LITERATURE REVIEW – SRI LANKA

Livelihood Insurance from Elephants (LIFE) - 2019

Contents

1. **Human-Elephant Conflict and Solution to it in Sri Lanka.** (Dharmaratne & Magedaragamage, 2014)

Introduction

- Human-elephant conflicts take place due to a number of reasons, basically based on competition for space.
- Usually, the cost of human-elephant conflict arise in three forms,
    - ✓ Direct cost

      Crop damage, human death, and injury

    - ✓ Indirect cost
    - ✓ Opportunity cost
- Government and non-government organizations have a number of effort to control the problem so far, addressing short, medium and long-term approaches.

2. **Climate Influences on Human-Elephant Conflicts in Sri Lanka.** (International Research Institute for Climate and Society, 2005)

- The project study has basically focused on the question of whether there is any relationship between climate, water availability and river basin management and human-elephant conflict.
- The project study has obtained data regarding the rainfall from Department of Meteorology, Sri Lanka and Sri Lanka national Museum Library and a number of elephant deaths from Department of Wildlife Conservation and has analyzed the trend according to decades, seasons and inter-annual periods.
- The results of the analysis have identified a positive variation between climatic parameters and the death of elephants.

3. An assessment of the human-Elephant Conflict in Sri Lanka.

(Santiapillai et al, 2010)

Abstract

- As a result of trending human population and changes in land use pattern, agricultural lands and habitats of elephants are getting overlapping, resulting in a conflict between them.
- Rural people have been identified various crop species while stressing a serious impact on paddy, which is getting damaged frequently while pinpointing citrus trees as a method to avoid wild elephants.

Methodology

- Information has gathered by using questionnaires, interviewing 100 villages; belong to five provinces of the country.

Conclusion

- The human-elephant conflict in Sri Lanka is an old phenomenon.
- Due to overlapping of agricultural lands with elephant habitats, farmers are experiencing considerable damage to their cultivated crops and losing the positive attitudes towards the elephants.
- Since both species are sharing the same ecological requirements and as a result of the inadequate intervention of authorities to the problem, it has become one of the growing issues within the country.
- Therefore, immediate actions should be taken to solve the problem and it should include proper education and should drag the awareness of the people towards benefits of eco-tourism that can be practiced with involving wild elephants thus the people will recognize elephants as an economic asset to them and further it should include proper land use policy.

4. The Possibility for Developing a Sustainable Strategy to Solve the Conflict between Local People and Elephants in Hambantota District, Sri Lanka. (Liyanage, 2012)

Abstract

- Sustainable development has been identified as one of the key factors in developing countries and it should address both economic and environmental sustainability.
- With the sudden rise of development activities within the past few years in Hambanthota district, the human-elephant conflict has also gone up.
- In that case, the study focuses on the possibility of developing a sustainable strategy to solve the problem and at the same time, it focuses on finding a relationship between developing projects and increased number of human-elephant conflict, if there any.

Objective

- To investigate the relationship between Hambantota mega development projects and existing human-elephant conflict in the district while addressing following questions.
    a. What extent does the elephant represent a serious problem to local communities in Hambantota?
    b. How has the urbanization of the Hambantota district influenced the human-elephant conflict?
    c. How can elephants be utilized as an important resource for Hambantota development projects?
    d. What strategies have been tried to solve the elephant problem, and to what degree have these strategies been successful?
    e. What could be the role of wildlife conservation organizations?

Methodology

- Data has collected from entire Hambanthota district, randomly checking the places where human-elephant conflict is being existed by using the following methods;
    - Interviews
    - Observation
    - Focus group discussion
    - Snowball sampling
    - Analyzing text and documents

Findings

- Not availability of enough sources to obtain and share the information on human-elephant conflict among the villagers.
- Human-elephant conflict is highly affecting the livelihood of some community members and they have to go on with that as there is no any solution available.
- The perspectives and awareness about the relationship between elephant and development is really low among the community and they do not see elephants as an economic asset.
- According to most of the villagers and the officers of the Department of Wildlife Conservation (DWC), well-functioning fences are the most appropriate solution for the problem.
- Further, some modern approaches also can be utilized for the case such as;
    - Human-elephant living together,
    - Introducing new crops to avoid the crop raiding of elephants,
    - Establishing more translocation places,
    - Elephant corridors, more elephant orphanages.
- Officers of DWC are doing their best to mitigate the problem however monotony of the work and fewer payments have dissatisfied them and also there are some conflicts between the community and DWC officers.
- Megaprojects of the Hambanthota district have influenced the enhancement of human-elephant conflict as a result of poor consideration of environmental effects of the projects.

