

National Action Plan for the Mitigation of Human-Elephant Conflict

December 2020



Preparation of the Action Plan

On the direction of His Excellency the President, the *Presidential Committee to Prepare a National Action Plan for Human Elephant Conflict Mitigation* was appointed by the Secretary to the President on the 22nd of July 2020.

The committee conducted a review of all human-elephant conflict mitigation methods. Activities to be adopted for the National Action Plan were selected based on their proven effectiveness, ability to be implemented at an appropriate geographic and time scale, and cost effectiveness. Stakeholder consultations were conducted with the public and relevant agencies and expressed views incorporated in the Action Plan as appropriate.

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Abbreviations

CSD	Civil Security Department
DWC	Department of Wildlife Conservation
ESCAMP	Eco-Systems Conservation And Management Project
FD	Forest Department
HEC	human-elephant conflict
MoW	Ministry of Wildlife and Forest Resources
SMoW	State Ministry of Wildlife
NGO	non-governmental organization
OSF	Other State Forest

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EXECUTIVE SUMMARY

Human-elephant conflict is very widespread in Sri Lanka. It is currently reported from over half the country and almost the entire dry zone. It has been continuously increasing and has shown a dramatic escalation in the last few years.

The previous approach to elephant management and human-elephant conflict mitigation was formulated in 1959 and prescribed limiting elephants to designated protected areas. In spite of dedicated efforts by the Department of Wildlife Conservation, after 60 years of pursuing this goal, today 70% of elephant range is in areas with resident people. Its failure is mainly due to biological factors, including protected area carrying capacity, ecological requirements and behaviour of elephants and their response to management actions. Intensifying efforts at limiting elephants to protected areas is unlikely to succeed and will cause conflict escalation. It will also decimate elephant herds hence negatively impact nature-tourism. Therefore this Action Plan recommends a change in the approach to human-elephant conflict mitigation, based on wider stakeholder participation and prioritizing protection of settlements and cultivations from elephant depredation.

The Action Plan proposes activities providing results in the short, medium and long term. Effective conflict mitigation requires their concurrent and long-term implementation. Short-term actions will immediately reduce crop and property losses where implemented. Countrywide reduction in conflict will be proportionate to the geographic scale of implementation and a significant reduction is expected over a two to three year period if implemented widely and fully. Medium-term actions are expected to help further reduce conflict over a five-year period and long-term actions to sustain these achievements.

A number of activities are proposed for providing immediate relief to the affected public from elephant depredation. They include constructing community-based electric fences such as village and paddy-field fences to prevent elephants entering and causing damage to settlements and crop fields. Where community involvement is not possible, the government is to construct and maintain the fences. Electric fences with elephants on both sides are to be relocated to the boundary of areas used by elephants. It is recommended that activities that may increase conflict, such as elephant drives, be minimized or discontinued after evaluation. Continuation and further strengthening of compensation for deaths, injuries and property damage is recommended. Insurance initiatives and plans for clearing of road verges or installing street lighting at critical locations for preventing accidental deaths by elephants are to be developed and implemented. Although the use of elephant firecrackers escalates conflict, distribution is to be continued till other recommended initiatives reduce conflict. Activities such as translocation to holding grounds, for which no data is available, are to be monitored and evaluated to decide on applicability to conflict mitigation. Illegal activities that increase conflict such as encroachment of state land and livestock grazing in protected areas are to be prevented. Conducting concerted awareness programs is proposed to decrease human and elephant deaths, and to facilitate implementation of proposed actions.

Activities providing results in the medium term will ensure better development planning to prevent creating and escalating human-elephant conflict and provide data for better management. Actions proposed include elephant-distribution surveys, elephant census, GPS-radio collaring of elephants, conducting habitat management trials, developing new methods for human-elephant conflict mitigation and improving existing methods such as trenches and hanging fences. The need for incorporating human-elephant conflict mitigation initiatives in developmental activity and regulating chena cultivation is emphasized.

In the long term, a detailed, practical elephant management plan based on science is required so that the proposed short- and medium-term actions are complemented and long-term conflict reduction ensured. Data on effectiveness and impact of many of the actions that need to be assessed for this purpose are currently not available. Therefore it is recommended that a committee be immediately appointed to develop a long-term elephant management plan.

Finally it is proposed that a Presidential Task Force be established to monitor implementation of the Action Plan and that the Action Plan be reviewed annually and revised as appropriate, taking an adaptive management approach.

