% of the 92 respondents did not mention the type of area where the conflict event had occurred.

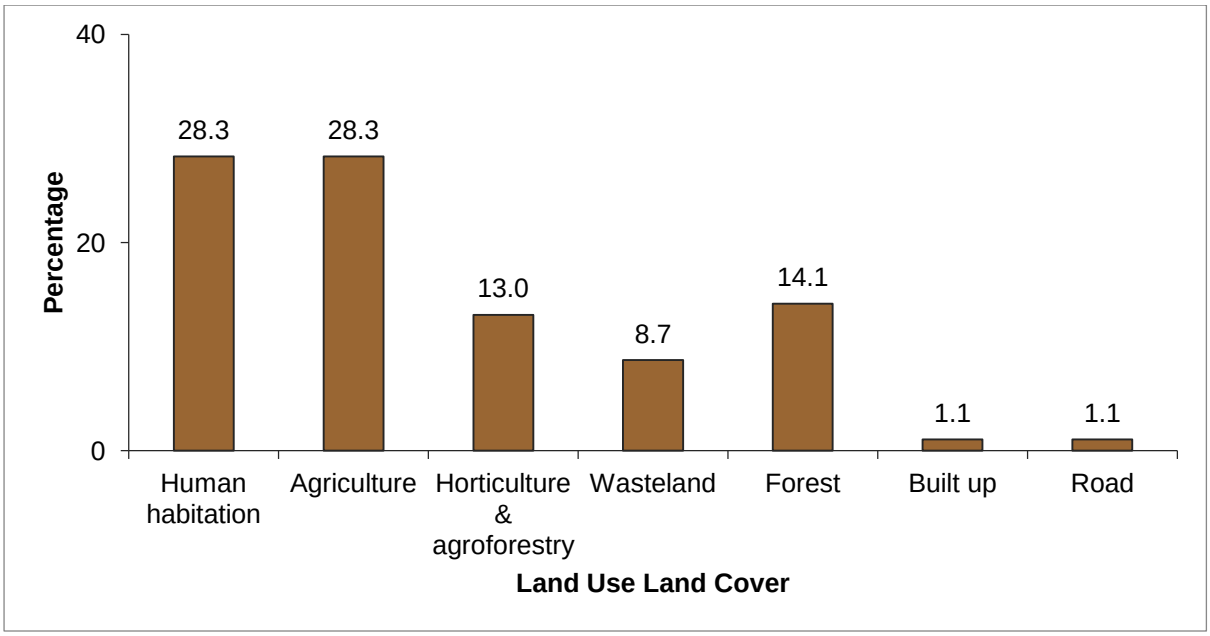

Figure 4.31: Percentage representation of the type of area where the conflict event occurred in the project villages

25% respondents mentioned that the distance to water source from the conflict event site was 1-100 metres (Figure 4.32).

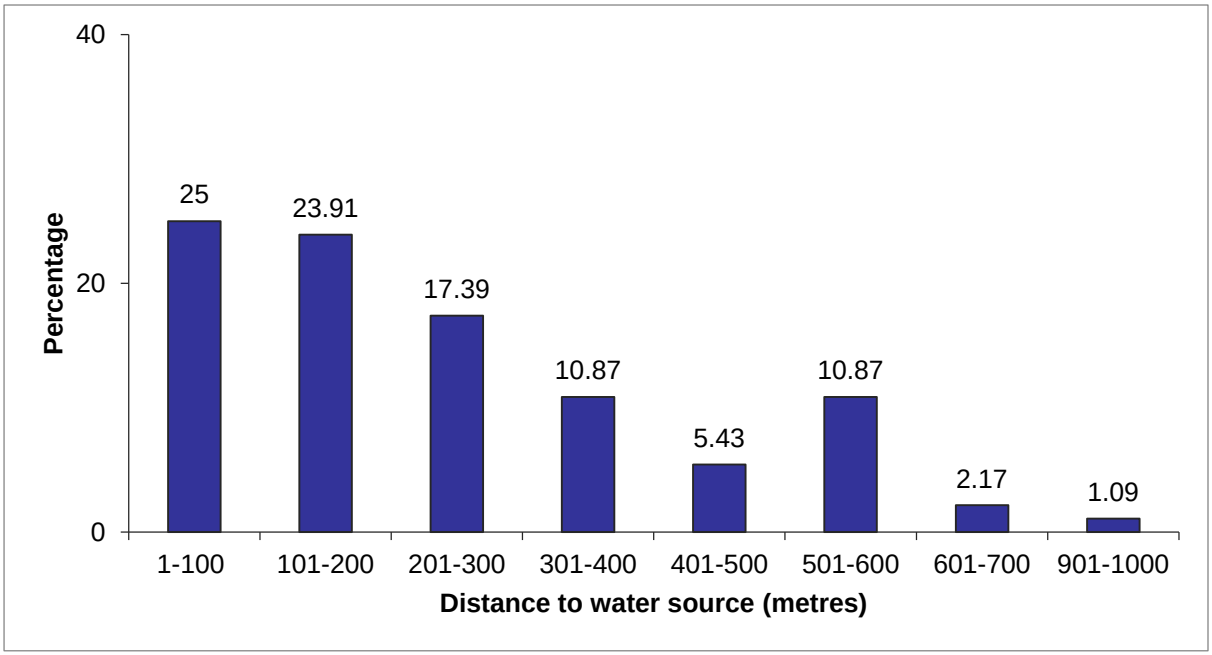

Figure 4.32: Percentage representation of the approximate distance of the conflict event site to water in the project villages

45.8% respondents who had suffered livestock depredation reported the cost of their killed livestock to be ₹ 1001-10000 (Figure 4.33). 1.4% of the respondents did not report the cost of the dead livestock.

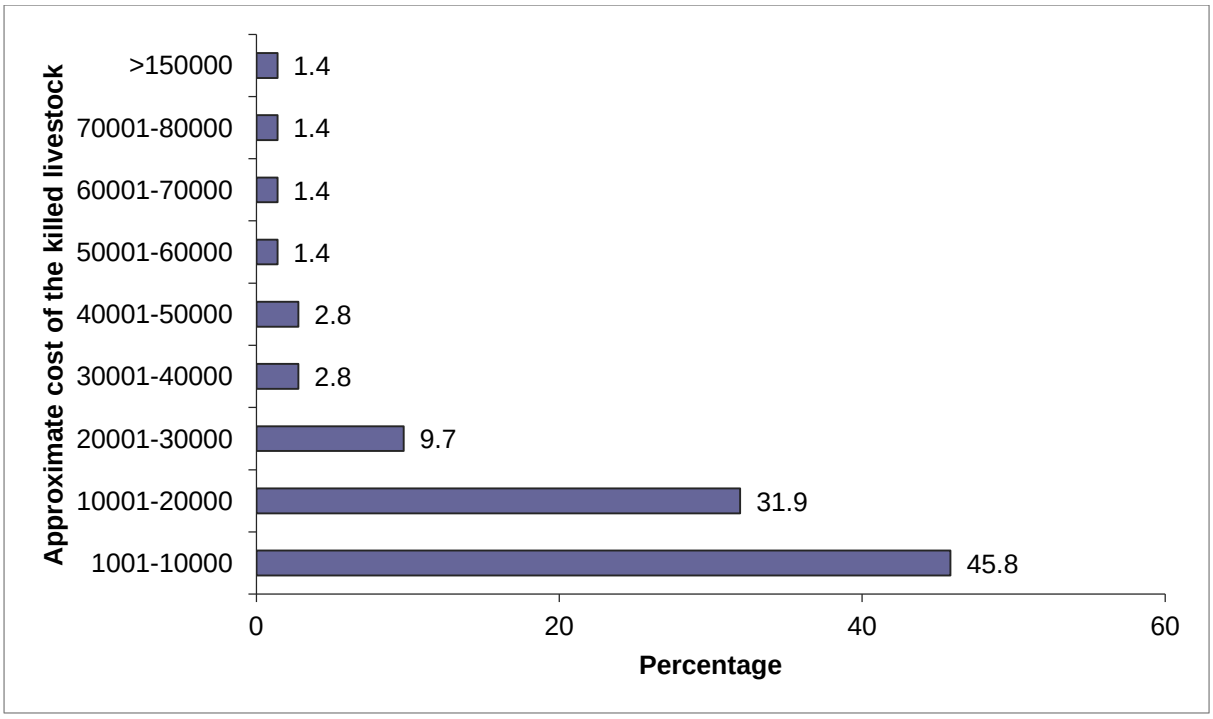

Figure 4.33: Percentage representation of the approximate cost of the killed livestock by wild carnivores in the project villages

Out of the 92 respondents, 44.6% had applied for compensation (Figure 4.34).

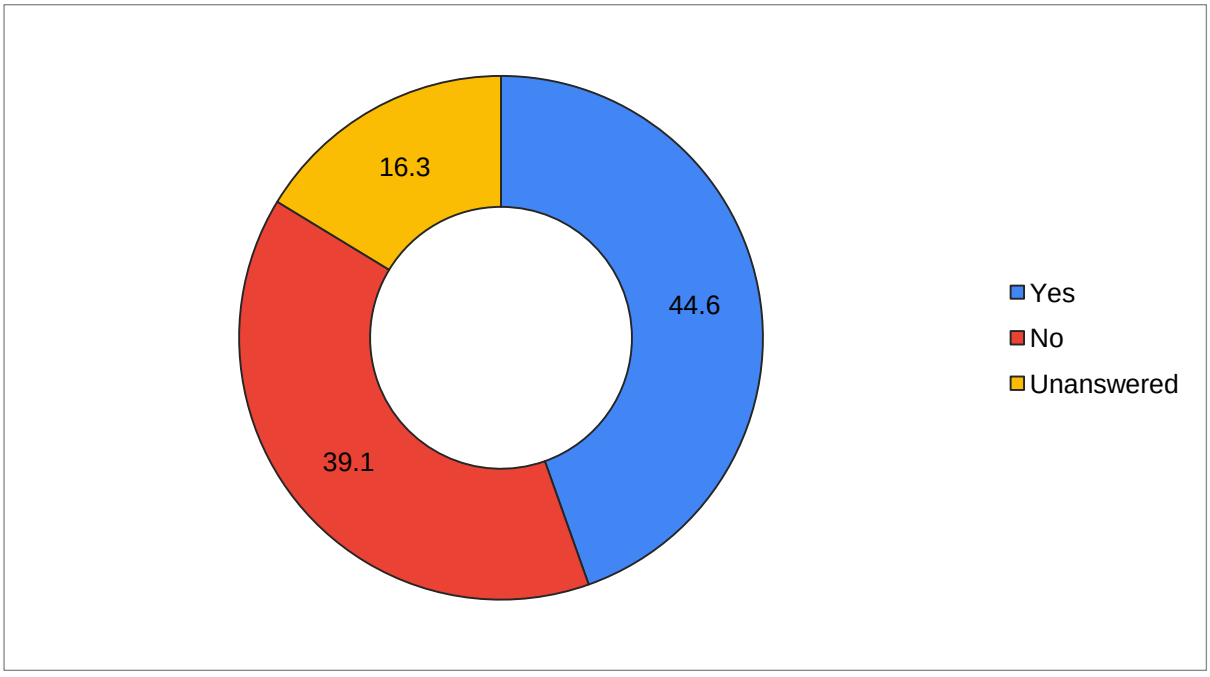

Figure 4.34: Percentage representation of the respondents who had applied for compensation in the project villages

Among these applicants, 70.7% had received the compensation (Figure 4.35).