5. Perceptions and Patterns of Human-Elephant Conflict in Old and New Settlements in Sri Lanka: Insights for Mitigation and Management. (Fernando et al, 2005)

Abstract

- Since human-elephant conflict is a major threat towards the presence of elephants in Sri Lanka, the study has examined the situation of conflict between human and elephant in two selected areas Yala and Kahalle, contrasting with the land use pattern.
- It has identified there is a strong relationship between land use pattern and conflicts in selected areas and suggested that traditional land use pattern should be included as a part when developing strategies to conserve the elephants.

Methodology

- The study area has selected as two research and conservation projects have conducted in the selected area.
- Land use patterns have obtained by using ground-truthing and updating 1:50,000
  Scale topography the information on habitat has gathered by using overlaying a dot matrix and field visits.
- A questionnaire survey was carried out among the householders of two areas to examine the attitude towards the case.
- Agricultural and crop depredation pattern has examined by interviews and analyzing dung samples of elephants.
  Elephant behavior and ranging have examined by using radio-collared elephants in the southeastern region.

Results

- Since the land use pattern of Kahhale area is mosaic, there are no any large extended natural forest areas and patches of forests which elephants are living in are overlapping with human settlements, or in other words, since there is no any defined and separated area for utilization of land between two species there is a considerable conflict situation in the area.
- The land use pattern of Yala area is well defined and segregated, thereby it encourages the co-existence of the human and elephants within the area.
- There are three main agriculture practice patterns in the selected area, namely;
  - Double – crop permanent agriculture
  - Single crop permanent agriculture
  - Chena cultivation

- Methods of crop protection are not well organized and carrying as an individual basis in Kahalle area, as result of the lack of coordination between farmers, at harvesting periods, fields are getting damaged by the elephants.
- In yala, crop protection is well organized and carrying out by the farmer societies with the construction of watch huts in every felid. As a result of that, the guarding and harvesting is well coordinated and there is a strong co-operation within the community at the presence of a threat.
- As an overall comment, the elephants are ranging over a large area, completely in, out and both in and out from the protected area.
- Crop depredation occurs in the entire year in Kahelle whereas in Yala crop riding is relatively low and strictly seasonal.
- When considering the human attitudes towards the case, the community of Kahalle area has stated that elephants as a primary cause for crop damage, a major threat to human safety and authorities are the only party that should address the problem in higher percentage when comparing the community of Yala.

6. Effective Economic Management and Evaluation on Human-Elephant Conflict: Sri Lankan Empirical Evidences and Analysis.

(Bandara, 2003)

Abstract

- Human-elephant conflict is a common issue as a result of fragmentation of land and loss of habitats.
- Even though there are some policies to solve the problem, they have not resulted in any progress towards the resolving, thereby, new strategies are needed for the issue.

Objective

- To examine the economic issues involved in the conservation of the Asian elephant and mitigation of human-elephant conflict in Sri Lanka in order to suggest effective economic management strategies to ensure the long-term survival of this species of wildlife.

Methodology

- Information has gathered by using a survey, based on two samples, one is from urban residences and the other one is from affected farmers in six villages of Northwestern province of Sri Lanka.
- Logic and probit regression models have used to responses of the respondents to payment principle questions and to identify the factors that influence the responses of respondents.

Findings

- The willingness to financial support from the urban sample has exceeded the cost that incurred as a result of conflict thus it indicates that elephants are a net asset, not a pest.
- Further, it has indicated that Sri Lanka would experience a net economic loss if elephants become extinct.

7. Rural and Urban Attitudes to the Conservation of Asian Elephants in Sri Lanka: Empirical Evidence. (Bandara, 2002)

Abstract

- The study explained the attitudes of urban dwellers and farmers towards conservation of nature in general and on the other end especially focusing on elephant conservation.
- Majority of both samples have positive attitudes regarding nature conservation whole there is a difference between samples towards the attitudes of elephant conservation.

Methodology

- Required information was gathered from a face-to-face survey from two samples; one is from randomly selected three housing schemes in Colombo including the upper middle class, middle class and lower middle class, 100 respondents from each by using stratified random sampling method.
- The other sample has derived from human-elephant conflict-affected, randomly selected six villagers, totally 300 farmers.

Findings

- There is no any significant difference between the two samples regarding nature conservation but still, there is a variation in responses regarding elephant conservation between two samples.
- In combination of both samples, the majority of people have agreed that elephants should be conserved and for the question of why, out of some reasons, rural dwellers have given the priority towards historical, cultural and religious value of the elephants whereas urban dwellers have given priority towards altruistic, bequest, and existence value of the elephants.
- Level of education, age, gender has identified as main factors that affect the responses of respondent while the level of crop damage has identified as a factor responsible for negative attitudes of conserving elephants.
- Majority of respondents have answered positively for the payment settlement scheme with variation according to biding prices.

