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Invited Article

Higher Vertebrate Problems and Management Strategies in Agricultural Landscape

Across the world, as human populations have expanded, wildlife species have been restricted to small patches and land has been transformed to meet human needs like settlement, cultivation, construction of roads, railways, and other infrastructure projects. Indiscriminate destructions and fragmentation of natural habitats, blocks migration routes, facilitates encroachment, and encourages poaching, all these factors cumulatively force the wildlife to restrict to small patches, thus resulting in severe conflicts between humans and wildlife. These changes often increase the potential for conflicts between wildlife and people that result in damage to resources and threaten human health and safety. Human-wildlife conflict (HWC) has been a well known problem in vicinities of protected and non-protected areas. Incidences of human casualties, livestock depredation and crop damage caused by wild animals *e.g.* elephant, tiger, lion, sloth bear, leopard, nilgai, deer and wild boar have been widely reported from various parts of India (Bargali *et al*., 2005, Chauhan, 2005 Bargali, 2003, Manakanda and Rahmani, 1998, Mishra, 1997, Chandra. 1997, Rajpurohit, 1996, Saberwal *et al*., 1994, Indrukar *et al*., 1994, Sinha and jha, 1994, Chauhan and Singh 1990 and Schultz 1986). Many species (including elephants, rhinoceros, and tigers) are killed for international trade of their body parts. Although poaching is not a direct source of conflict, injured elephants and other animals (e.g., tigers) often retaliate by killing humans and damaging their property. The other important phenomenon due to crop raiding by different species of animals which led these activities increases conflict between farmers and wildlife throughout the world. Crop raiding by animals, in particular mammals like elephants (*Elephas maximus*), gaur (*Bos gaurus*), black buck (*Antilope cervicapra*), chinkara (*Gazella bennetti*), wild boar (*Sus scrofa*), Hanuman langur (*Semnopithecus entellus*), and porcupine (*Hystrix indica*) has been widely reported from all over the country (Prater, 1971; Schultz, 1986; Sukumar, 1990; Bohra *et al.*, 1992; Balasubramanian *et al.*, 1993; Chhangani, 1994; Chhangani, 2000; Chhangani and Mohnot,1997; Chhangani *et al.*, 2002; Rao *et al*., 2015).

In recent years, HWC in agricultural landscapes is an increasing factor of concern for managers. India is the seventh largest country in the world and second largest nation of Asia having 10

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different biogeographic zones, encompassing varied landscapes with rich natural resources. India also has the rich diversity with approximately 45,000 species of plants, 86,874 species of animals, 390 species of mammals, 1300 species of birds, 456 species of reptiles, 311 species of amphibians and 2546 species of fishes. All the bio-geographic zones are facing the issue of HWC from variety of species, in varying degrees. The major species involved in the HWC are Snow leopard, Himalayan bear, monkeys, wild ass, nilgai, black buck, wild boar, elephant, leopard, sloth bear, gaur, tiger, porcupine and crocodile. In Trans Himalayas and Himalayan zones the HWC is mainly due to snow leopard, Himalayan beer and monkeys. The wild ass and nilgai problems are severe in regions like Thar and Kutch of desert zone. The number of problematic species involved in HWC is comparatively similar in semi-arid, Western Ghats, Deccan peninsula and Gangetic plains. In these zones the predominant species like wild boar, nilgai, monkeys, elephants and other antelopes cause significant HWC in relation to agricultural landscape, while other species like tiger and leopard cause predation on livestock and human death.