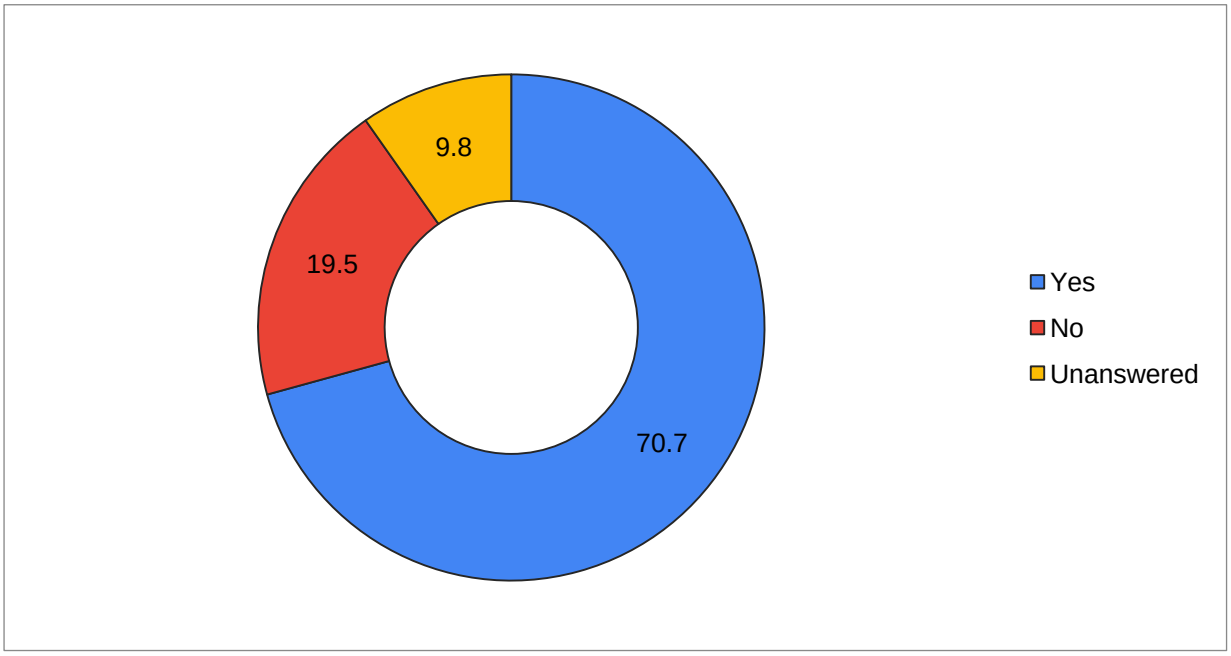

Figure 4.35: Percentage representation of the applicants who had received compensation in the project villages

Among the 29 respondents who had received the compensation, 48.3% felt that the compensation amount was adequate while 37.9% reported the compensation amount to be inadequate (Figure 4.36).

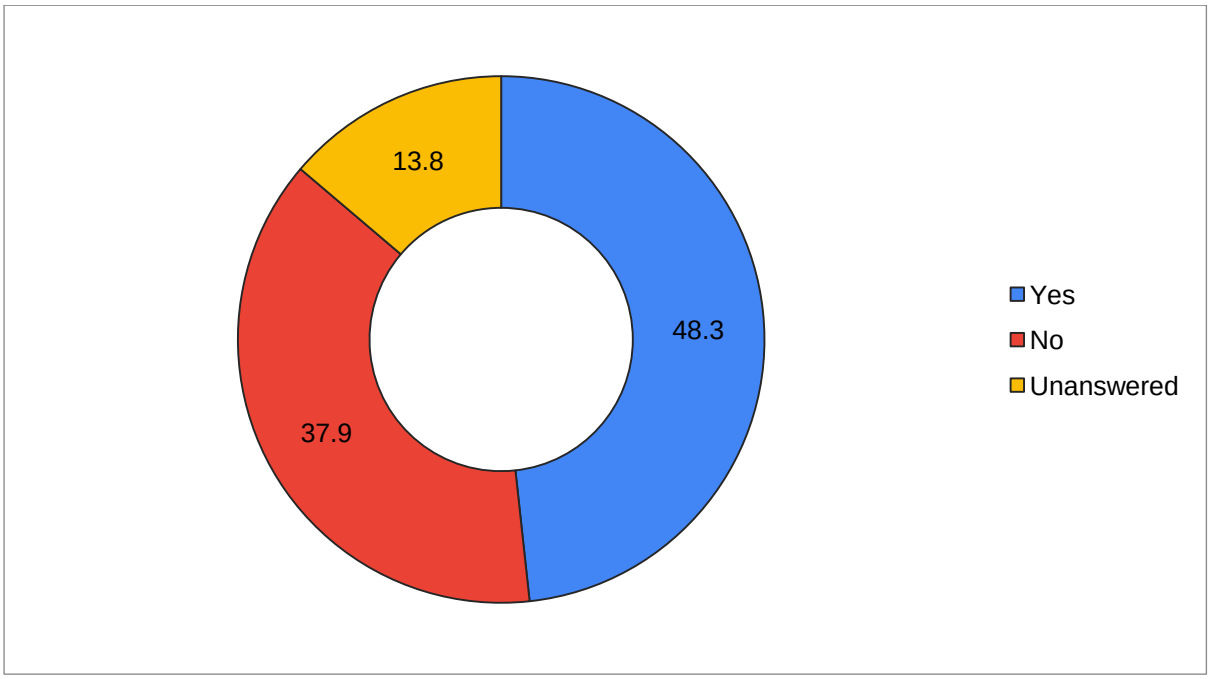

Figure 4.36: Percentage representation of the adequacy of the amount as per the compensation recipients in the project villages

Upon enquiring with the respondents who had suffered these human-carnivore conflict cases, a relatively high number of respondents (45.7%) reported sudden encounter to be the reason for the occurrence of the conflict event (Figure 4.37). Around 18% believed that the livestock were corralled in a gullible manner, while about 14% mentioned that the livestock were unguarded when the conflict event occurred. Some respondents mentioned reasons such as hampering of movement path of the animal (8.7%), open defecation (7.6%), the animal retaliated in response to disturbance by the person or people (5.4%), and irresponsible food waste disposal practices (2.2%). About 3% respondents felt that it was only natural for the carnivore to behave that way and 5.4% were not sure about the reason.

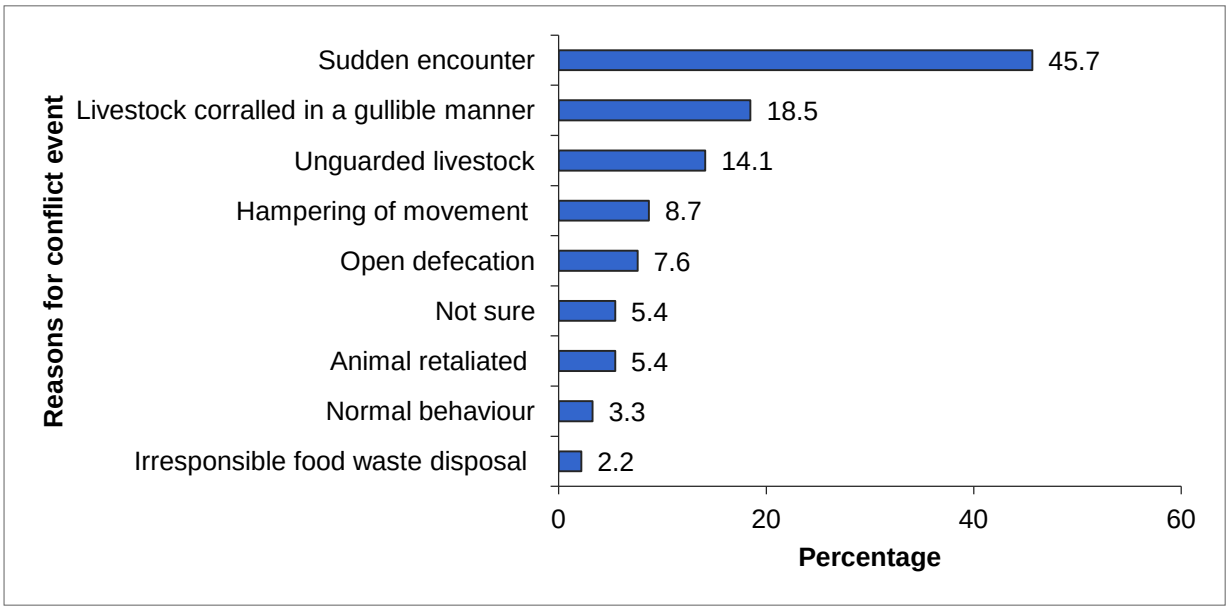

Figure 4.37: Percentage representation of the reasons behind the occurrence of human-carnivore conflict events as per respondents in the project villages

People's perceptions on the generic reasons of occurrence of human-wildlife conflict were also recorded. 408 responses were received. Among these, 17.4% respondents believed that livestock are attacked when unguarded or not corralled, 11.8% respondents believed that conflicts occur due to negligence by people to take precautions. As seen in Figure 4.38, 8.8% respondents mentioned that wild animals retaliate or act in self defence if people harass or attack them, 7.8% of them believed that over grazing by livestock reduces resources for wild herbivores and 7.4% respondents mentioned that conflict events occur due to collection of NTFP from the forests. 6.6% respondents each believed that these events occur if a wild carnivore is

old or incapable of hunting wild prey and hence attack humans as easy targets, as well as social and religious ethos result in facilitation of commensalism in non-human primates. Some of the respondents also mentioned reasons such as ill planned mitigation and management strategies (5.4%), human encroachment in wild lands (5.4%), competition for common resources between humans and wildlife (4.4%), wild herbivores prefer to feed on crops as compared to vegetation in the forests (3.4%), wild animals visit farmlands in search of water (3.2%), changing farming practices (2.5%), irresponsible disposal of food waste by humans (1.7%), non cooperation among people for implementation of mitigation measures (1.5%) and introduction of invasive alien species knowingly or unknowingly by humans (1.5%). None of the respondents felt that domestic prey was preferred over wild prey by large carnivores in the project villages.

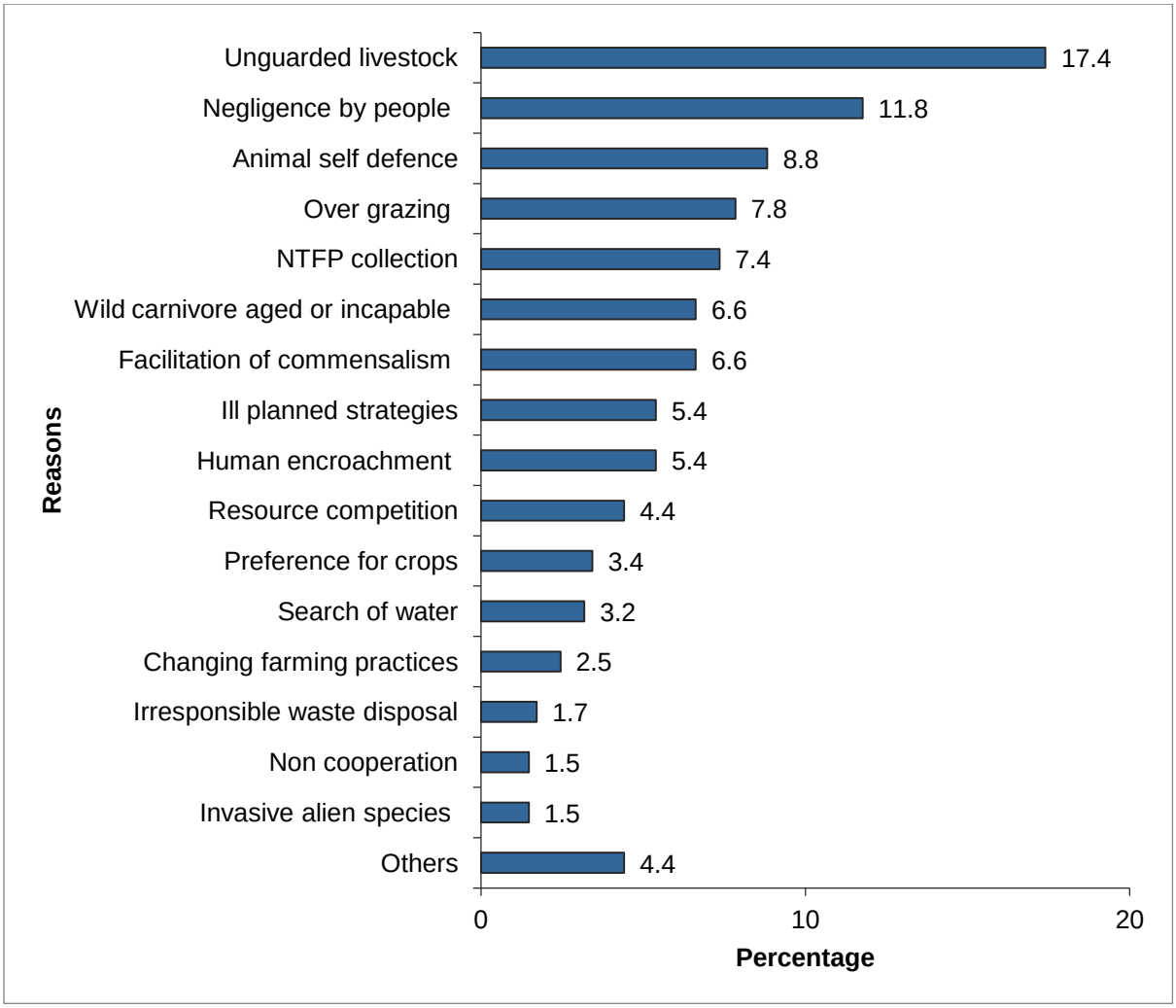

Figure 4.38: Percentage representation of the reasons behind occurrence of human-wildlife conflict as per respondents in the project villages

Upon enquiring about their opinions regarding free roaming and unguarded livestock being depredated in relatively higher proportion, 52.1% of 498 respondents nodded in agreement (Figure 4.39).