IMPLEMENTATION SUMMARY

A. MEASURES THAT WILL PROVIDE RESULTS IN THE SHORT TERM

A1. Provide immediate relief from crop and property damage

A1.1. Electric fencing

A1.1.1. Village electric fences

No.	Action	Responsibility	Timeline
1.	A policy decision to be taken that Divisional Secretariats should implement community-based village electric fencing in collaboration with appropriate agencies	Presidential Secretariat	Immediately
2.	Develop training program, including manuals ^[1,2]	MoW, SMoW, Divisional Secretariats, other relevant agencies	Commence immediately
3.	Train 50 officers in implementation of community-based village electric fencing		2 months from commencement
4.	Procure material for 100 village electric fences		3 months from commencement
5.	Implement 100 village electric fences		By end of year 1
6.	Develop monitoring and evaluation protocols		3 months from commencement
7.	Monitor and evaluate		3 months on
8.	Upscale based on the results of year 1 and expand program to all Divisional Secretariat Divisions faced with HEC		Year 2 on

A1.1.2. Paddy-field electric fences

No.	Action	Responsibility	Timeline
1.	A policy decision to be taken that the Department of Agrarian Development should implement community-based paddy-field electric fences in collaboration with appropriate agencies	Presidential Secretariat	Immediately
2.	Develop training program, including manuals ^[1,3]	MoW, SMoW,	Commence

		Department of Agrarian Development, Mahaweli Authority, other relevant agencies	immediately
3.	Train 50 officers in implementation of paddy-field electric fencing		2 months from commencement
4.	Procure material for 200 paddy-field electric fences		3 months from commencement
5.	Implement 200 paddy-field electric fences		Next cultivation season
6.	Develop monitoring & evaluation protocols		3 months from commencement
7.	Monitor and evaluate		3 months on
8.	Upscale based on the results of year 1 and expand program to all areas faced with elephant depredation of paddy-fields		Year 2 on
9.	Explore possibility of incorporating into tourism plans that also benefit communities		Year 2 on

A1.1.3. Awareness campaigns

See Section A6

A1.1.4. Non-community-based electric fences

No.	Action	Responsibility	Timeline
1.	Identify and map situations where non-community-based fencing needs to be done	MOW, SMOw, DWC, other relevant agencies	6 months from commencement
2.	Estimate extent of fencing required		End of 6 months
3.	Implement 100 km of electric fences		By end year 1
4.	Develop monitoring & evaluation protocols		3 months from commencement
5.	Monitor and evaluate		3 months on
6.	Upscale based on the results of year 1 and expand program to all areas faced with elephant depredation		Year 2 onwards

A1.1.5. Relocate electric fences situated within 'areas used by elephants'

No.	Action	Responsibility	Timeline
1.	Formalize decision to relocate existing electric fences to the boundary of areas used by elephants	Presidential Secretariat, MoW	Commence immediately
2.	GPS map all DWC electric fences	MoW, SMoW, DWC	2 months from commencement
3.	Identify fences with elephants on both sides		3 months from commencement
4.	Prepare relocation plan and schedule, and make cost estimate		3 months from commencement
5.	Relocate 100 km of fences		By end year 1
6.	Develop monitoring & evaluation protocols		3 months from commencement
7.	Monitor and evaluate		3 months on
8.	Continue till all existing fences are relocated to the boundary of areas used by elephants		Year 1 on

A1.2. Elephant drives

A1.2.1. Discontinue large-scale elephant drives

No.	Action	Responsibility	Timeline
1.	Formalize policy decision to discontinue large-scale drives	MoW, SMoW, DWC	Commence immediately

A1.2.2. Assess medium-scale elephant drives

No.	Action	Responsibility	Timeline
1.	Obtain 10 elephant GPS collars	MoW, SMoW, DWC, research organizations, universities	Commence immediately
2.	GPS collar two female herds and three adult males, for each of next two medium-scale drives conducted, assess behaviour, habitat use, body condition and health, 2 months before and one year after drive		Upon completing Action 1

3.	Collect data on HEC in the drive area before and after drive by conducting questionnaire surveys		
4.	Based on data from Actions 2–3 assess the impact of medium scale drives on HEC and elephant conservation and decide on continuity		Upon availability of data

A1.2.3. Small-scale elephant drives (chasing elephants)

No.	Action	Responsibility	Timeline
1.	Conduct awareness program for DWC field officers and other stakeholders to make them aware of the negative repercussions of chasing elephants on HEC and elephants	MoW, SMoW, DWC, research organizations, universities	Commence immediately and refresh annually
2.	Collect following data, compile by office and region per day, month and year: <ul style="list-style-type: none"> No. of requests for chasing elephants No. of requests complied with Assessment of effort Assessment of effectiveness 		Commence immediately, continue for 1 year
3.	Correlate collected data with level of HEC and evaluate role of chasing elephants in HEC mitigation and elephant conservation		Upon completion of Action 2
4.	Take policy decision on chasing elephants by DWC		Based on results of Action 3