Management of problematic species mainly depends on their status as per the Indian Wildlife Protection Act 1972 (IWPA) and International Union for Conservation Nature (IUCN). The species like tiger, leopard, lion, sloth bear, snow leopard, elephant, black buck, gaur and crocodile are kept under Schedule–I, species like rhesus macaque, bonnet macaque and wild dog are listed under Schedule–II and other problematic species like wild boar, nilgai are covered under schedule–III of IWPA. Whereas, as per IUCN, tiger, snow leopard, elephant and wild dog are listed as endangered; lion, sloth bear, gaur and crocodile are listed as vulnerable; leopard and black buck listed as near threatened and others like wild boar, nilgai, rhesus macaque, bonnet macaque are listed as least concerned species. The status of these species as per IWPA and IUCN is the hurdle while dealing with the species in agro-pastoral ecosystems. Apart from these, the major constraints in vertebrate pest management are: lack of sustained efforts at local level, strong religious sentiments against killing, high cost of eliminating animals, lack of coordination with district authorities and lengthy procedure for declaration as vermin.

Population estimates and Management

Estimating population density of animal species, more specifically the mammalian species that attract conservation interest (Krishnan, 1972; Ramachandran et al., 1986), is an important tool for their conservation and population management (Karanth and Sunquist, 1992; Varman and Sukumar, 1995; Sutherland, 1997; Varman, 1988). However estimating animal numbers in tropical forest habitat is difficult, because of poor visibility and relatively low density of some species resulting in inadequate sample sizes for obtaining statistically precise results (Koster and Hart, 1980; Varman and Sukumar, 1995). Also except in a few locations, no systematic or scientific approaches have been followed to estimate population densities. Population numbers that are available for species such as the Asian elephant or prey species of large carnivores originate only from census programs. Although these census operations are systematic or assumed to be successful, their results are neither validated nor compared with any other long-term population studies on the species (Verma, 2007). The available population status of some of the problematic higher vertebrate species, based on secondary information revealed that the tiger population reported approximately 2,226 individuals, leopards ranging between 12,000-14,000, nilgai in outside protected areas having over five lakh individuals, elephants, over 25,000 individuals, gaur, more than 20,000 and sloth bear around 10,000 individuals. In several countries like America, England, Poland, Russia and Japan control of problematic animals in agricultural landscape is done through hunting, caging, shooting, electrocution and translocation. In certain situations, poison baits on a large scale are widely used, as in Pakistan, for managing the wild boars. In Bhutan on the other hand, trained groups of farmers are engaged in hunting the wild boars. Italy is a country where wild boar menace is kept under check by using sodium monofloro acetate or warfarin. Despite the above methods being effective in problematic vertebrate management, none of them is applicable for Indian conditions as most of the problematic animals are listed in Schedule I to III of Wildlife Protection Act 1972. Any method resulting into either intentional or unintentional death of the animal is punishable. However, sections 11 & 12 of chapter III dealing with the Hunting of Wild animals, permit the hunting in certain cases. The various State governments like Gujarat, Punjab, Haryana, Himachal Pradesh, Uttarkhand, Uttar Pradesh, Karnataka, Telangana, Tamil Nadu, Andhra Pradesh and Maharashtra are providing compensation for the people affected by wildlife. In such a situation development of vertebrate management practices in India need to be strategic, logical, economical and above all, must be legally sound. There are various management practices suggested by different organizations to control the wild animal entry into the agricultural fields. Though there are several methods like traditional techniques, acoustic deterrents, physical barriers, vegetative barriers, various types of fencings, chemical deterrents, capture and relocation

of the problematic animals and fertility control are available, no data on large scale evaluation and efficacy is available.

The basic research work on HWC mostly focused around status and behavioural science with well-understood ecology in relation to man animal conflicts (Woodroffe *et al*., 2005). However, it involves people, and it is very essential to understand attitudes, beliefs and values of stakeholders to mitigate conflicts where livestock holdings and agriculture are an important part of household's and incomes, competition between local communities and wild animals for the use of natural resources is intense thus escalating conflict (Redpath *et al*., 2004;Ogra, 2008; Mishra *et al*., 2003). HWC results in agriculture and property damage and livestock depredation, which threaten the livelihoods of millions across the globe and costs lives of both human and wildlife, thus, keeping the wildlife conservation goals under risk (Oli, 1994; Sekhar, 1998; Rajpurohit and Krausman, 2000; Ogra and Badola,2008).