- Majority of the respondents have answered in favor for the question that whether or not the farmers compensate the losses due to human-elephant conflict indicating different groups of people that should pay the compensation.

8. Local Sustainable Development Solution for People, Nature and Resilient Communities. (Lamptey et al, 2012)

- The human-elephant conflict has identified as one of the growing issues in Sri Lanka due to loss of habitats for elephants basically.
- Thereby, the issue should be addressed properly and here the project study has done a number of efforts to mitigate the problem by working with the affected communities as a participatory approach.
- Here, improved fencing strategy has identified as one of the key solutions for the issue.
- Further, altering the land use pattern has also identified as one of the important aspects and it highly focuses on creating buffer zones around the cultivated lands by using the crops which repel elephants instead of attracting them.
- Also, the project study indicates that it is important to have a clear vision of the behavior of the elephants, habitat usage, abundance, movement and distribution when it comes to managing the human population.
- Further, it encourages the communities to practice agroforestry practices and home gardening concept as solutions for habitat losses.
- The project has witnessed some of the positive biodiversity and socioeconomic impacts while providing some of the key points for the policy development on this regards.

9. Surveying Elephants and Helping to Solve Human-Elephant Conflict in and around Wasgamuwa National Park, Sri Lanka. (Fernando et al, 2005)

- Expanding of irrigated agricultural lands has resulted in an increment in incidences of human-elephant conflicts causing conservation issue for elephants while causing socio-economic and political issues for the human.
- The project study has conducted a survey according to different monitoring methods, namely;
    - Elephant identification
    - Tank monitoring
    - Road transect
    - Trail transect
    - Fence monitoring
    - Human-elephant conflict
    - Dung monitoring
- As an overall comment, according to the combined results of all of the above-mentioned monitoring methods, the project study has concluded that a considerable number of elephants is ranged outside the protected areas and monitoring and maintenance of the mitigating methods such as electric fences of the project area should be updated.

10. The Human-Elephant Conflict in Southeastern Sri Lanka: Type of Damage, Seasonal Patterns, and Sexual Differences in the Raiding Behavior of Elephants. (Campos et al, 2009)

Introduction

- The subsequent increment in human-elephant conflict due to habitat losses and land fragmentation has caused significant treat towards the Sri Lanka society as well as the elephant population of the country.
- Even though there are some policies available regarding the case, since none of them are successful, the study focuses on finding the new, scientific strategies by analyzing information regarding;
    - Characteristics of damages produced by elephants.
    - Temporal distribution of human-elephant conflict.
    - Human-elephant conflict with rainfall, water availability and agriculture calendar.
    - Sexual difference in raiding behavior of elephants.

Methodology

- Data has collected according to agriculture calendar, water availability, occurrences of human-elephant conflict in six areas with the help of the trained and hired locals (qualitative and subjective data).

Discussion

- Crop riding has become the most common type of human-elephant conflict in the study area and attacks on human and houses are less frequent.
- Although People of the study area are ready to tolerate the crop damages, they have less tolerance towards human and house damages, thus leads to change the attitude of people towards the elephants.
- The study has shown human-elephant conflict is a seasonal phenomenon, depending on the rainfall and basically, this is due to quality and variance of the quantity of wild forage with the rainfall.
- Even though Sri Lanka elephants do not migrate according to seasons, the study has pointed out, some seasonal difference in their local special distribution and also has stressed that this is basically due to cultivation activities of Chena.
- The study has found that most of the elephant attacks have caused by small groups of elephants, dominating males and has further explained that, even though female leading

large groups are managed to obtain their diets without frequently damaging to crops, as a result of further development projects in the study area might cause increment in the situation as with the massive habitat losses these large groups of elephants also can become obligate rather that optional crop riders.

- In the long run, protected areas for elephants will be able to conserve the elephants, however; the human-elephant conflict will be increased due to elephants that are ranging outside the protected area, thereby, more effective human-elephant conflict mitigation strategies are needed by considering both human and elephant requirements.

11.Human-Elephant Conflict Mitigation and Co-existence in Sri Lanka.