A1.3. Distribution of elephant-firecrackers (ali-wedi)

No.	Action	Responsibility	Timeline
1.	Issuance of fire crackers – continue at current level	MoW SMoW, DWC	Ongoing
2.	Collect data per day, month and year on <ul style="list-style-type: none"> Expenditure on purchasing firecrackers Distribution of firecrackers by office and region Level of HEC 		Commence immediately

3.	Assess data, correlate with level of HEC and evaluate role of distribution of firecrackers in HEC mitigation and elephant conservation		Upon availability of data
4.	Take policy decision on distribution of firecrackers		Based on results of Action 3

A2. Reduce death and injury of people caused by elephants

A2.1. Awareness programs See Section A6

A2.2. Develop and clear specific locations

No.	Action	Responsibility	Timeline
1.	Coordinate with Road Development Authority, rural development projects and local authorities to inform them of the requirements and develop plans for implementation	MoW, SMOw, relevant agencies	Commence immediately
2.	Under brushing/clearing of a strip on either side of rural roads where appropriate		0–3 months, regular maintenance
3.	Installing street lamps		By end of year 1

A2.3. Removing ‘problem-elephants’

A2.3.1. Capture-translocation

No.	Action	Responsibility	Timeline
1.	Obtain 10 elephant GPS collars	MoW, SMOw, DWC	Commence immediately
2.	GPS collar next 10 elephants released into the holding ground, assess their behaviour, habitat use, body condition and health	MoW, SMOw, DWC, research organizations, universities	Commence immediately
3.	Collect data on the numbers of elephants put in the holding ground, and the numbers that remain inside, die inside and escape		
4.	Collect data on HEC in the areas around the holding ground by conducting questionnaire surveys		
5.	Based on data from Actions 3–4 assess the impact of holding grounds on elephant conservation and HEC and decide on continuity		Upon availability of data

- A2.3.2. *Capture-domestication* Not recommended
 A2.3.3. *Culling* Not recommended

A3. Provide reparation for people's losses

A3.1. Compensation

No.	Action	Responsibility	Timeline
1.	Continue, strengthen and expand existing programs	DWC, District Secretariats, Divisional Secretariats	Commence immediately

A3.2. Insurance

A3.2.1. Life and injury

No.	Action	Responsibility	Timeline
1.	Coordinate with appropriate agencies to develop and popularize policies covering death and injury due to elephants	MoW, SMoW	Commence immediately

A3.2.2. Crop and property damage

No.	Action	Responsibility	Timeline
1.	Coordinate with appropriate agencies to develop and popularize policies covering crop damage due to elephants	MoW, SMoW	Commence immediately

A4. Reduce death and injury of elephants caused by people

A4.1. Prevent intentional killing/injuring of elephants

A4.1.1. *Conduct awareness programs* See Section A6

A4.1.2. Prosecution of offenders

No.	Action	Responsibility	Timeline
1.	Coordinate with appropriate agencies to strengthen and develop investigative and	MoW, SMoW,	Commence

	prosecution capabilities of the DWC	DWC	immediately
2.	Collect data on the number of cases filed against elephant killing/injury and number of convictions		Commence immediately
3.	Compile data on annual basis and place in the public domain		By end of each year

A4.2. Prevent accidental death/injury of elephants

No.	Action	Responsibility	Timeline
1.	Identify issues to be addressed and what data needs to be collected	MoW, SMoW DWC, relevant agencies	Commence immediately
2.	Collect relevant data and assess locations, extent and causative factors for accidental deaths		Commence immediately
3.	Coordinate with appropriate agencies to develop and implement effective actions		Upon data availability

A4.3. Minimize/eliminate management actions that cause death and injury of elephants and/or modify them to prevent detrimental effects on elephants

Capture-translocation See Section A2.3.1
Elephant drives See Section A1.2
Fencing within elephant habitat See Section A1.1.5

A5. Prevent loss of elephant range and habitat

A5.1. Prevent encroachment of state land

No.	Action	Responsibility	Timeline
1.	Prevent political interference in implementing the law with regard to illegal encroachments in state land	Presidential Secretariat	Immediately
2.	Set up a task force to identify and address specific cases and re-locate encroachers providing adequate alternatives to them	Presidential Secretariat MoW, relevant agencies	Commence immediately

A5.2. Prevent livestock herding inside protected areas

No.	Action	Responsibility	Timeline
1.	Prevent political interference in implementing the law with regard to livestock grazing in protected areas	Presidential Secretariat	Immediately
2.	Conduct studies on the extent of the issue and its impact	MoW, SMOw, DWC, Forest Department, research organizations, universities	Commence immediately
3.	Develop plan for alternative management of cattle in coordination with agencies responsible for livestock management	MoW, SMOw, DWC, Forest Department	Based on results of action 2
4.	Implement plan		Year 2 onwards