Agricultural damages due to Wildlife

All the animals and birds listed in India are not problematic in causing HWC. Among the 103 species of rodents listed, only 13 species were found to be involved in agricultural damage at different growth stages of the crop. In case of birds of the1364 species, 63 species were identified as depredatory in nature and causing damage to various agriculture and horticultural crops mostly during vulnerable stages of the crops. Among the six antelopes reported in India, three species like nilgai, black buck and four horned antelope were reported as crop riders. Similarly, of the nine deer species, only spotted deer has been reported involving crop damage in the fringes of forest blocks. Out of 13 species of primates listed, five species are involved in crop damage across different agro-ecological regions. The other species like elephant predominantly causes crop damage, property loss and injuries to humans mostly in forest fringes and also during migration across the corridors. The wild boar is the most problematic species causing significant crop damage across different agro-climatic zones of the country.

Studies conducted by the All India Network Project on Vertebrate Pest Management over a decade showed that the extent of damage caused by different species of rodents was to the tune of 15%, followed by birds 9%. Recent studies revealed that the wild boar damage to different crops varies from 15-40%, nilgai to the extent of 10-30%, elephants, 20-50%, rhesus macaque, 10-30%, black buck, 5-15% and gaur, 5-10%. The intensity of damage depends on population density, cropping pattern, extent of crop area, season and stage of the crop. Carnivores often cause serious economic and social losses by preying on livestock, causing damage to property and general community insecurity, and in exceptional cases, human injury or death (Madhusudan and Mishra, 2003; Mishra *et al*., 2003; Distefano, 2005; Ogra and Badola, 2008; Ogra 2008; Lee, 2011). The economic loss due to snow leopards (*Panthera uncia*) and wolves in Spiti region of the Indian Trans-Himalaya has been estimated at Rs. 8000 per family annually, amounting to about half the per capita income of the state (Mishra 1997). Also a similar study by Maheshwari *et al*. (2010) showed over 2% livestock loss every year due to snow leopard, Tibetan wolf and Himalayan brown bear (*Ursus arctos isabellinus*) in Kargil, Ladakh. The impact is exacerbated if the loss is of human life. Similarly, during 2007-2011 a total of 888 human deaths were reported across several regions due to wild animals and compensation was reported to the tune of Rs. 5.72 crores. In case of human injuries, a total of 7,381 cases were reported with a compensation of Rs. 3.4 crores. Several crop damage cases were also reported by wild animals and compensation paid to the extent of Rs. 10 crores. The antagonism arising from conflict with carnivores pushes people towards retributive killings, that have a substantial impact on the carnivore population undermining the conservation efforts (Woodroffe *et al*. 2005, Dickman, 2008; Hazzah *et al*., 2009). Therefore, reducing antagonism caused mortality is an important strategy for conservation of carnivores (Lee, 2011).

Management Issues

The damage caused by wild mammals like Nilgai, wild boar and monkeys to agriculture has become a matter of serious concern and needs to be managed effectively. Farmers across the nation are suffering badly due to their menace. Since these animals are protected under Wildlife Protection Act, their management through non-lethal approach is the pre requisite to minimize the crop losses as well as man animal conflict. Legal issues: These animals being protected by Indian Wildlife Protection Act 1972 and Biodiversity Act 2004, hunting or using any lethal method is legally barred. However in extreme situations the State Governments has been empowered to issue the licenses/orders for killing the problematic animals following proper procedure. The Act states, 'The Chief Wildlife Warden or the authorized officer may, if he is satisfied that any wild animal specified in Sch. II Sch, III or Sch. IV has become dangerous to human life or to property (including standing crops on any land) or is so disabled or diseased as to be beyond recovery, by order in writing and stating the reasons therefore, permit any person to hunt such animal or cause such animal to be hunted'. Gujarat has appointed Sarpanches of 1545 villages as

Honorary Wildlife Warden under Section 4(1)(bb) and empowered Chief Wildlife Warden under Section 5(2) to delegate his powers to Sarpanches under Section 11(1)(B) to allow hunting of Nilgai in their respective areas. Similarly in the states like Haryana, Uttarakhand and Uttar Pradesh also the Government has empowered DFOs, District Collectors and Block Development officers to issue permit to kill the problematic nilgai in extreme situations.