(Global Wildlife Program., 2017)

- As a country holding the highest Asian elephant density, Sri Lanka accounts for 95 protected areas for elephants and yet the country is having the highest level of human-elephant conflict in the world as 70% of the elephant population ranging outside of the protected areas.
- Strategies that attempt to control the human-elephant conflict in Sri Lanka involves,
    - Translocation of problem elephants,
    - Large-scale elephant drives from areas earmarked for development,
    - Establishing electric fences around the protected area.
- However since these strategies are failed to address the issue properly, a new approach to fencing agriculture lands and villages under the fund of World Bank has begun and it has given better solutions for the problem recently.
- The study has given the solution for the failure of previously established electric fences as they have established without considering the behavior, responses, ecology. Habitat or ranging pattern of the elephants and at the other end, without involving communities to design, installation process, management and monitoring of these fences.
- The study has explained that the key points that should be considered when establishing electric fences;
    - ✓ Even though electric fences are the best way to mitigate the issue, they should establish according to the national land use and migratory corridor planning.
    - ✓ Electric fences should be located appropriately, which means that they should be located considering ecological boundaries rather than administrative boundaries.
    - ✓ Location of the fence, specifications, and design, maintenance, and responses of the elephants are the main factors that affect the success of the electric fences.
- The project has established two types of electric fences with the involvement of the affected communities, namely,
    - Seasonal/ temporarily paddy field or agriculture fences which are mobile fences that only establish when crops are growing in the fields.

    - Permanent village electric fences which establish to protect the social infrastructures of the areas.
- Awareness among the community members are critical when establishing, managing and monitoring these fences.
- When location the fences, the intention should be protected rather than restricting the movements of the elephants.
- Village ownership of the fences is important while government helping to scale up the fences and different agencies are giving the technical assistance.

12. Impact of human – Elephant Conflict on Livelihood: A Case Study from a Rural Setting of Sri Lank. (Thenakoon et al, 2017)

Abstract

- With the increasing human settlements, the human-elephant conflict has become a frequent issue in the communities of Sri Lanka, as the elephants are losing their habitat continuously.
- The study basically focusing on to find out is there any similarity or difference between the behavior of the elephants and is there any difference in number during the various stages of the harvest.

Methodology

- Dambe GN division which is the most affected GN division from the human-elephant conflict in North Western Province, Kurunegala District, Polpithigama DS division has chosen for the study.
- 26% of the total household population has chosen as the sample and quantitative data have gathered by using questionnaires and qualitative data have gathered by using formal and informal interviews
- Proximity to each farmland, prevention measures, the quantity of destruction, the connection between the number of times wild elephants invaded the farmland and quality of destruction have analyzed with statistical variation.

Discussion

- According to the statistics of crop damages in different stages of the crop, the study has identified almost every stage of paddy are affecting by wild elephants whereas the germination period of coconut is highly affecting followed by the felling of coconut trees and destruction of tender coconut.
- Banana cultivation has also faced equal destruction in every stage and on the other end; there is considerable destruction to Chena cultivation especially when it comes to root crops.
- When considering the total % of destruction, paddy has accounted for 65% in extent, while the banana has accounted for 75.6% and coconut 36% in trees within the sample.
- Location of the land and the status of the damage that has done to the cultivation take a spatial form.

- When the distance from the house to cultivated land is getting longer, the damage also getting higher.
- The farmers of the study area are using preventive methods such as firing crackers, fire, trapping guns, hooting and using ropes around the field, but the study has found that there is no connection between these types of preventive measures and damages, which means that no amount of effort of preventing the field using these kinds of methods can save crops are getting damaged by the wild elephants.
- Since the primary income source of this community is agriculture, this is affecting them in a number of ways;
    - The financial status of farmers become weakened
    - Further indebtedness
    - Money has to be spent on food items
    - Farmers become more and more vulnerable
- Property damages are the most prominent type of damages next to crop destruction and the study has identified the nature of the damage according to three main factors;
    - Location of the house close to elephant corridors.
    - Construction condition of houses.
    - Grain stored inside the house and crops in the home gardens.

13.Human-Elephant Conflict at the Bordering Villages of the Udawalawe National Park. (Ranjeewa, 2014)

- The human-elephant conflict has become a serious issue for bordering villages of Udawalawe National Park such as Dahaiyagala, Pokunuthanna, Aluthwawa, Neraluwa.
- Farmers of every village in study sample have to put a serious effort in guarding their farmlands and properties as elephants are destroying cultivated lands, home gardens, and homes while roaming the village even at the daytime and even breaking the electrical fences.
- With the continuous threats from wild elephants, people of these areas are tired up and criticize government authorities and political leaders for not paying enough attention towards the issue.
- The study has suggested some small changes to the issue, as it takes a long time to supply a well-planned solution to the problem;
    - Fixing of street lamps at the entrance and the exit of the Dahaiyagala corridor.
    - Re-establish the function of the guard rooms at the entrance to and the exit of the
    - Dahaiyagala corridor.
    - Re-establish the function of the electric spring gate at the entrance and the exit of the Dahaiyagala corridor.
    - Recruit villagers to maintain the electric fence of the Udawalawe national park and the Dahaiyagala sanctuary.