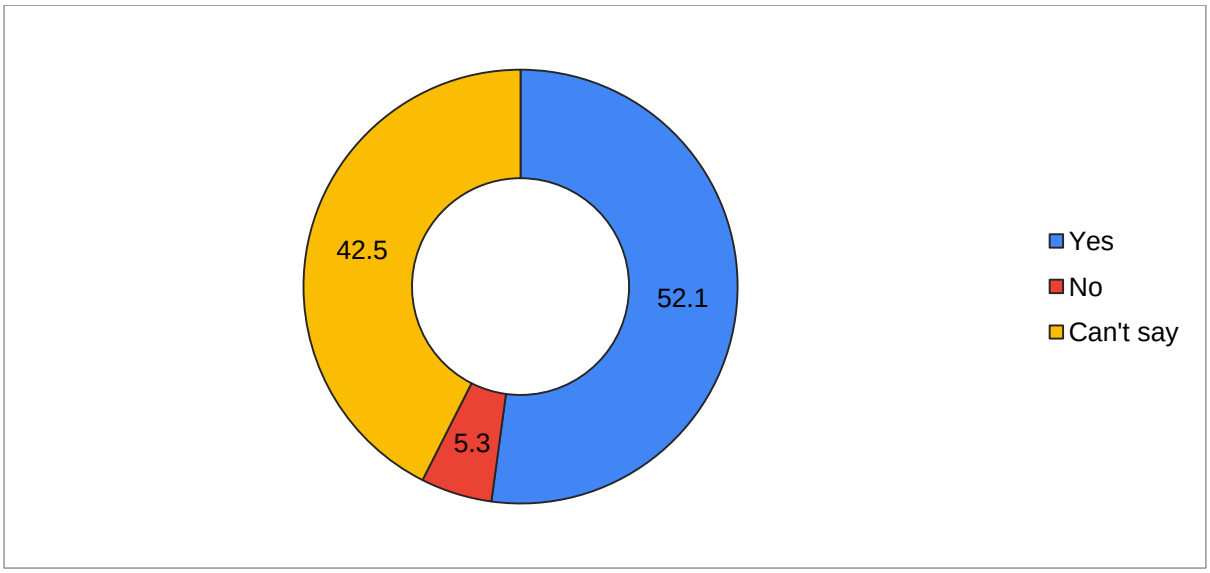

Figure 4.39: Percentage representation of the opinions on relatively high predation of free roaming and unguarded livestock in the project villages

398 responses were received for understanding the perceived frequency of human-carnivore conflict events in the project villages. Among these respondents, 32.9% reported these to occur once in 3 months (Figure 4.40).

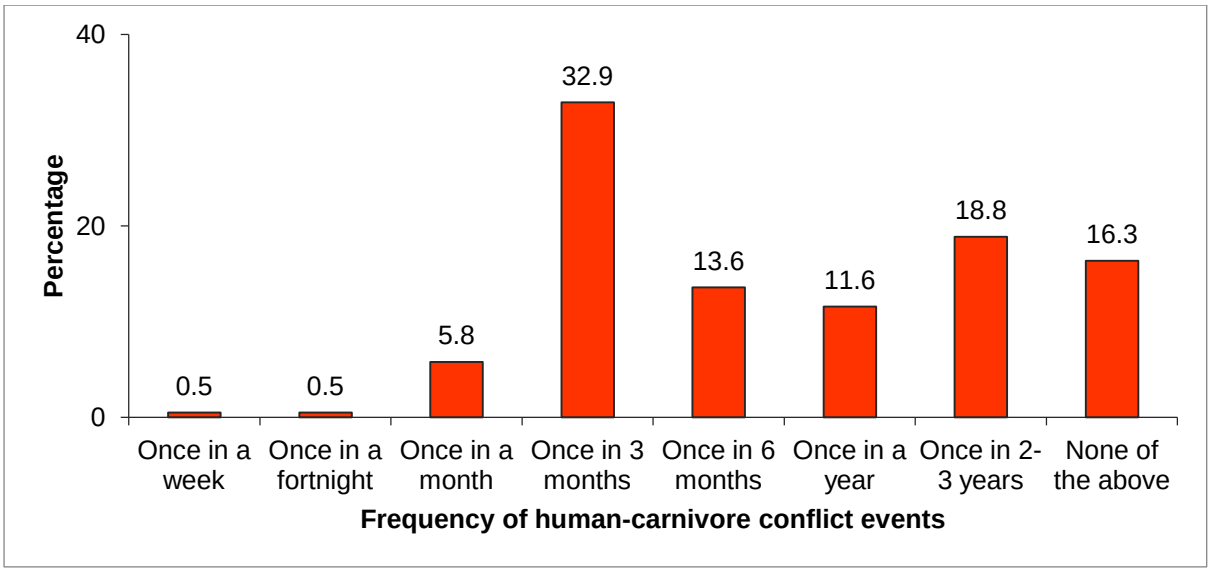

Figure 4.40: Percentage representation of the frequency of human-carnivore conflict events as per the respondents in the project villages

Similarly, 405 responses were received for the perceived frequency of human-herbivore conflict events in the project villages. Among these respondents, 22.2% reported these to occur once in 6 months (Figure 4.41).

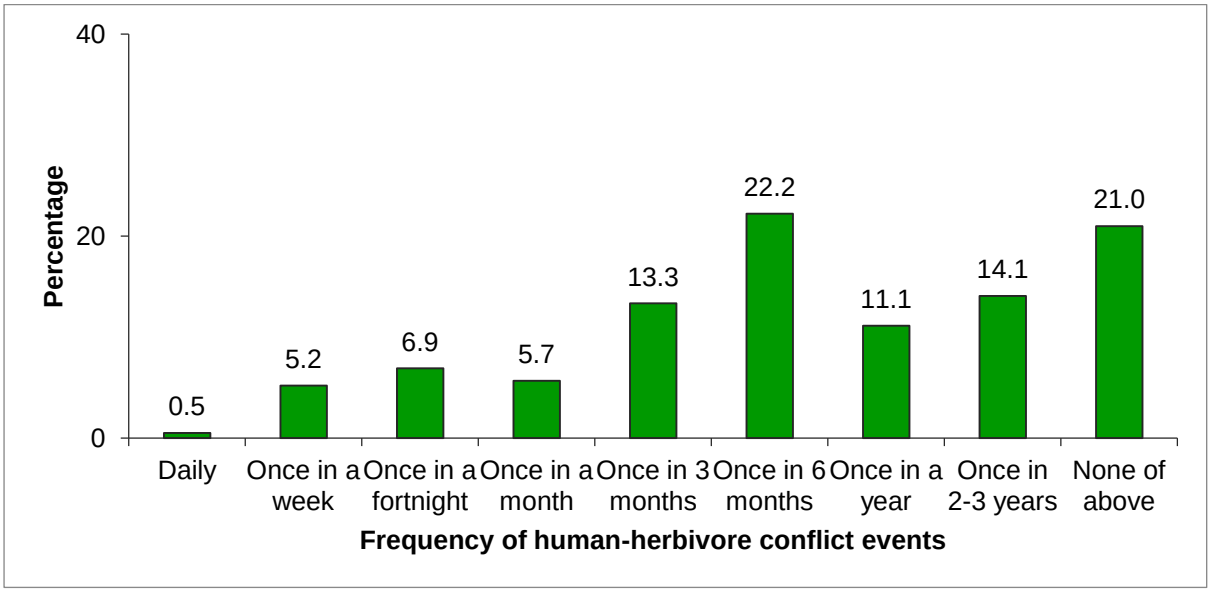

Figure 4.41: Percentage representation of the frequency of human-herbivore conflict events as per the respondents in the project villages

Based on 587 responses received, the Asiatic Lion and Indian Leopard were the most frequently observed animals by the respondents in the project villages, while the Chausingha and Indian Pangolin were the least observed (Figure 4.42).

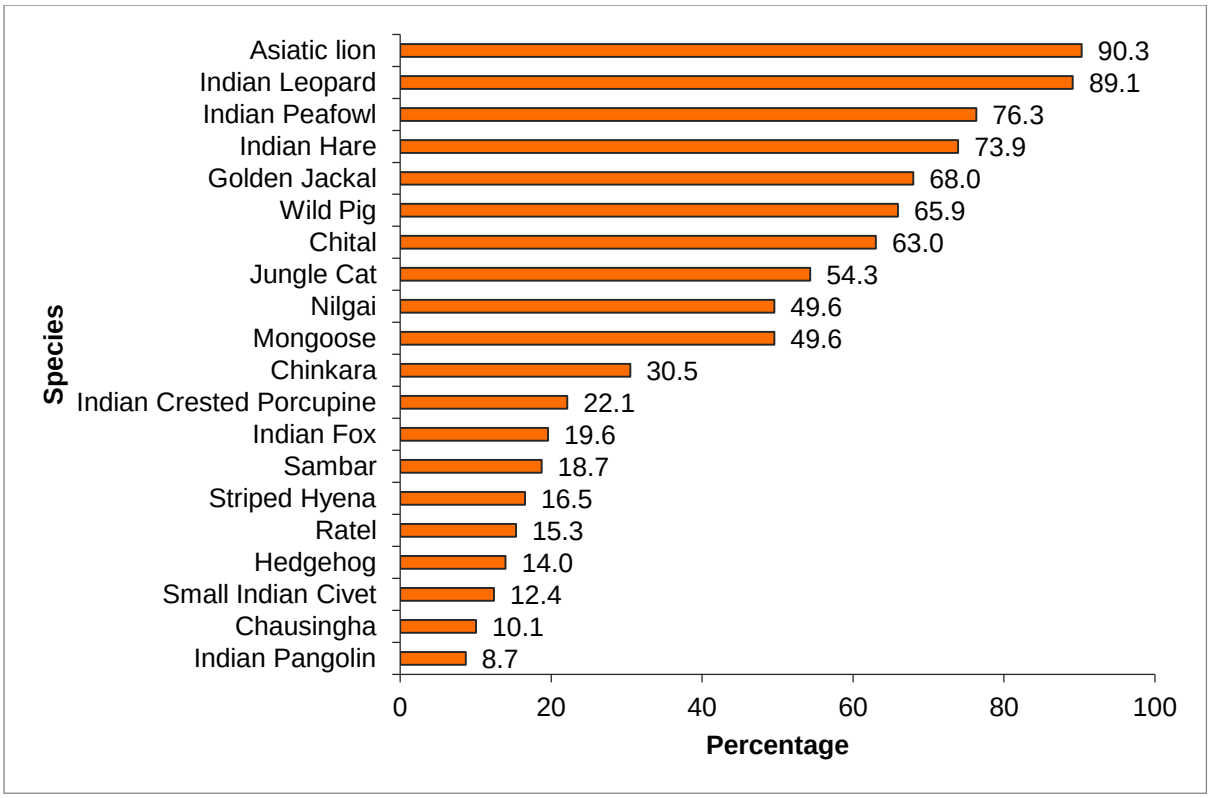

Figure 4.42: Percentage representation of the frequency of observation of wild animals by the respondents in the project villages

Among 555 respondents, 41.1% felt that wildlife was crucial for human existence while 42.7% remained neutral on the importance of wildlife for human existence (Figure 4.43).