GENERAL ISSUES RELATED TO TARGET ANIMALS FOR R&D ACTIVITIES

Risk Assessment

Assessment of population of target animals may be planned along with mapping the pestilence in different agro-ecological zones of the country. The assessment includes behaviour, ecology and niche analysis of target pests.

Technology options

Short term: Traditional methods, viz., trenching, fencing (bio as well as mechanical); trap crops and non-chemical methods may be advocated. Formation of National Expert Group comprising of experts from ICAR, AINP VPM, IVRI, MoEF, WII and State Forest Departments can be considered for advisory role.

Long term: Sterilization, bioacoustics, reproduction control methods, policy planning, repellents, participatory management plans; Integration of control methods; Creation of database on population vis-a-vis damage patterns in agricultural landscape; Training for awareness creation.

Policy imperatives

Advise the Ministry of Environment and Forests to rationalize Wildlife Protection Act in need-based manner and under exigency to facilitate farmers to take timely management measures; Translocation of monkey troops following IUCN guidelines from problematic areas to wild forest area to monkey homes managed by Compassionate Unlimited People for Animals (CUPA) and People for Animals (PFA); With respect to nilgai, farmers are often reluctant to kill due to religious taboo. Hence, emphasis on changing the proposed common name as vanaroz may be considered.

Keeping in view the severity of the problem associated with the wild animal species, to minimize the crop losses and also farmer – animal conflict in agricultural landscape, ICAR has launched an All India Network Project on Vertebrate Pest Management during XII Plan period. Besides studies on birds and rodents, management of higher vertebrates is an important component of the Network; the AINP on Vertebrate Pest Management had extensively studied the behavior and pest status of the targeted species wild boar and developed some potential strategies to control the wild boar damage in agricultural fields. The methods are proved effective in several locations but need to propagate in different agro-ecological regions of the country.

ECO FRIENDLY COST EFFECTIVE MANAGEMENT METHODS FOR CONTROLLING OF WILD BOAR

Biological barriers:

Use of four rows of Safflower as barrier crop

The practice of having 4-5 rows of safflower crop (high density) as border around ground nut found to be most promising in preventing the damage by wild boar. Safflower crop by being thorny in nature causes great amount of inconvenience and damage to wild boar especially under situations when it is sown in closed spacing (row to row 30 cm and plant to plant 10cm). In addition, safflower crop emits strong chemical odour effectively masking the odours emitted by ground nut crop. Due to this wild boar at the first instant fails in locating the ground nut crop, secondly even if it is locates the thorns of the safflower plant causes mechanical injury or damage, thereby they will not try to enter into the ground nut field. By using this, extent of damage by wild boar can be minimized to the level of 75 – 90% and also additional income realized through safflower crop comes as an added advantage to the farmer.

Four rows of castor around the crop

This method is widely being popularized in maize and sorghum crop by planting 4-5 rows of castor with close spacing (high density with row to row 45cm and plant to plant 30cm) around the maize crop. Wild boars being capable of identifying maize only through smell can't do so owing to the strong odour emitted by the castor successfully masking the odour emitted by the maize crop. Damage in castor by wild boar is also not possible due to the non palatable nature of the plants with high amount of alcholodies and glucoscides. Through this method, a farmer is benefitted with additional income through castor. Usage of castor as border crop is practicable in both

Kharif and Rabi seasons and the same crop can be used as border crop in crops like pulses and oil seeds. This method effectively controls the wild boar damage to the extent of 75-90%.