14.Elephants and Electric Fences, a Study from Sri Lanka. (Gunerathne, 2006)

- The study basically focuses on answering the reason of failing electrical fences in giving a proper solution for the human-elephant conflict even they have identified as an effective mitigating strategy.
- Data have gathered by using a structured questionnaire, surveying the households. These data include;
    - General household information.
    - Agriculture land.
    - Ownership information.
    - Damage caused by the elephants.
    - How the animal's impacts had been mitigated by the construction of electric fences.
    - Opinions of community members on how to make electric fences more effective.
- According to the responses, the study has identified the following points regarding the electric fences.
    - There are some technical failures such as wrong spacing, placement of wires and power failures.
    - When establishing electric fences, elephant behavior and distribution pattern had not taken into account thus cause many failures in electric fences.
    - Social community participation is a key social factor that determines the success of the electric fences.
    - Electric fences have seen as last solution rather that establishing other kinds of barriers.
    - Electric fences will be more effective when they use together with other mitigation strategies such as establishing elephant corridors and enriching the elephant's habitat.
    - Ill-legal destruction of electric fences by ill-legal timber fellers and liquor producers should be avoided.
    - When creating strategies for mitigating the conflict, it should give priorities such as;
        - ✓ Present land use pattern.
        - ✓ The degree of habitat fragmentation in the surrounding area
        - ✓ Elephants behavior in nearby reserves
        - ✓ Local people’s priorities and perceptions of the elephant threat.

15. Elephant Routes – Alert System for Villagers via Motion Tracking

(Amarasekara et al, 2014)

- The decrement of habitats for elephants have causes increment in human-elephant conflict causing serious damages to the lives of both human and elephants and on the other end, causing a considerable level of property damages.
- So far, none of the used methods have been able to clear the issue at least up to some extent thus the study has focused on finding a modern solution for the strategy by using information communication technology as the base.

Methodology

- A prototype has developed according to the information gathered by using formal interviews with relevant authorities and informal interviews with villagers.
- The prototype has used GPS technology to track the elephants and pattern analyzed method to analyze the deviation of their moments.
- The prototype functions as;
    - Tracking the elephant
    - Analyzing the path of the elephant with past data
    - Analyzing the current path of the elephant
    - Predict the next moment of the elephant
    - Alert the stakeholders of the case if there is at least a 70% probability of elephants coming towards the relevant area.

Discussion

- The system has given 60% of accuracy when testing it under various circumstances and the designers have considered the result as a good value since it has run with insufficient data and it is expected to be learned by itself when it applied to real-world condition thus the accuracy would go up.
- Other than hardware and technical failures, the software had run without crashing and the designers have indicated that the system would need continuous maintenance.
- The designers have further explained that with the system it is also possible to examine the living pattern of any animal thus it can use as a guide for observing the wild animals for wildlife experiences as well.

16. Willingness to Pay for Conservation of Asian Elephants in Sri Lanka.

(Bandara, 2010)

- The human-elephant conflict has become one of the major poverty-related issues in Sri Lanka causing considerable damage to both human and elephant lives annually.
- As elephants are one of the main key creatures that helps to determine and maintain the forest dynamics, special attention should be given to minimize this issue, thus Ceylinco Insurance has presented an insurance scheme that is based on corporate social responsibility.
- Here, life/vehicle policyholders of Ceylinco Insurance are expected to pay a small amount as a premium to establish a social trust fund.
- Increased opportunities to domesticate elephants for religious festivals, local tourism and increased agriculture production due to decreased damages are the benefits that urban stakeholders of the scheme are expected to experience.
- It has recorded that the majority of the respondents were (89%) willing to participate in the scheme and its economic value has exceeded the total loss due to elephant damages in the agriculture sector.
- On the other end, farmers have asked to pay a nominal annual fee of Rs. 650 and as a return, they will receive payments on death, the death of a spouse, property damage, crop damage and support for their children's education.
- The farmers are entitling for the benefits even if they do not own their own land.
- 10% commission will be given to the relevant government authority as the implementation cost.

17. Survival of the Fittest; Human-Elephant Conflict and its Impact on Sustainable Development. (Ayoob, 2012)

- The relationship between human and elephants has been recording from a longer period of time.
- The study has examined the nature of the human-elephant conflict in Addalaichenai Divisional Secretariat Division in Ampara District where one of the places that human-elephant conflict can be seen often.
- The study area is a multinational area where farmers are cultivating paddy as their main crop whereas coconut, sub food and Chena as supplementary cultivations.
- The study has identified following points as causes for human-elephant conflict in these areas;
    - 30% of the forest lands have deforested for human settlements in the study area by so far.
    - Continuous disturbances to traditional habitats of elephants due to activities and operations of forces.
    - The study area locates very close to the forest or forest boundaries.
    - Uncontrollable behaviors of elephants.
    - The killing of elephants for business gains.
- The study explains the adverse impacts of human-elephant conflict as;
    - Physical effects and human deaths.
    - Damages to infrastructures including education, healthcare, and water.
    - The economic loss of agriculture has estimated to Rs. 300 000/ year due to elephant attracts.
    - The cost of production has increased as a result of expenditure incurred on elephant frightens methods causing dropping of farmers below the poverty line, debt, and frustration.
    - Coconut production, Chena cultivation of the area has restricted to very few places as a result of elephant damages.
    - Forest-based occupations, as well as other cottage industries such as brick making, mat production, have also restricted.
- The study further highlighted some of the efforts that have made by the government to mitigate the problem;
    - Keeping the elephants in protected areas.