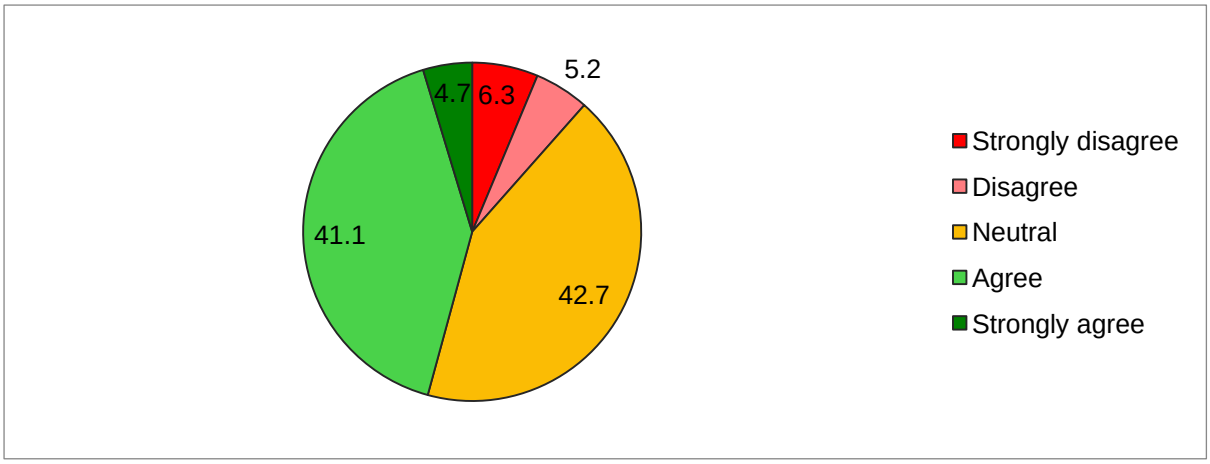

Figure 4.43: Percentage representation of the opinions on importance of wildlife for human existence in the project villages

Among 529 respondents, 47.1% had a positive attitude towards human-wildlife coexistence, while 41.8% remained neutral. About 11% respondents depicted a negative attitude regarding human-wildlife coexistence (Figure 4.44).

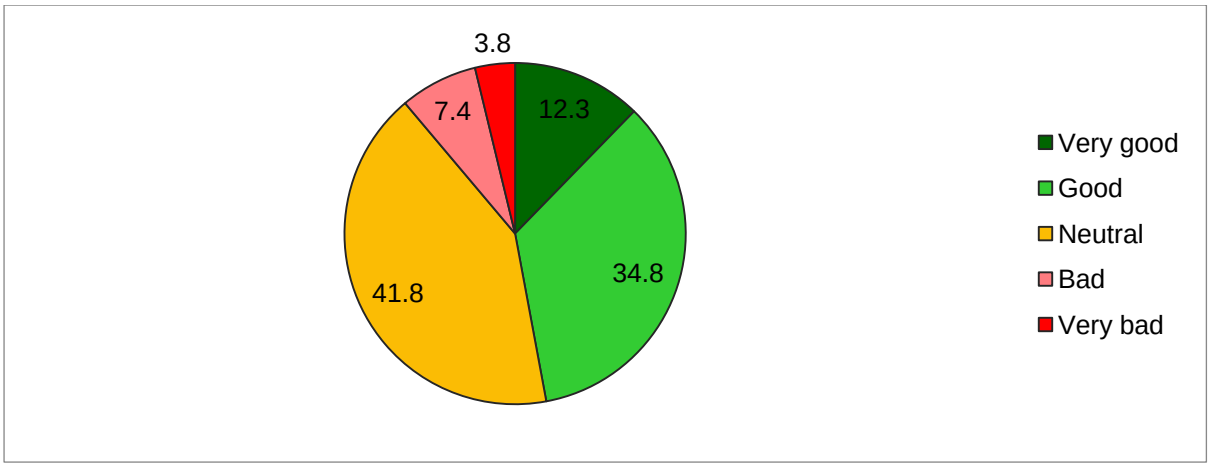

Figure 4.44: Percentage representation of the attitudes regarding human-wildlife coexistence in the project villages

A total of 391 responses were received regarding the employed mitigation measures in the project villages. Night patrol was the most common mitigation measure followed by bio-fencing and barbed wire fencing. Cement sheet fences were the least used mitigation measure and a few respondents mentioned that they used no mitigation measure (Figure 4.45).

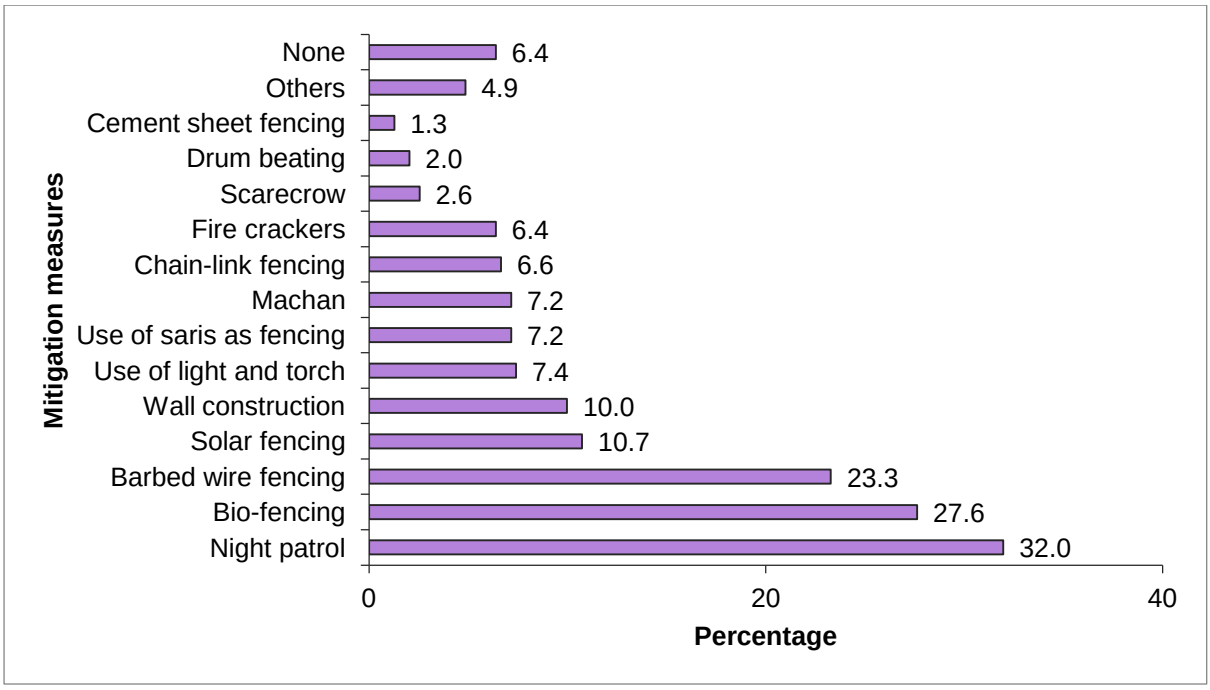

Figure 4.45: Percentage representation of the mitigation measures implemented in the project villages

Among the different mitigation measures employed, solar based power fencing was reported as the most satisfactory, followed by wall construction, chain-link fencing *Machan*, and barbed wire fencing. Cement sheet fencing, sari fencing and bio-fencing were reported to be the least satisfactory (Table 4.6)

Table 4.6: Percentage representation of efficacy of various mitigation measures in the project villages as reported by the respondents

Mitigation measure	Not Satisfactory	Satisfactory	Highly satisfactory	Unsure	No experience
Night patrol	28.8	38.4	4.8	1.6	0.0
Bio-fencing	**54.6**	20.4	0.0	0.9	0.0
Barbed wire fencing	35.2	**58.2**	2.2	2.2	1.1
Solar fencing	0.0	9.5	**61.9**	0.0	0.0
Wall construction	23.1	**64.1**	2.6	0.0	0.0
Use of light and torch	13.8	44.8	3.4	0.0	0.0
Use of saris as fencing	**75.0**	3.6	0.0	0.0	0.0
Machan	7.1	**60.7**	3.6	3.6	0.0
Chain-link fencing	11.5	**61.5**	3.8	0.0	0.0
Fire crackers	20.0	4.0	0.0	0.0	0.0
Scarecrow	20.0	30.0	10.0	20.0	0.0
Drum beating	12.5	0.0	0.0	0.0	0.0
Cement sheet fencing	**60.0**	20.0	20.0	0.0	0.0
Others	5.3	0.0	0.0	0.0	0.0

114 respondents provided information on the cost of the employed mitigation measure. Majority of mitigation measures incurred an expense upto ₹50000 (Figure 4.46).

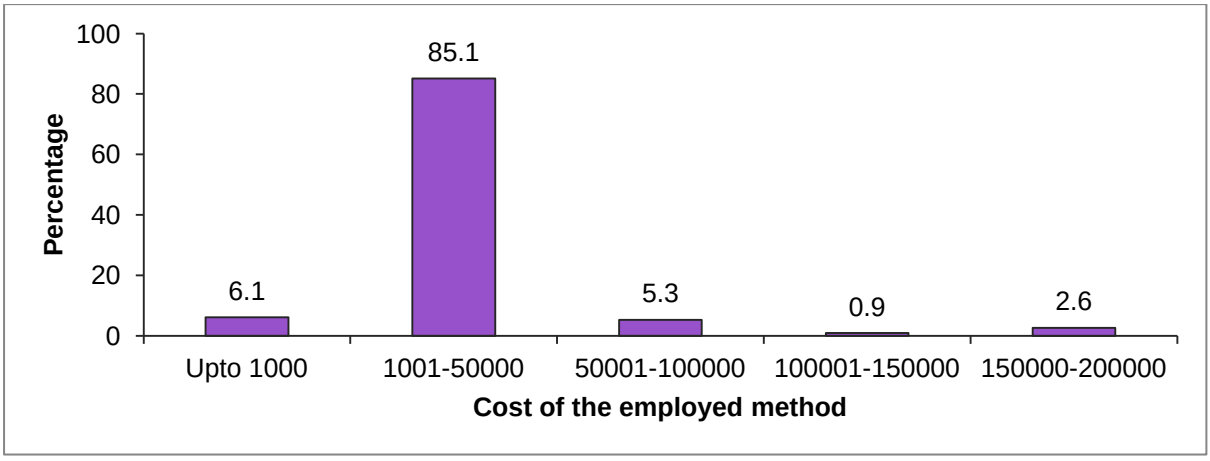

Figure 4.46: Percentage representation of the mitigation measures employed in the project villages

Out of 606 respondents, 44.9% did not provide any information for any benefits availed for implementation of mitigation measures. Only 8.9% of the respondents mentioned that they had availed any benefits. A majority of these respondents had availed benefits from non-governmental organizations, followed by the government and other sources (Figure 4.47).

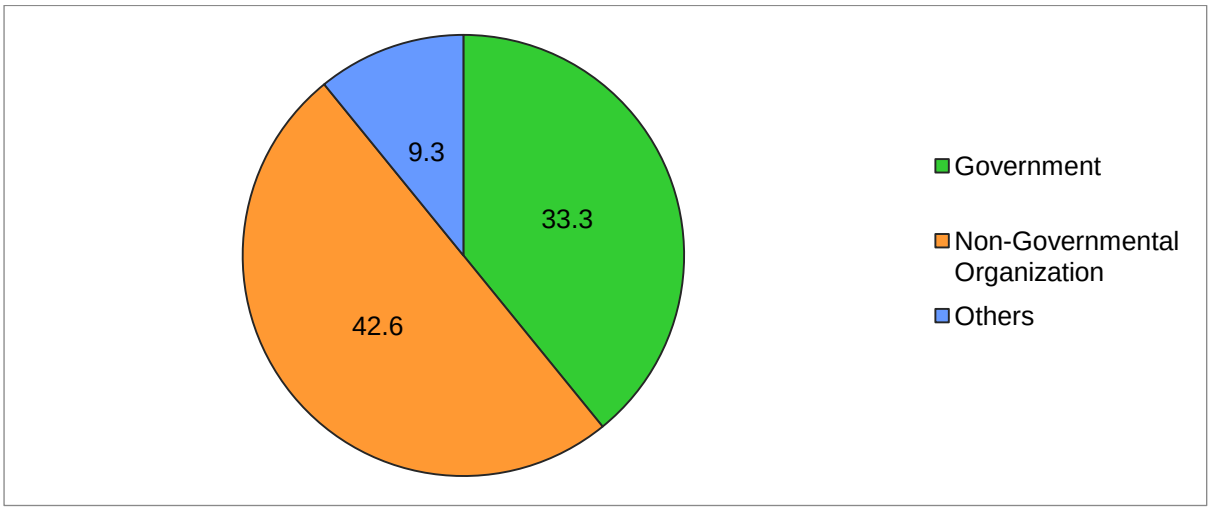

Figure 4.47: Percentage representation of agencies that provided support for mitigation to respondents in the project villages

Building of *Machan* was the most commonly reported scheme for which benefits were availed from the above mentioned agencies, followed by covering of wells (Figure 4.48). Eight respondents did not provide any information on the schemes.