Physical barriers:

Circular razor wire as physical barrier

The iron wire fixed with sharp razor blades at regular distance is kept 1 ft away from the cropped area as border by forming circular rings. The blades caused serious damage to the wild boar which tries to enter into the field. This not only prevents the animal to enter into the field but also scares away other animals. The entangled animal makes alarm calls which deter away the other wild boars thereby saving the entire crop without any damage. Implementation of this method reduced the wild boar entry into the cropped area to the extent of 70-85%.

HDPE Nylon Fish net as physical barrier

The fish nylon net (HDPE, UV stabilized, 2'' mesh and 1.5mm thickness) using bamboo or strong wooden poles should be erected around the crop vertically for about 3 – 4 feet height. At every 10 – 15cm nails to be fixed on the poles for better fixing of the net. Insert the nylon rope in between the mesh net and fix horizontally on the ground by using small wooden pegs. This method prevents entry of the animal into the fields and also if by chance animal enters will be entangled and makes alarm calls which deter away the other wild boars. Erecting of fish net around the field reduce the wild boar damage to the tune of 70-90%.

Barbed wire fence

Erecting of barbed wire around the field in three rows with first row being at the height of 1 foot from the ground. This is highly effective in preventing wild boars from entering into the cropped area to the extent of 60 -74%.

Chain link fence

It is an easy and most effective way of fixing a barrier which is more durable in nature. Chain link meshes of 3 feet height can be fixed around the crop by maintaining a distance of 1 ft away from the crop. This method can be used in seed production crops and also in various horticultural crops. By using this permanent physical barrier the extent of damage by wild boars reduced by 65-80%.

Solar fence

This is a permanent type of physical barrier arranged around the cropped area which is gaining

more popularity in the present times. This method is being widely practiced to prevent the damage by wild boar in high valued remunerate crops. In this method a solar fence is fixed around the crop with 12 volts electricity being sent to the fence with the help of solar plates. The shock received by the animal during the contact will not be capable of killing the animal but certainly ward off not only the animal which comes in contact but also other following animals which will be scared due to the alarm calls of the shocked animal.

Chemical and non-chemical methods:

Spraying of egg solution

By exploiting the habit of the wild boar using smell of the crop as criteria for identification, an extensive level of experiments were carried out to use spray of egg solution either on the border row of the crop or on the wet soil around the crop. The results has given a clear cut indication that spray of egg solution 25 ml/lt of water was capable of successfully making the natural odour of the crop and thereby reducing the wild boar damage up to 50-60% .

Arrangements of coconut ropes soaked in mixture of sulphur + pig oil.

Arrangement of coconut rope in three rows around the crop by keeping 1 ft distance between the rows with the help of wooden poles can be done. Preparation of solution with sufficient quantity of sulphur is mixed with local / domestic pig oil is done and that mixture should be smeared on the arranged coconut ropes. This mixture generates the typical smell there by repelling wild boars not to enter into the cropped area. For an effective use of this method two such applications should be done with ten days interval in between, this method is effective up to 60-80%.

Traditional methods:

Human hair as respiratory deterrent

Wild boar with poorly developed sight and hearing mechanism has to depend on its smell sensory mechanism only for movement as well as locating of food. In this process it moves from one place to other place only by a way of sniffing on the ground there by getting guided in to the desired routes. Spreading of human hair collected from local barber shops is an affective and low cost traditional method being followed by farmers. Technically this indigenous method do have scientific logic which clearly suggest that the human hair in the movement routes wild boar gets sucked through nostrils causing severe respiratory irritation. Due to this the wild boar gets totally disturbed and loses its track by making distress calls, which will ward off other wild boars entering into the cropped area. Several farmers are extensively practicing this method in different crops and controlling the damage caused by wild boar to the extent of 70-80%.