- “Kajamithuro” central organization to establish electric fences, natural fences and providing materials and training for farmers.
- Providing compensation to farmers on elephant damages.
- Establishing rules and regulations on elephant protection.

- However, it has recorded that farmers are not receiving their compensation accordingly, some electric fences are not working properly and the operations and functions of the “Kajamithuro” organization is not in an acceptable level when implementing above measures.

18.Electric Fence Intrusion Alert System (eleAlert)

- The study has introduced innovative and cost-effective strategy with the objective of increasing the effectiveness of electric fences using a network of sensors which detect and locate the damage instantly and alert the relevant community via a mobile communication network.
- Usually, electric fences have regarded as common mean against elephant attracts worldwide, however in some cases, elephants tend to damage them and walk over them.
- In this case, fault and intrusion detection system is needed for electric fences and it should include the following qualities;
    - Detect and locate breaches to the fence.
    - Consume very low energy.
    - Be repaired and maintained by persons with little technical know-how, with locally available material.
    - Be monitored remotely.
    - Operate in areas with poor connectivity.
    - Be scalable to be installed along long lengths of electric fencing.
- In this new method, Remote Transmit Unit (RTU) identifies when an intrusion occurs and transmit the message to central access station and to a designated person and the status of the fence can be monitored via the web as well.
- The RTU is capable of remotely switching off the electric fence for the repairing purpose.

19. Agricultural Lifestyle, Perspectives and Conservational Issues in Protected Areas: A Study of Human-Elephant Conflict in Pidurangala in the Central Province of Sri Lanka. (Ranaweerage, 2012)

- The human-elephant conflict has become one of the major issues in Sri Lanka as human and elephants are sharing identical habitats for the living.
- The study was conducted in Pidurangala area, investigating human-elephant conflict incidents within one year, daily basis by using enumerator reporting system and field interviews.
- Accordingly, the study has divided incidents into two main categories;
    - Elephant induced damages on the human.
    - Human-induced damages on elephants.
- When considering elephant induced damages on human, the study has highlighted the following points;
    - When ranking according to the frequent, the order comes as, crop damages, property damages, human deaths and other impacts that are difficult to quantify.
    - Crop damages occur according to the crop calendar of the area, July to September which is vegetable harvesting period and February to April which is rice harvesting period.
    - Rice has recorded as the worst affected crop, followed by pumpkin, melon, onions, and tomato. Sesame, mustard, and green chili have recorded as less affected crops and further, it has noted that elephants haven't consumed onions, green chili and mustard and damages have only occurred by trampling.
    - Most of the time small groups of elephants have caused the crop damages which in completely upside down observation with the previous studies. The study explains that this is mainly due to paddy fields are located in far away from homes.
    - Property damages are high between July to September due to a high amount of rice storage in this period and in most cases, individual male elephants are responsible for the damages.
    - The local people of the area have experiences of recognizing the existence of elephants from the smell, the sound of footsteps and breaking leaves and branches of trees even in nights and mostly newcomers, who do not hold this knowledge are becoming victims of elephant attracts often.

- The inadequacy of sleeping hours, less time to spend with the family members, affecting social lives of the community members, low level of school attendance and after school activates are the impacts that cannot be quantified in this regard.
- Distribution of elephant induced damages has concentrated to paddy lands in the rainy season whereas property and home garden damages have recorded mostly in dry season.
- Human-induced damages on elephants can be divided into two categories, elephant injuries, and elephant deaths and there is an increment in these incidents showing the level of intolerance of human toward the elephants.
- Locals of the area are usually using methods like watch posts, lighting, notices, biological fences, avoidance of night outings to mitigate the issue.
- Divisional Secretariat and Wildlife Conservation of Sri Lanka (DWCS) are the responsible authorities for mitigating the issue and they have introduced a compensation scheme for farmers with the aim of increasing the level of tolerance of farmers towards the elephants thus reduces the killing of elephants however, in local's opinion the process is inefficient as it takes long processing time.
- DWCS has given crackers to the farmers however the community is not satisfied with the quantity.
- Further, DWCS has established electric fences but it has caused issues for both human and elephant population as it separates human from forest access and it blocks elephant movements thus the community of the area is not participating in the maintenance of the fence.
- According to the perceptions of locals, shifting from traditional cultivation practices and absent of direct communication methods with the relevant authorities has caused the issue more serious thus allowing the traditional cultivation methods and valuing the traditional conservation methods of the people is very much needed in a suitable mitigation strategy for the issue.