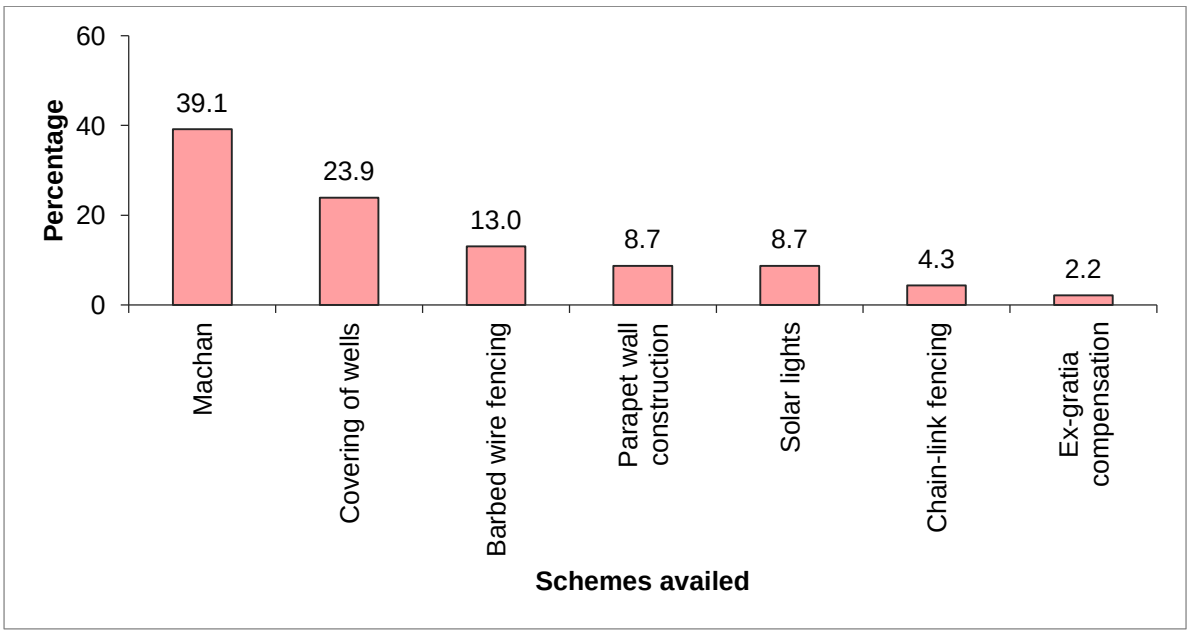

Figure 4.48: Percentage representation of schemes availed as part of mitigation by respondents in the project villages

A total of 218 respondents provided suggestions for mitigation of human-wildlife conflict. A vast majority among them felt the need for generation of awareness and people participation, followed by the need for practicing caution, assistance from the government, fencing, etc. (Figure 4.49).

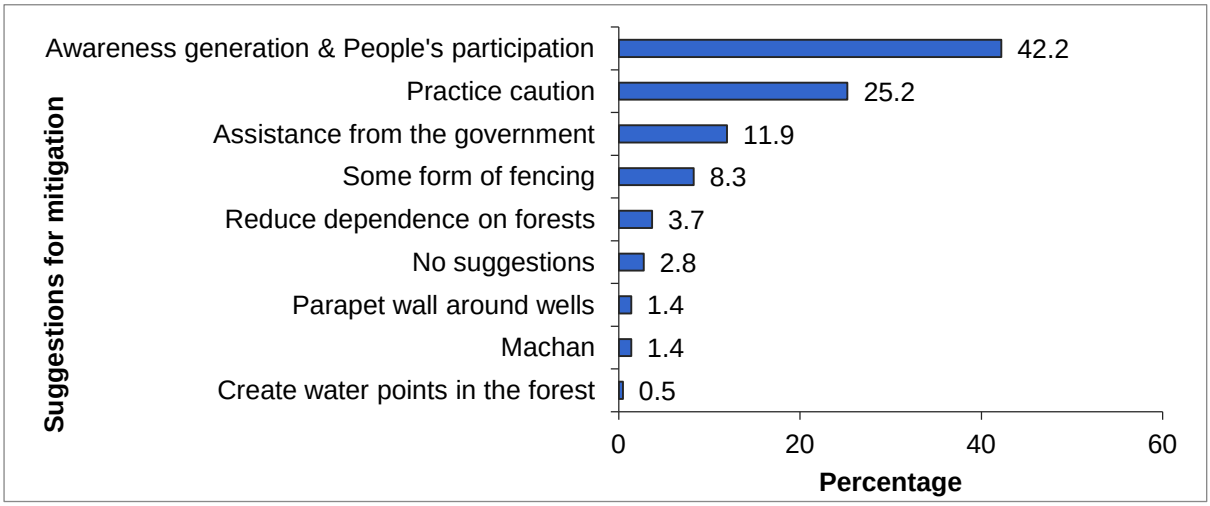

Figure 4.49: Percentage representation of the suggestions for mitigation provided by respondents in the project villages

181 respondents provided information regarding their expectations from the government or the society for mitigating human-wildlife conflict. These included cooperation among people and with the government, provision of government schemes, subsidized fencing, *Machan* and solar lights in addition to development of a responsible waste disposal mechanism in the villages, habitat management and protection of wildlife as well as provision of grazing land (Figure 4.50).

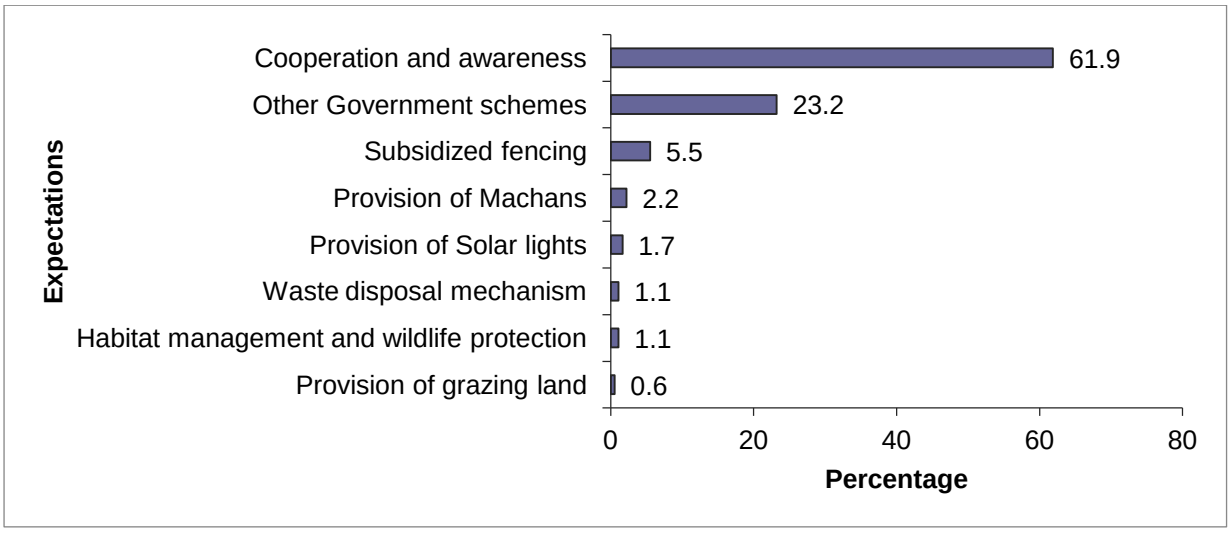

Figure 4.50: Percentage representation of the respondents' expectations from the government and society for mitigating human-wildlife conflict

Discussion

The study landscape is dominated by agriculture, followed by horticulture & agroforestry, thus suggesting the occurrence of an agrarian economy in the project villages. Accuracy assessment is important to determine the quality of the information derived from remotely sensed data in classified maps (Fitzgerald and Lees 1992, Congalton and Green 1999). Accuracy assessment, governs the degree of correctness of the classified vegetation groups compared to the actual ones (Basu 2013). A correct map is the one that provides a true representation of the region it characterizes (Foody 2002, Weber 2006). The LULC maps for the villages had a mean Kappa value of 0.99. These maps thus bear high accuracy and can be used for further planning and implementations of various works in the future.

The documentation of the floristic composition was carried out in part through direct field observations by *Gir Mitras*. A majority among them graded the Reserved *vidis* to be in an average condition with the primary attributable reason being relatively dense tree cover. All the reserved *vidis* possessed invasive alien species. Consequently, the most frequently suggested improvement measure for reserved *vidis* was removal of weeds and invasive alien species. Similar observations on the condition of the Non-Reserved *vidis* and the presence of invasive alien species were recorded, with an emphasis on the need for better protection and management measures for improvement of the Non-Reserved *vidis* in the project villages. For villages that were on the fringe of the forested areas, the primary improvement measures suggested for these habitats by *Gir Mitras* included removal of invasive alien species and tree plantations. The basic awareness among *Gir Mitras* regarding issues and concerns in conservation of these habitats could be evaluated through this component. The Reserved and Non-Reserved *Vidis* as well as different classified forests are under the jurisdiction of the state forest department and these hold sizeable populations of wildlife (Ram et al. 2021a). The habitat improvement measures and interventions are being undertaken by Gujarat Forest Department in the landscape (Meena and Kumar 2012). Appropriate management interventions should be continued to conserve these pristine grasslands (Mehta 2015).

Most of the villages possessed a *Gauchar* of up to 4 hectares, the majority of which were graded as being in an average condition by the *Gir Mitras*. The most frequent reasons cited for the reported condition were invasion by alien species and dense tree cover. Eradication of invasive alien species and encroachment dominated the suggested improvement measures for the *Gauchar*. Grazing by livestock does occur in these areas with majority of the *Gir Mitras* reporting about 51-100 livestock observed per day in the *Gauchar*. The improvement measures for *Gauchar* need to be taken up by the competent authorities through eradication of invasive alien species and encroachment, undertaking plantation of high quality fodder which should also be well protected and increase in the area where possible to sustain the dietary requirements of the livestock in the village. Carnivores such as Asiatic Lion, Indian Leopard and Golden Jackal and herbivores like Wild Pig, Nilgai and Chital have been frequently observed in the *Gauchar*.

The majority wastelands were also graded to be in an average condition with primary reasons for the reported condition attributable to rocky substratum, illegal mining and poor management regime. All the wastelands were infested with invasive alien species. The villagers do take their livestock for grazing in the wastelands. The suggested measures for the improvement of wastelands in the project villages included afforestation, prohibition of illegal mining, removal of encroachment, increase the productivity of the soil, garnering support among villagers and eradication of invasive alien species. The frequently reported mammals observed in the wastelands included Asiatic Lion, Indian Leopard, Golden Jackal, Wild Pig and Nilgai. Wastelands are important wildlife areas and provide suitable habitats and also act as conducive corridors for the movement of long ranging animals (Ram et al. 2021b). The concerns and issues regarding the condition of the wastelands could be reported to the competent authorities who could then devise strategies and undertake viable actions for development of wastelands for the benefit of the wildlife and the people.

Some *Gir Mitras* collected information on the locations of the invasive alien species in their villages. Most of these locations were in privately owned lands and revenue areas. A diverse set of eradication measures have been implemented for the removal

of these species pan India, the most common being manual removal (Mungi et al. 2015). Areas with infestation of these species should be cleared first and then plantations of native flora need to be carried out on priority in the project villages. The eradication and differential use of these species also holds potential to generate livelihoods through community involvement. Multiple policies for the management of invasive alien species in India are already in place (Mathur et al. 2015). Adhering to these policies and guidelines would aid in avoiding further proliferations of these species.