Fixing of used colored sarees

This method also is a farmers' innovation, which has a behavioural background as far as wild boar is concerned. By arranging used sarees of different colors around the crop will make wild boars

to assume human presence in the area there by not preferring to enter into such areas. Even though, not feasible in all situations it has some marginal benefit in the areas of human movement. By using this, extent of damage by wild boar can be minimize to the level of 45-60%.

Bioacoustics

The bioacoustic technology uses only sounds of predators, distress and alarm calls of target and closely related species of target animals. The calls are broadcast in a field by suing an electronic platform with sound drives. Bioacoustic tries to convey the message 'this area is dangerous' to the target animals in their own language. On hearing the sounds, the target animals start avoiding the area, thus saving the crop from being damaged. The sounds are natural and safe on humans, birds and animals.

The equipment produces fixed volume of 110 dB at source covering an area of 8-10 acres when ambient noise level is around 42 dB. At 37 dB of ambient noise, the equipment can cover up to 19 acres. The equipment should be ideally installed when the animal damage is beginning. Bioacoustics is 92% effective in dispersing wild boar from the cropped area.

MANAGEMENT METHODS FOR NILGAI

Physical barrier:

HDPE Nylon Fish net as physical barrier

The fish nylon net (HDPE, UV stabilized, 2'' mesh and 1.5mm thickness) using bamboo or strong wooden poles should be erected by inserting the nylon rope in between the mesh net and fix around the crop vertically for about 6 feet height, at every 10 – 15cm nails to be fixed on the poles for better fixing of the net. Insert the nylon rope in between the mesh net and fix horizontally (2 feet) on the ground by using small wooden pegs. This method prevents entry of the animal into the fields and also if by chance animal enters will be entangled (since the animals are having hoofed feet) and makes alarm calls which deter away the other nilgai.

Biological barriers:

Planting of Karanda around the crop

Planting of karanda (*Carrissa carandus*) around the crop as bio fence does prevent effectively the entry of nilgai into the cropped area owing the thorny nature and not preferred as food. Using karanda as a border crop gives enormous benefits to the farmer by giving value added products extract of medical important, effective alternative to tamarind etc., in addition to fulfilling of basic purpose of nilgai prevention.

Four rows of curry leaves tree (*Murraya koenigii*) around the crop

This method is widely being popularized in all the crops by planting 4-5 rows of *Murraya koenigii* with close spacing around the crop fields. Nilgai is unable to prefer curry leaves due to its bitter taste and avoid the main crop. Through this method, farmer is benefitted with additional income throughout the year. Usage of curry leaves as border crop is Profitable around the year and avoids nilgai entry in to the crop area.

Solar shock fence

This is a permanent type of physical barrier arranged around the cropped area which is gaining more popularity in the present times. This method is being widely practiced to prevent the damage by nilgai in high valued remunerate crops. In this method a GI wire is fixed around the crop in 6 rows, one feet apart

with 12 volts electricity being sent to the fence with the help of solar plates and regulator. The shock received by the animal during the contact will not be capable of killing the animal but certainly ward off not only the animal which comes in contact but also other following animals which will be scared due to the alarm calls of the shocked animal.

Bioacoustics

The bioacoustic technology uses only sounds of predators, distress and alarm calls of target and closely related species of target animals. The calls are broadcast in a field by uing an electronic platform with sound drives. Bioacoustic tries to convey the message 'this area is dangerous' to the target animals in their own language. On hearing the sounds, the target animals start avoiding the area, thus saving the crop form being damaged. The sounds are natural and safe on humans, birds and animals.

The equipment produces fixed volume of 110dB at source covering an area of 8-10 acres when ambient noise level is around 42 dB. At 37 dB of ambient noise, the equipment can cover up to 19 acres. The equipment should be ideally installed when the animal damage is beginning. Bioacoustics is 80-90%% effective in dispersing nilgai from the cropped area.