20.Mitigation of Human-Elephant Conflicts in Sri Lanka. (Santiapillai, 1996)

- Continuous contraction of elephant habitats has caused an increased number of human-elephant conflict incidents.
- When considering the methods, they can be further divided into two main categories;
    - Methods of combat.
    - Preventive measures.
  - Methods of combat include;
    - Using powerful beams of light.
    - Using domesticated elephants to chase wild elephants.
    - Use of firecrackers.
    - Use of loudspeakers which play jumble of notices.
    - Use of infrasound that is intolerable for the elephants.
    - Use of firearms.
  - Preventive measures include;
    - Common sense on behaviors of elephants.
    - Use of repellants.
    - Changing the land use pattern.
    - Establishing buffer zones.
    - Establishing trenches.
    - Establishing log and electric fences.
    - Translocation of problematic elephants.
    - Removal of male elephants.

21. Human Elephant Conflict: case of amapra district, with special reference to sammanthurai divisional secretariat. (Ahamad & Rifasa, 2016)

- As a result of increasing human population and changes in land use pattern, the human-elephant conflict has become a common sight in many rural areas of the country.
- The study has examined the nature of the human-elephant conflict, giving special reference to Sammanthuai Divisional Secretariat Division in Ampara District.

Objectives

- The main objective of the study is to analyze the nature of the human-elephant conflict in the coastal belt of Ampara District with special reference to Sammanthurai (DSD). It has further divided into several specific objectives;
    - To assess the cost of Human-Elephant Conflict in the study area.
    - To study the risk and preventive techniques against Human-Elephant Conflict in the study area.
    - To identify how much the expenditure by the public to be used in this conflict.
    - To recommend biological mitigation measures to reduce this increasing issue.

Methodology

- Both primary and secondary data have used for the study.
- Secondary data have collected from relevant government authorities.
- Primary data have collected mainly by surveying 30 households using questionnaires.
- The study area has selected by using purposive sampling technique.
- The data have analyzed using SAS and Minitab software.

Results and discussion

- The study area is basically based on an agro-based economy where paddy, coconut, highland crops, Chena cultivation, banana can be identified as major cultivations.
- The mean value of elephant arrival in the study area has recorded as 35 times per year.
- The distance between household and forest is an important factor that has influenced the number of times that elephants arrived, accordingly, if the distance is short the number has increased and vice versa.
- According to the behavior of the elephant, most of them have arrived at night time.

- Considering the cultivation calendar of paddy, most of the respondents have answered that arrivals of elephants are high in the Maha season rather than Yala season.
- The study has divided the cost of the human-elephant conflict into three main categories; direct, indirect and opportunity cost.
- The mean value of property damage in the study area has recorded around Rs. 150 000 and these properties include paddy grains, small cottages, walls of the houses.
- The mean crop damage in the study area is around Rs. 385 000, these crops include; paddy, coconut and vegetable gardens.
- Injuries, deaths of both human and elephants have taken place in the study area however no compensation was paid to the victims. Explaining further, the study indicates that, compensation only pays for the people those who have registered with the insurance scheme and majority of the community members are not aware of it.
- Guarding crops from field huts, lighting lamps in the field, of battery –operated and electric torches or flashlights, burning firecrackers and erecting fences are some methods that are using by locals mitigate the damage.
- A paid guard is hiring some areas with a monthly payment of Rs. 25 000, collected from farmers however this is not a guaranteed method.
- Adverse impacts on the education of the children in the study area have identified as a long run-welfare issue that arises from the issue.
- Expanding of wildlife-based tourism, conducting awareness programs among the communities, promoting national dialog on protecting Sri Lankan elephants, introducing proper compensation and insurance scheme, resettlement of the people from elephant corridors, providing weapons, training and life insurance for border guards, introducing of biological fences with Palmyra and lime and bee fences are the possible suggestions for the issue.

22. Wi-alert: a wireless sensor network-based intrusion alert prototype for hec. (Edirisinghe et al, 2013)

- The human-elephant conflict has become the biggest environmental and socioeconomic problem in Sri Lanka as 70% of the wild elephants are living outside of the protected areas.
- Recently, 3 million people of 13 different district of the country are struggling with this issue and as a result, 225 elephants are being killed by people as an average figure and on the other end, Rs. 1100 million agricultural losses recording annually as an outcome of the issue.
- Electric fencing system is the most popular mitigation strategy that uses within the country however it is frequently attacked by the elephants, thus there is a need for an improved technological solution.
- As an alternative, the eleAlert system has introduced but due to several limitations of eleAlert, the study has introduced a sensor-based alert system as an improved version of the eleAlert system.
- The study basically based on an ongoing project, which detects the elephants using a wireless sensor network, called Wi Alert.
- In the experiments, the prototype verified its ability to detect elephants, filter the obstacles and reduce the multipath effect.