Most of the senior citizen respondents interviewed for understanding the changes in the floristic composition were males in the age class of 60-70 years. They were chiefly involved in farming. A large majority of these respondents opined that there was a change in the floristic composition in their villages and rated this change to be good. However, they attributed these changes to occur due to negative anthropogenic impacts. From the responses, it seems that the species composition in the landscape hasn't drastically changed. However, 21 out of the 85 tree species that were observed by them in their childhood are not observed in the villages now. Among these, *Sesbania grandiflora* and *Commiphora wightii* are still a rarity in the Gir landscape. 17 out of 85 reported species of trees have recently been observed in their opinion and most of them are ornamental or are a part of the current horticulture practices. 7 out of 27 species of shrubs were reported to occur during their childhood but not observed now. From these responses, it seems that cultivation of *Ricinus communis* and *Helianthus annuus* may have been common in the landscape previously. 6 out of 26 species of shrubs were reported to be observed recently which includes *Gossypium herbaceum, Jatropha curcas* and *Tecoma stans.* These thus seem to have been relatively recent in cultivation. 12 species of herbs out of 56 were reported to be observed earlier indicating occurrence of plants of ethnobotanical value and the farming of *Daucus carota*, *Spinacia oleracea* being carried out previously in these villages. 13 out of 54 species of herbs were reported to be observed recently including the invasive *Senna uniflora* and other plants of ornamental value. From these responses, it seems that the cultivation of *Cajanus cajan* in these villages is relatively recent. Three out of the reported 6 species of climbers were observed earlier. The ones observed recently

included some ornamental climbers. *Combretum ovalifolium* is commonly observed in the Gir landscape. 4 species of grass out of 25 were reported to occur previously, some of them being of high nutritional value for livestock. 8 species of grass being recently observed also included some high quality fodder but indication of *Aristida adscensionis* indicates degradation of the soil. *Bambusa vulgaris* was reported to be observed recently. 68 species of trees, 19 species of shrubs, 54 species of herbs, 6 species of climbers and 22 species of grass were reported to be of significance to people, livestock and wildlife. The overall responses from the senior citizens indicate that they are well versed with the vegetation occurring in their villages. More than 90% of these respondents were aware about invasive alien species and more than 50% identified *Senna uniflora, Parthenium hysterophorus, Lantana camara* and *Prosopis juliflora* to be invasive. They reported to have largely observed domestic livestock to be feeding on plant parts of the invasive alien species.

The ethnobotanical uses of 52 plant species were recorded. *Azadirachta indica* is considered to be one of the most valuable plant species for its medicinal properties (Biswas et al. 2002). *Senna auriculata* was reported to be used for treatment of muscular inflammation in the project villages. The plant also has other medicinal properties that include antibacterial, antioxidant, antiinflammatory and antidiabetic (Samy and Ignacimuthu 2000, Kumaran and Karunakaran 2007, Prasathkumar et al. 2021). *Achyranthes aspera* is used as a *Datun,* the plant also bears wound healing, antioxidant and anti-inflammatory properties (Edwin et al. 2008, Vijayakumar et al. 2009). The twigs of *Mimusops elengi* are also used as *Datun*. The medicinal properties of this plant have been well documented (Baliga et al. 2011a, Gami et al. 2012). *Solanum surattense* is used to cure cough. The plant also has antioxidant properties (Muruhan et al. 2013). *Terminalia chebula* has many medicinal properties and is thus considered to be important for maintaining good health, it is also a key ingredient in the *Triphala* powder (Gupta 2012). *Aloe barbedensis* is used to treat constipation in the project villages and also as a cosmetic for skin and hair. Aloe vera has a long history of use as a topical and oral therapeutic (Boudreau and Beland 2006). *Maytenus emarginata* is used in the project villages to cure jaundice. The plant has shown antibacterial properties (Moteriya et al. 2014). *Xeromphis spinosa* has been

traditionally used in India to treat gastrointestinal and hepatic problems and as an anti-inflammatory (Lee et al. 2019, Timalsina et al. 2021). In the project villages, it is also used in treating the site of a snake bite. The fruit has cultural significance in the wedding ceremonies in Gujarat. *Eclipta prostrata* is used to enhance hair quality and treating scalp problems. It is also used in therapy of respiratory disorders (Fang et al. 2019). In the project villages, *Ocimum americanum* leaves are used to treat dysentery. The plant also has culinary uses and has been known to possess antimicrobial properties with a suggested use in oral health care (Thaweboon and Thaweboon 2009). *Ficus religiosa* is used to treat dermatitis in the project villages. The tree is considered to be one of the most sacred in India and has vast applications in ethnobotanical context and has been recorded to treat ailments of the central nervous system, endocrine system, gastrointestinal tract, reproductive system, respiratory system and infectious disorders (Singh et al. 2011). *Eucalyptus globulus* is used in treating cold, fever and pulmonary disorders. The essential oil also possesses anti-inflammatory and analgesic properties (Silva et al. 2003). *Ocimum sanctum* is considered to be the most sacred herbs in India and holds religious and cultural significance. It has a wide range of therapeutic applications in the country (Pattanayak et al. 2010). *Typha elephantina* has been reported to have various therapeutic activities including membrane stabilizing potential, anthelmintic, thrombolytic, antioxidant, wound healing, anxiolytic, anti-inflammatory, analgesic and cytotoxic activities (Singh et al. 2020). The fruits and roots of *Tribulus terrestris* have been used as a folk medicine for thousands of years in China, India, Sudan, and Pakistan (Zhu et al. 2017). It has diuretic, aphrodisiac, antiurolithic, immunomodulatory, antidiabetic, absorption enhancing, hypolipidemic, cardiotonic, central nervous system, hepatoprotective, anti-inflammatory, analgesic, antispasmodic, anticancer, antibacterial, anthelmintic, larvicidal, and anticariogenic activities (Adaikan et al. 2001, Chhatre et al. 2014). *Zingiber officinale* is used as a condiment, and has several medicinal, ethno medicinal and nutritional values (Kumar Gupta and Sharma 2014). *Vitex negundo* is also an important plant documented for its medicinal values (Vishwanathan and Basavaraju 2010, Gill et al. 2018). *Punica granatum* is a common fruit with medicinal values (Jurenka 2008). *Aegle*

marmelos has cultural significance in India and has been recorded to have many ethnobotanical applications (Kala 2006, Baliga et al. 2011b, Rahman and Parvin 2014). *Helicteres isora* has been reported to be used as a folk medicine to treat snake bite, diarrhoea and constipation of new born baby (Kumar and Singh 2014). The fruit has been reported to possess antioxidant, hypolipidaemic, antibacterial, antiplasmid antispasmodic, antiperoxidative, antinociceptive, hepatoprotective and anti-diarrheal activity (Pohocha and Grampurohit 2001, Logonayaki et al. 2013). *Enicostema hyssopifolium* was recorded to be used as an antidiabetic in the project villages. The plant has been known to have hypoglycaemic properties (Patel and Mishra 2011). *Cassia fistula* is used in the treatment of gastro-intestinal disorders in the project villages. The plant constituents are reported to possess various biological activities such as antioxidant, antimicrobial, antidiabetic, antitumor and antimelasmic (Sharma et al. 2021). *Tinospora cordifolia* finds common mention in Ayurveda and possesses anti-diabetic, antipyretic, antispasmodic, anti-inflammatory, anti-arthritic, antioxidant, anti-allergic, anti-stress, anti-leprotic, antimalarial, hepato-protective, immuno-modulatory and anti-neoplastic activities (Upadhyay et al. 2010, Sharma et al. 2019). *Derris indica* is used in the project villages for curing skin diseases and arthritis. The plant has been used in traditional medicine in many countries for the treatment of bronchitis, whooping cough, rheumatic joints and dipsia in diabetes (Anusiri et al. 2014). *Haplanthus verticillatus* finds mention in Ayurvedic medicine and is used to cure diabetes and fever in the project villages. *Ficus benghalensis* aerial roots are used as *Datun* in the project villages. The tree has multiple medicinal properties and holds a lot of cultural and religious significance in India (Gopukumar and Praseetha 2015). Dried powder of *Curcuma longa* is used in the daily diet in Indian homes; the plant also has vast medicinal applications (Eigner and Scholz 1999, Luthra et al. 2001). *Rauvolfia serpentina* has been traditionally used as a medicine (Monachino 1954) to treat high blood pressure, mental agitation, epilepsy, traumas, anxiety, excitement, schizophrenia, sedative insomnia and insanity (Kumari et al. 2013). The leaf juice is used to treat posterior capsular opacification in the project villages. *Ricinus communis* has antibacterial and antifungal properties

(Naz and Bano 2012). The medicinal properties of *Carica papaya* have been well documented (Vij and Parashar 2015). The leaves of the plant are used to treat dengue and constipation in the project villages. Their efficacy in treating dengue has been proven (Akhila and Vijayalakshmi 2015). *Adhatoda vasica* is a well-known plant drug in Ayurvedic and Unani medicine and is used for the treatment of various diseases and disorders, particularly for the respiratory tract ailments (Claeson et al. 2000). *Balanites aegyptiaca* fruits are used to cure stomach aches. The plant is traditionally used in treatment of various ailments i.e. jaundice, intestinal worm infection, wounds, malaria, syphilis, epilepsy, dysentery, constipation, diarrhoea, hemorrhoid, stomach aches, asthma, and fever (Chothani and Vaghasiya 2011). *Phyllanthus emblica* is an important plant in Unani and Ayurveda and is a rich source of vitamin C (Mirunalini and Krishnaveni 2010). *Citrus medica* is known for its multiple medicinal uses (Chhikara et al. 2018). The leaves of *Nyctanthes arbortristis* have anti-inflammatory properties and are used in the treatment of sciatica and arthritis (Saxena et al. 1984). The plant is also used as an anti-helminthic, anti-pyretic in addition to its use as a laxative and treatment of skin ailments and as a sedative (Agrawal and Pal 2013). *Asparagus racemosus* is used as a blood purifier in the project villages. It is known to be used in the treatment of diarrhoea and dysentery. The plant also has potent antioxidant, immunostimulant, anti-dyspepsia and antitussive effects (Bopana and Saxena 2007). Various parts of *Moringa oleifera* act as cardiac and circulatory stimulants, possess antitumor, antipyretic, antiepileptic, antiinflammatory, antiulcer, antispasmodic, diuretic, antihypertensive, cholesterol lowering, antioxidant, antidiabetic, hepatoprotective, antibacterial and antifungal activities, and are being employed for the treatment of different ailments in the indigenous system of medicine, particularly in South Asia. It is also used in water treatment (Anwar et al. 2007, Gopalakrishnan et al. 2016). *Elephantopus scaber* has been reported to possess many biological activities such as antimicrobial, hepatoprotective, antioxidant, antidiabetic, anti-inflammatory, analgesic, antiasthamatic, antiplatelet, and wound healing (Hiradeve and Rangari 2014). The leaves and seed of *Datura metel* have anaesthetic, hallucinogenic, anti-asthmatic, anti-spasmodic, anti-tussive, narcotic, bronchodilator, anodyne, hypnotic and mydriatic

effects. Leaves are used as a local application for rheumatic swellings of the joints, lumbago, sciatica, neuralgia, painful tumors, scabies, eczema, allergy and glandular inflammations, such as mumps; used externally for earache and smoked to relieve spasmodic asthma (Monira and Munan 2012). In the project villages, the plant pods were reported to be used for curing asthma. *Trachyspermum ammi* is used as a daily condiment in Indian households. The fruit has been reported to possesses stimulant, antispasmodic and carminative properties and is used traditionally as an important remedial agent for flatulence, atonic dyspepsia, diarrhea, abdominal tumors, abdominal pains, piles, and bronchial problems, lack of appetite, galactogogue, asthma and amenorrhoea. Medicinally, it has been proven to possess various pharmacological activities like antifungal, antioxidant, antimicrobial, antinociceptive, cytotoxic, hypolipidemic, antihypertensive, antispasmodic, broncho-dilating actions, antilithiasis, diuretic, abortifacient, antitussive, nematicidal, anthelmintic and antifilarial (Bairwa et al. 2012). *Sapindus emarginatus* is used tradiotionally as a hair shampoo. *Adansonia digitata* is native to Africa. It is a multi-purpose tree which offers protection and provides food, clothing and medicine as well as raw material for many useful items. The fruit pulp have very high vitamin C, calcium, phosphorus, carbohydrates, fibres, potassium, proteins and lipids content, which can be used in seasoning as an appetizer and also make juices. Seeds contain appreciable quantities of phosphorus, magnesium, zinc, sodium, iron, manganese, whereas they have high levels of lysine, thiamine, calcium and iron The plant also has numerous biological properties including antimicrobial, anti-malarial, diarrhoea, anaemia, asthma, antiviral, anti-oxidant and anti-inflammatory activities amongst others (Rahul et al. 2015). In the project villages, the bark concoction is used in curing fever. The seeds and leaves of *Trigonella foenum-graecum* have culinary uses. The seeds are known for their carminative, gastric stimulant, antidiabetic, galactogogue (lactation-inducer), hypocholesterolemic, antilipidemia, antioxidant, hepatoprotective, anti-inflammatory, antibacterial, antifungal, antiulcer, antilithigenic, anticarcinogenic properties (Zia et al. 2001, Yadav and Baquer 2014). *Daucus carota* and *Spinacia oleracea* were mentioned to be important plants in maintaining good health by the senior citizens in the project villages. *Vernonia*