Fixing of LED series of lights

Arranging Series of bulbs (Blue, red, yellow) 1 feet above the ground in 4 to 5 rows with the help of iron or wooden poles 1 feet away from cropped area will helps farmer to minimize the nilgai entry. This method is effective due to different colour lights, the animal may misguided that the presence of human beings and danger of current shock.

<u>Management methods for Monkeys</u>:

HDPE Nylon Fish net as physical barrier

The fish nylon net (HDPE, UV stabilized, 2'' mesh and 1.5mm thickness) using bamboo or strong wooden poles should be erected by inserting the nylon rope in between the mesh net and fix around the crop vertically for about 6 feet height and fix horizontally (1 meter) on the ground by using small wooden pegs. This method prevents entry of the animal into the fields and also if by chance animal enters will be entangled and makes alarm calls which deter away the other monkeys.

Agri Cannon (Monkey scarer gun)

Agri cannon is a mechanical device made of MS steel helps in deterring monkeys from the crop fields by producing huge sound. The device contains a drum, long barrel, electric igniter, ball valve and carbide tray. This device will work with the help of carbide, when carbide comes in contact with the water it will produce esthalene gas, when it ignites produces loud noise and disturb the animals from the area. It is effective up to 2 – 3 acres with the help of a person.

Bioacoustics

The bioacoustic technology uses only sounds of predators, distress and alarm calls of target and closely related species of target animals. The calls are broadcast in a field by using an electronic platform with sound drives. Bioacoustic tries to convey the message 'this area is dangerous' to the target animals in their own language. On hearing the sounds, the target animals start avoiding the area, thus saving the crop form being damaged. The sounds are natural and safe on humans, birds and animals.

The equipment produces fixed volume of 110dB at source covering an area of 2-3 acres when ambient noise level is around 42 dB. At 37 dB of ambient noise, the equipment can cover up to 6 acres. The equipment should be ideally installed when the animal damage is beginning. Bioacoustics is 63% effective in dispersing monkeys from the cropped area.

Strategies and challenges to mitigate the human wildlife conflict

- Large scale demonstration and popularization of different methods developed by AINP VPM through extension.
- People be discouraged to offer food/feed monkeys around temples and tourist places, wherever they are problematic.
- Preparation and circulation of documents on (i) Wildlife Protection Act schedules concerning the target animals for awareness creation (ii) Technologies available to be demonstrated at pilot scale through ICAR/SAU System (KVK).
- Meetings to be arranged by ICAR and DAC for focused discussion with senior officials of MoEF on Wild life Protection Act and other issues related to MoEF-higher vertebrate pests. The agenda may also cover issues in context of human-wildlife conflict
- Organization of high level meetings for showcasing species-based proven technologies for better adoption
- Need based basic research topics to be allocated to students by SAUs/ICAR Institutes for Ph.D. programmes for better understanding of HWC.
- In agro-pastural landscapes, Human Animal Conflict needs to be converted into Human Animal Co-Existence.
- Maintaining the delicate balance between Wild life Protection Acts and Crop Protection modules for Vertebrate Pest Management (VPM).
- Development of location specific VPM practices duly attaching practicable time lines for withdrawal mechanism.
- Creating safe zones for Wild life as an integral part of agro-pastoral landscapes.
- Evolving synchronization between wildlife biologists and plant protection specialists for a win-win strategy.
- Creation of buffer zones in the cropped areas, duly working out economic modalities on the basis of agro-ecological zones of India.
- Development of precise Data Base on crop damage by animals to implement VPM on priority.
- Multi-locational evaluation of developed VPM practices for enhancing their applicability across India
- Development of HRD in VPM through extensive training to agricultural scientists in wild life Protection laws
- Organization of awareness programmes in VPM to inculcate a sense of social responsibility in adopting VPM practices.

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