23.Human-Elephant Conflict in Sri Lanka: With Special Reference to Thanamalavila DS Division. (Samaraweera et al, 2010)

- The relationship between elephants and human is becoming increasingly conflictual as a result of increasing population and agricultural lands, both parties have to compete for space and resources.
- The study has focused on the nature of the human-elephant conflict in Thanamalvila Divisional Secretariat Division.

Objectives

- To investigate the human-elephant conflict in Thanamalvila DS division where recorded a high number of such incidents in recent years with the following specific objectives.
    - To identify the costs of the Human Elephant conflict in the study area.
    - To study the risk and preventive techniques of human-elephant conflict in the area.

Methodology

- Both primary and secondary data have used for the study.
- Secondary data have collected from relevant government authorities.
- Primary data have gathered from 106 households by using a stratified random sampling method and with the help of questionnaires and field observations.
- Data have analyzed by using SPSS package.

Results and discussions

- The study area is basically an agro-based community, cultivating paddy, Chena, Banana, Corn, Coconut whereas the majority of farmers are depending on Chena cultivation.
- Majority of the respondents have pre-secondary education level.
- The mean income of the households of the study area has reported as approximately Rs. 15 000 with the majority below Rs. 10 000.
- The mean number of elephant arrival per year has estimated as 20 times.
- The distance between house and forest has a very close relationship with the arrival of elephants when the distance is getting shorter, the number of arrivals is getting higher and vice versa.

- In most cases, elephants have arrived at night time and when considering with the paddy cultivation calendar, the elephants tend to arrive during the Maha season.
- The study has stated that the cost of human-elephant conflict as multidimensional and it has identified as physical, economic and mental costs as direct costs on human as the outcome of the issue.
- Explaining further, the study has stated that, a considerable proportion of respondents is having serious damage to their agricultural lands, especially to Chena and Banana cultivations.
- Preventive measures that have already undertaken can be classified into three categories; government, community, and household level.
- Distribution of elephant crackers is the common approach that has used in the study area at government level while at the community level; people are practicing methods such as changing cultivation areas and use of fences.
- At household levels, people are practicing mitigation strategies such as the building of tree houses and using of weapons.
- Although the compensation scheme is available for the losses, the majority of the community is not satisfied with the scheme.
- The study further suggests following points to be considered when launching mitigation strategy for the issue.
    - Proper management of Chena cultivation, integrating with the land policies.
    - Cultivation of border of crops around Chena that repel elephants such as chili.
    - Expanding wildlife-based tourism.
    - Conducting awareness programs regarding the cultural and economic value of elephants, especially among the younger generation.
    - Promoting national dialog on protecting elephants.
    - Introducing proper compensation and insurance schemes.
    - Resettlement of people out of the elephant corridors and mapping of elephant corridors in the area.

24. Would masking the smell of ripening paddy-fields help mitigate human-elephant conflict in Sri Lanka? (Santiapillai & Read, 2010)

- The human-elephant conflict that is related with agriculture is a serious issue in Sri Lanka and mainly the deaths of elephants have been identified as results of interfering with agricultural practices.
- Different countries around the world are using different measures to mitigate the issue;
    - In Kenya, honeybees have been used to mitigate the issue.
    - In West Thailand, hanging of used CD s can be seen as a mitigation measure.
    - In Sumatra, farmers are using chili fences to guard the cultivations from elephants.
    - In the colonial era of Sumatra, farmers had used human urine soaked rags to avoid elephants.
- However, when analyzing the behavior of elephants in Sri Lanka, a seasonal pattern of elephants can be seen when it comes to damaging of crops. This pattern is closely related with the cultivation calendar of Paddy, with Maha and Yala seasons.
- The article has stated that this seasonal variability can be the outcome of the olfactory trigger of elephants which means that since elephants are excellent in detecting smells, they are responding to the odor of paddy when it is at its palatable stage.
- Explaining further, the article stressed that, proper research studies should be carried out to decide whether or not the odor of paddy is an attractant for elephants and if yes, suitable masking methods should be undertaken to avoid the attraction of elephants towards paddy fields.
- As a conclusion, the article is pointing out that, rather than focusing on strategies that minimize the conflict, studies should be given more attention on the question why elephants choose a certain time to raid the crops.

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