anthelmintica is known for its vermicidal properties (Iqbal et al. 2006). The plant also has a long history of traditional use for the management of several disorders related to skin, central nervous system, kidney, gynecology, gastrointestinal, metabolism, and general health (Dogra et al. 2020). *Citrus limon* is commonly used in food items and the cosmetic and pharmaceutical industries. Multiple uses of *Clerodendrum multiflorum* were reported from the project villages. The other reported therapies include those on inflammation, diabetes, nervous disorder, asthma, rheumatism, digestive disorders, and urinary disorders as well as a bitter tonic (Maruga Raja and Mishra 2010). *Capparis decidua* possesses many pharmacological attributes such as antidiabetic, anthelmintic, antibacterial, antifungal, analgesic, anti-nociceptive, antirheumatic, hypolipidemic, antiatherosclerotic, anti-tumor, antigiardial, antioxidant, anti-inflammatory, hepatoprotective and anticonvulsant activities (Nazar et al. 2020). *Terminalia bellirica* possesses antioxidant, anti-inflammatory, immunomodulatory, antimicrobial, hepatoprotective, renoprotective, antidiabetic, anti-hyperlipidemic, and anticancer activities (Gupta et al. 2020). It is also a component of the *Triphala* powder.

The farming practices in the study landscape were understood through questionnaire surveys with the farmers. A total of 647 such surveys could be achieved in 18 project villages as compared to the envisaged 35 responses per project village. Majority of these respondents were men in the age group of 41-50 years. More than 65% respondents opined that there was a change in the farming practices in the project villages. A large proportion of the respondents reported these changes to be neutral or positive. As per the responses, Moong, Groundnut and Wheat seem to be the most consistently grown crops in the project villages, with agroforestry being a recent trend. The crops mentioned to be discontinued for cultivation were however similar to those that were reported to be consistently grown since 50 years. Upon enquiring the reasons for discontinuation of cultivation of the previous crops, most respondents reported them to be that they were less lucrative and were less productive. Concurrently, the major advantages of the current cropping pattern reported by the farmers were that the current crops were cost effective and it was possible to obtain the desired production in a shorter time span. Majority of these

respondents mentioned that the disadvantages of the current cropping pattern included reduction of soil fertility, heavy requirement of pesticides and fertilizers. They were thus aware of the detrimental effects that the use of these chemicals poses to human health and the biota in general.

More than 60% farmers mentioned that there was a change in the fertilizers used, with many of them possessing a neutral outlook on this change. Previously, around 50% of the respondents had used natural fertilizers. However, chemical fertilizers were equally in use in the past. The respondents mentioned that the reasons for discontinuing the previous fertilizers were that they were not easily available, led to less productivity, involved an expensive and lengthy process and were not suitable for all kinds of crops. Concurrently, the major advantages of the current fertilizers reported were easy availability and the suitability for all kinds of crops in addition to yielding good production. A relatively large proportion of farmers knew that the current fertilizers are detrimental for the soil (Geisseler and Scow 2014).

Insect larvae, Groundnut white grub and locusts were the most frequently reported insect pests to be observed recently. A relatively high proportion of farmers reported locusts to be a major pest 50 years ago. Locusts are considered to be a major threat to food security globally (Murali Shankar and Shridevasana 2020, Kimathi et al. 2020). The Pink Bollworm, aphids and thrips were reported to be relatively recent pests in the study landscape. The Pink Bollworm is a major pest of cotton and has also been reported to develop resistance against *Bt* toxins (Tabashnik et al. 2000, 2002, Dhurua and Gujar 2011). Thrips and aphids attack a wide range of crops (Workman and Martin 2002, Van Emden and Harrington 2017).

Over 60% respondents mentioned that there was a change in the use of pesticides in the past 50 years and most of them had a neutral outlook on the change. Rogor was the most frequently reported insecticide to be used earlier. Some farmers also used herbicides and fungicides. The major reason for discontinuation of the previously used pesticide was non suitability for all kinds of crops. The main advantage reported for the current pesticides was easy availability. The farmers were well cognizant that pesticides pose as serious public health hazards (Alavanja et al. 2004, Karunamoorthi et al. 2012, Hernandez et al. 2013, Kim et al. 2017).

Most of the surveyed farmers had not tried organic farming, but had a positive view for the practice. Organic farming has been proposed as a sustainable form of farming and promotes reduction of the use of chemicals in farming. However, the pros and cons and concerns of this practice need to be considered before proceeding or promoting this form of farming (Trewavas 2001, Rigby and Caceres 2001, Mader et al. 2002, Hole et al. 2005, Ramesh et al. 2005, 2010, Liefield 2012).

Over 86% farmers believed that the visitation of large mammals had increased in the farmlands with the Wild Pig being the most frequently reported animal. The common reasons for these visitations were that the wild herbivores were attracted to the crops for food and loss of habitat.

In order to assess perceptions regarding human-wildlife conflict, 35 respondents per village were planned to be interviewed. A total of 606 respondents from 19 villages could be interviewed to address this component. Most of the respondents were men in the age group of 38-47 years old and belonged to the Koli and Patel castes. Most of the respondents were occupied in farming with a land holding of 1-10 *bigha*, thus supporting the fact that the study landscape is chiefly agrarian in economy. Most of the respondents owned a pucca house with water storage facility and sanitation units. The reported monthly family income of most of the respondents was up to ₹ 10000.

Based on the responses, the villagers seem to be majorly dependent on the forest for fuel wood. Appropriate interventions and efforts to alleviate living standards could reduce this dependence and prevent forest degradation (Heltberg et al. 2000, Khanwilkar et al. 2021, DeFries et al. 2021). The average livestock per surveyed households was 2.77. Most of the respondents owned 1-10 individuals of livestock, more people owned buffaloes as compared to cows. Most of the livestock owners had a single milch animal. Considering an average production of 7-8 litres of milk per day per milch animal (H. Solanki *pers. comm.*), and not accounting for domestic use or conversion to any other milk product and not including expense towards the management of the livestock, this would fetch ₹350-400 on an average per day for a person owning a milch buffalo and ₹280-320 on an average per day for a person owning a milch cattle. A miniscule fraction of people owned other livestock or

poultry. More than 40% livestock owners reported that none of their livestock was vaccinated. Half of the livestock owners took their livestock to graze mainly in the fringe areas of the forest. There is thus an urgent need to generate awareness among people to get their livestock vaccinated to prevent the transmission of any zoonotic diseases in the landscape (Frolich et al. 2002, Ayele et al. 2004, Gilbert et al. 2005, Ward et al. 2006, Gortazar et al. 2012 Barasona et al. 2014). Majority of the respondents informed that the wells in their farms were covered by parapet walls. Open wells are a threat to wildlife (Ram et al. 2019); hence, the remaining wells need to be covered on priority since these villages lie in the Gir landscape with probable high movement of wild animals (Meena and Kumar 2012, Gujarat Forest Department 2020).

Most of the respondents cultivated crops throughout the year, indicating good water availability in the region. In concurrence with the farming practice data, groundnut and wheat were the most frequently reported cultivated crops. Majority of the farmer reported production of up to 50 quintals for these crops. The average selling price for these crops is ₹400/quintal and ₹1200/quintal in the study landscape (H. Solanki *pers. comm.*). This would thus mean that most of the farmers may earn up to ₹20000 through wheat and up to ₹60000 through groundnut at the end of the cropping season. The other less frequently reported crops were Moong, Chick pea, Coriander, Baja, Pigeon pea, Soybean, Sesame, Mango and Black lentil. The annual production of most of these crops was also reported to be 1-50 quintals. The average selling prices for these crops are ₹1200/quintal, ₹1000/quintal, ₹1600/quintal, ₹450/quintal, ₹1000/quintal, ₹1000/quintal, ₹2000/quintal, ₹800/quintal and ₹1000/quintal respectively (H. Solanki *pers. comm.*). Thus considering an annual production of up to 50 quintals, the farmers could earn up to ₹60000 through Moong, ₹50000 through Chick pea, ₹80000 through Coriander, ₹22500 through Bajra, ₹50000 through Pigeon pea, ₹50000 through Soybean, ₹100000 through Sesame, ₹40000 through Mango, and ₹50000 through Black lentil. Majority of the coconut farmers reported the annual yield to be up to 100 units. A single coconut is sold by the farmer at an average rate of ₹10 in the study landscape. These earning amounts do not account for the costs of purchasing seeds, protecting the crops or any other

expenses that are incurred while managing the farmlands. The net earnings of the farmers would obviously be lower than these aforementioned calculated prices. The most frequently reported amount of crop loss through depredation by wildlife was up to 20%, though some crops were reported to have higher losses. Considering wheat and groundnut to be the most frequently cultivated crops in the study landscape with an annual yield of up to 50 quintals, the perceived loss of 20% would amount to a loss of ₹4000 for wheat and ₹12000 for groundnut per year. The damage reported by the farmers due to crop depredation by wildlife is based on their perceptions. The perceived losses usually drastically differ from the actual losses (Nyirenda et al. 2013, Pandav et al. 2021). Thus mitigation strategies should be devised based on accurate and standardized estimation of loss and should be targeted at increasing social tolerance (Wang et al. 2006, Bayani et al. 2016, Karanth et al. 2018, Gross et al. 2018). Night patrolling was the most common form of mitigation measure implemented by the people followed by biofencing and barbed wire fencing. Most of the farmers spent up to ₹50000 on the employed mitigation measure. The solar fencing was rated as the most satisfactory form of mitigation, followed by wall construction, chain-link fencing, *Machan* and barbed wire fencing. Bio-fencing, cement sheet fencing and use of saris as fencing were rated to be the least satisfactory. Battery operated solar fencing was also reported as one of the most effective method in preventing crop damage by large herbivores in Central Saurashtra, Gujarat (Mehta 2014). Subsidizing this form of fencing may thus aid in reinforcing people's support in conservation. Additionally, the possibility of crop insurance schemes for damage through wildlife should be explored (Mathur et al. 2014).

Most of the farmers reported crop depredation incidents to occur either throughout the year or during winter and monsoon. Wild Pig and Nilgai were the most frequently reported animals that cause crop damage. These animals have a notorious reputation as agricultural pests in most of their distribution range (Chauhan and Singh 1990, Sankar et al. 2004, Mehta and Soni 2018). Other species like Indian Peafowl, Chital, Porcupine, Chinkara, other rodents, Grey langur, insects, birds, Sambar and Chausingha were also reported. The Wild Pig was reported to raid

crops between 06:00 PM and 06:00 AM. . The Wild Pig are reported to be normally most active in the early morning and late in the evening, though they become nocturnal in disturbed areas, where activity usually commences shortly before sunset and continues throughout the night (Chauhan 2004). The observations by the villagers thus concur with scientific findings. The Nilgai was reported to raid crops between 06:00 PM and 02:00 AM. The Nilgai exhibit diurnal activity patterns in Gir Protected Area (Chaudhary et al. 2020). They have been reported to raid crops in the night in other studies (Chuahan and Singh 1990, Mehta 2014). The Grey langur was r perceived to be crepuscular in its crop depredation habits. However, Langurs are diurnal mammals (Prater 1971). The Chital was reported to cause crop depredation between 10:00 PM and 06:00 AM. Chital exhibit diurnal activity patterns (Chaudhary et al. 2020), but may raid crops on the fringe areas of the forest in the night. Sambar and Chinkara were reported to raid crops between 10:00 PM and 02:00 AM. Sambar are predominantly forest-dwellers, favouring the cover of trees, venturing out into the open mainly at night, and late at dusk or early dawn (Sankar and Acharya 2004, Chaudhary et al. 2020). They usually rest the whole of the daylight hours (Schaller 1967). Chinkara are reported to be relatively more active in the evenings and are known to avoid farmlands (Prater 1971). Chausingha was reported to raid crops between 06:00 PM and 02:00 AM. Chausingha in the Gir landscape have been known to visit agriculture and horticulture fields and also feed on crops, though the damage caused is relatively minimal (D. Mehta *pers. observation*). Indian Crested Porcupine was reported to raid crops between 06:00 PM and 06:00 AM. The species is known to be highly nocturnal (Fattorini and Pokharel 2012). The Indian Peafowl, other birds, rodents and insects were reported to damage crops between 06:00 PM and 10:00 PM. The peafowl and other birds activity usually recedes after sunset and thus the perceptions to crop loss by these species need to be worked upon. The activity of rodents and insect pest are likely to peak at night. There is thus a need of generating awareness among people regarding behaviour and activity patterns of wildlife among people.

Based on observations by the villagers, the Wild Pig, Chital and Chinkara were reported to mostly occur in group sizes of 6-10 individuals. Wild pigs are known to

be gregarious, forming herds or `sounders' of varying size depending on locality and season, but usually of between 6 and 20 individuals (Chauhan 2004). The mean group size of Chital in Gir is reported to be 7-8 individuals (Jhala et al. 2016, Gogoi et al. 2020, Ram et al. 2021a). The mean group size of Chinkara is reported to be less than 5 individuals (Rahmani 1990, Bagchi et al. 2008, Ram et al. 2021a, Mehta and Soni 2018). Species like Nilgai, Grey langur, Sambar, Chausingha, Porcupine and Indian Peafowl were mostly reported in group sizes of 1-5 individuals. The group size of Nilgai is usually 1-5 individuals (Bagchi et al. 2008, Mehta and Soni 2018, Ram et al. 2021a). The mean group sizes of Grey langur in the Gir landscape vary from 8-13 individuals (Jhala et al. 2016, Ram et al. 2021a). Sambar are known to occur in small group sizes. Studies in Gir have shown their group size being 1-5 individuals (Khan et al. 1995, Gogoi et al. 2020, Ram et al. 2021a). The mean group size of Chausingha in Gir has been reported to be 1-2 individuals (Khan et al. 1996, Jhala et al. 2016, Mehta 2020). Porcupines are shy and solitary creatures. Indian Peafowl have also been reported to occur in group sizes of 1-5 individuals in the Gir landscape (Jhala et al. 2016, Ram et al. 2021a). The villagers reported to have observed a larger proportion of males in the groups in case of Nilgai, Grey langur, Sambar, Chausingha and Indian Peafowl while they reported having observed more females in case of Wild Pig, Chital and Chinkara. They reported most of the porcupines as unidentified, but some villagers did report observing males or females. Assigning sex class to porcupines is difficult. Similarly, sexing wild pigs and Hanuman Langurs in non daylight conditions can also prove to be arduous. Thus, these perceptions and observations should be treated in the light of ambiguity and observer bias.

A small proportion of responses from some villages were received for data on human-carnivore conflict, out of which around 40 GPS locations were accurate. Aditionally, the data on human-carnivore conflict could not be obtained from Gujarat Forest Department as was envisaged. Considering this limited amount of data, a rigorous analysis as well as predictive risk mapping could not be carried out (Treves et al. 2004, Naha et al. 2018, Ramesh et al. 2020, Sharma et al. 2020). Most of the carnivore conflict events were reported to be livestock depredation by Asiatic

Lions in the project villages. The conflict events were relatively more frequently reported to have occurred in human habitations and agricultural areas. Based on the responses, most of these events occurred in areas from where a water source was at a distance of upto 200 metres. Most of the respondents reported the cost of the predated livestock to be up to ₹10000. About 45% of the respondents had filed for compensation of which over 70% reported to have received it. The adequacy of compensation amount showed mixed responses with 11 people reporting it to be inadequate, while 14 people reported it to be adequate. As per the Forest and Environment Department, Government of Gujarat GR No. WLP/102015/SF-62/W dated 07/06/2016, the *ex-gratia* relief provided for human death is ₹400000 and that for human injury ranges from ₹43000 to ₹200000 depending on the gravity of the injury. The compensation provided for depredation of a milch cattle, buffalo or camel is ₹30000 and for productive goat and sheep, it is ₹3000. For non milch camel, horse, bullock, the compensation amount provided is ₹25000 while those for non milch cattle, buffalo, calves, donkey, etc., it is ₹16000. There is thus ambiguity in the responses for adequacy of the compensation amount since the majority livestock owners reported the price of their depredated livestock to be ₹10000. Most of the respondents reported the reason of a human-carnivore conflict event to be a sudden encounter with the animal followed by gullible corralling or unguarded livestock. Non productive livestock is often left to freely roam in the village area by the owners. There was a mixed response regarding free roaming livestock in the villages being predated upon in relatively high proportion, but more than half of the respondents believed that to be true. The villagers seem to be well aware of the reasons behind conflict and seldom blamed the carnivore. This allows them to coexist harmoniously with large carnivores in the study landscape (Gujarat Forest Department 2020, Meena et al. 2021).

For generic reasons behind human-wildlife conflict, the villagers seemed fairly aware of the issues and seldom blamed the animals for conflict, thus strengthening the fabric of coexistence. The frequency of human-herbivore conflict as reported by the villagers was mostly once in 3 months while that of human-carnivore conflict was mostly once in 6 months, thus indicating low frequency of conflict events in the

project villages. This may also be one of the reasons for people's tolerance towards wildlife. Asiatic lion, Indian Leopard, Indian Peafowl, Indian Hare, Golden Jackal, Wild Pig, Chital and Jungle Cat were reported to be observed by over 50% of the respondents in the project villages. Indian pangolin was the least reported species to be observed by the villagers. The views of the respondents on the importance of wildlife and coexistence were mostly positive or neutral. The religious and cultural ethos may play a role behind these attitudes (Talukdar and Gupta 2018, Karanth et al. 2019).

Around 45% of the respondents did not provide any information on any benefits availed for mitigation. About 46% had not availed any benefits. Among the remaining 9% respondents, most of them had availed benefits through non-governmental organizations mostly for *Machan*. Most of the respondents felt the need to generate awareness among people and incorporate people's participation to mitigate human-wildlife conflict. Suggestions for mitigation of human-wildlife conflict also included practicing caution, obtaining assistance/subsidies from the government, fencing, reduction of dependence on the forests, construction of parapet walls around wells and *Machans,* and creation of water points in the forest.

The Gujarat Forest Department already has schemes in place for livestock injury, livestock depredation, human injury, human death (WLP/102015/SF-62/W dated 07/06/2016), barbed wire fencing (GR No. WLP-2005/491/G1(1674) dated 20/05/2005), *Machan* and provision of parapet walls (GR No. WLP/1107/572/W dated 01/03/2019). Water points in the Gir landscape have been constructed by the Gujarat Forest Department for provision of water during scarcity period (Ram et al. 2019). In addition, a scheme for *Vanyaprani Mitras* is also under implementation to involve locals in assisting the forest department in awareness generation, garnering public support and rescue and rehabilitation works (GR No. WLP-1107-572-W dated 21/05/2018). Subsidized solar fencing may prove to be a suitable mitigation strategy, but fencing has been reported to hamper movement and exports the problem to other unfenced areas and should hence be dealt with caution (Chauhan and Singh 1990, Osipova et al. 2018). Management interventions should also consider spatial and species specific aspects to not impede conservation efforts. Also,

diversion of land to other uses that could be detrimental for wildlife should be prevented. Expectations of the respondents from the government and society included cooperation among people and with the government, awareness generation, provision of government schemes, subsidized fencing, provision of *Machan,* provision of solar lights, development of a waste disposal mechanism in the villages, provision of grazing land in addition to habitat management and protection of wildlife. Many schemes from the government and non-governmental organizations including AKAHI already exist. Awareness generation regarding these needs to be carried out in the project villages. Other awareness programmes targeted at increasing social tolerance, wildlife conservation and coexistence with wildlife are also required to ensure long term survival of wildlife and conservation of natural resources. These programmes could be carried out by individuals, organizations and government departments in the study landscape. The trained community cadre of *Gir Mitras* can also play a significant role in this venture. Other relevant interventions in the project villages can be carried out by competent authorities through discussions and dialogue with the people, organizations and interdepartmental coordination.

The current study was a first of its kind in the study landscape. It was implemented through data collection by a trained community cadre based on interviews with locals in the project villages. The project has contributed in building their capacities and provided an ideal platform for community participation in wildlife conservation. This could be emulated for other research oriented initiatives in the future in the Gir landscape and elsewhere. The villagers are well versed with the current ecological scenario in their villages. Further awareness can be created through programmes targeted at sustainable farming practices, environmentally conscious living, reducing dependence on the forests, alternate livelihoods and nature conservation. The study has helped in generating a basic ecological profile and elucidating local perceptions and attitudes in the project villages. Further empirical data collection with scientific rigour holds the potential to substantiate the findings of the study as well as aid in devising conservation and management strategies to ensure long term human-wildlife coexistence in the Gir landscape.

Covering of wells in the farmland in a project village carried out by AKAHI

Provision of *Machan* to a farmer in the project village by AKAHI

Solar light installed in one of the project villages by AKAHI

Chain link fencing around a farm provided by AKAHI in the project village

Key Outcomes

For the study, the *Gir Mitras* were trained to collect the requisite data which included that on vegetation, geospatial data, farming practices and human-wildlife conflict. All the data for the study was collected by this identified community cadre in their villages. Thus, one of the key outcomes of the study has been in building their capacities which will yield beneficial and desired outcomes for the larger project/s and any foreseen initiatives to be undertaken in the landscape. Continuing orientation and motivation programmes for *Gir Mitras* will help in strengthening people's support and participation for sustainable living in the villages.

The village maps will aid in spatial analysis and in planning, strategizing and undertaking future works in these villages.

The documentation of floristic composition and the field surveys has aided in understanding social perceptions regarding floral changes, ethnobotanical significance of various plants, and occurrence of native and invasive species as well as developed an understanding of the current scenario and status of forested patches, wastelands and *gauchars* in the study villages. These data will also assist in strategizing habitat improvement/restoration works by competent authorities where necessary. The habitat improvement/restoration works should be carried out based on thorough scientific principles and after technical assessments of the sites. The removal of invasive alien species and plantation activities on private owned and revenue lands in the study landscape could be taken up by any organization as the first step towards habitat restoration considering financial and physical viability.

The documentation of farming practices has contributed in understanding the changes in cropping patterns, use of fertilizers, insecticides and pesticides over the past 50 years in the study villages. Organizations could assist in promoting and/or incentivizing sustainable farming and wildlife friendly practices in addition to organizing workshops for farmers by roping in agriculture, banking, irrigation and electricity sectors for generating awareness.

The surveys for the assessment of human-wildlife conflict have helped in understanding perceived damage to crops and livestock. The data regarding socio-

economic status of the respondents, dependence on forest resources, details of conflict instances with large carnivores, mitigation measures employed, attitudes towards wildlife, conflict and coexistence, *ex-gratia* relief, suggestions for mitigation and expectations of the people from government and non-government organizations aided in elucidating the current scenario regarding human-wildlife conflict. This has the potential to develop effective and informed mitigation strategies and assist in ensuring long term conservation and coexistence in the landscape. Subsidizing solar fencing can help in reinforcing people's support for conservation. AKAHI is currently involved with multiple on ground interventions. It undertakes installation of solar lights, covering of wells, provision of *Machan* and fencing. These activities could be augmented as per the need and priority for the villages and new initiatives can be undertaken. Vaccination programmes for livestock and canines in the villages could also be initiated by concerned organizations through coordination with the animal husbandry department. Awareness programmes for people as a mitigation strategy to prevent human-wildlife conflict could also be taken up. Development of a well structured waste disposal mechanism in the villages and development of grazing lands could be discussed with the competent authorities. Promoting alternate livelihoods and reducing forest dependence are also key initiatives that could be undertaken.

This project was a pilot study in the landscape and primarily aimed to provide documentation and generate a baseline on people's perceptions based on data collection by the *Gir Mitras* for future works in the villages. Further empirical and rigorous field data collection would be essential to scientifically substantiate the findings and add authentication as well as prudence to the work. Implementation of any ecological or conservation oriented intervention should thus contemplate this concern before initiation.

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