A6. Conduct awareness campaigns

No.	Action	Responsibility	Timeline
1.	Facilitate the conducting of awareness programs based on existing material, especially through mass media	MoW, SMOw, DWC, Forest Department, NGOs, media organizations, local authorities	Commence immediately
2.	Develop awareness campaign in coordination with relevant agencies		Commence immediately
3.	Estimate costs for campaign		6 months from commencement
4.	Set up fund and disbursement and management mechanisms	MoW, SMOw	Upon completion of Action 3
5.	Coordinate media campaign	MoW, SMOw, media organizations	Year 2 onwards

B. MEASURES THAT WILL PROVIDE RESULTS IN THE MEDIUM TERM

B1. Obtain baseline information to guide development and management

B1.1. Conduct elephant and HEC distribution surveys

No.	Action	Responsibility	Timeline
1.	Host currently available data on web in interactive manner with public access at a site such as < https://www.nsd.gov.lk/geoportal >	MoW, SMoW, DWC, research organizations, universities	Commence immediately
2.	Conduct survey every 5 years, using same methodology		Commence in 2021
3.	Update distribution maps		Upon completion of survey

B1.2. Conduct elephant census

No.	Action	Responsibility	Timeline
1.	Identify area for census trial	MoW, SMoW, DWC, research organizations, universities	Commence immediately
2.	Identify methodologies for conducting census		Commence immediately
3.	Conduct census using different methodologies		Upon completion of Actions 1&2
4.	Analyse data and determine appropriate methods and geographic scales for elephant census		Upon completion of Action 3
5.	Conduct elephant census at appropriate scale		Based on results of Action 4

B1.3. GPS-collaring of elephants

No.	Action	Responsibility	Timeline
1.	Make data from elephants collared under ESCAMP available for decision making	MoW, SMoW, DWC	Immediately
2.	Purchase 100 collars		Commence procurement process immediately
3.	Set up a new unit for collaring		Commence immediately

4.	Collar 100 elephants	MoW, SMoW, DWC, research organizations, universities	Complete before end year 1
5.	Provide public access to the tracking data by hosting on the web at a site such as < https://www.nsd.gov.lk/geoportal >		Once collaring commences
6.	Analyse the data continuously and use for management and guiding development		Once collaring commences
7.	Procure additional collars based on completion of collaring and identification of needs & continue actions 4-7		Year 2 on

B.1.4. Conduct trial of habitat management

No.	Action	Responsibility	Timeline
1.	Identify an area where habitat management could be done	MoW, SMoW, DWC, FD, District Secretariats, research organizations, universities	Start immediately
2.	Select 10 plots of approximately 100 ha for habitat management trial		Based on completion of Action 1
3.	Select 5 treatments of habitat management (could be 5 crops or permutations of fewer crops with different methods of cultivation or ground preparation)		Based on completion of Action 2
4.	Randomly assign each of five treatments with 2 replicates each		Based on completion of Action 3
5.	Assess the use of each experimental plot by elephants and other animals by conducting dung counts based on transects and sampling plots, every 3 months for two years		Upon completion of Action 1 for 2 years
6.	Assess vegetation in each plot, based on sampling plots, by recording diversity and abundance every 3 months for two years		Upon completion of Action 1 for 2 years
7.	Radio collar 2 female elephants from different herds and 5 males in the area of habitat management. Monitor their use of the habitat management area and other areas		At start
8.	Conduct habitat management		After 1 year of Actions 5, 6 & 7
9.	Analyse vegetation profile and abundance, and elephant and wildlife use, of the sampling plots before and after habitat management		After 2 years of Actions 5, 6 & 7
10.	Conduct cost-benefit analysis, impact on elephants and determine relevance to HEC mitigation		Upon completion of Action 9

B2. Develop and improve HEC mitigation tools

B2.1. Trenches

No.	Action	Responsibility	Timeline
1.	Develop modifications of trenches	MoW, SMoW, DWC, research organizations, universities	Commence immediately
2.	Build test trenches and assess cost, durability and effectiveness		Based on results of Action 1
3.	Implement on pilot scale and monitor durability and effectiveness		Based on results of Action 2
4.	If successful, incorporate in Action Plan and implement on appropriate scale		Based on results of Action 3

B2.2. Improve electric fence designs

No.	Action	Responsibility	Timeline
1.	Develop modifications of electric fences	MoW, SMoW, DWC, research organizations, universities	Commence immediately
2.	Build test fences and assess cost, durability and effectiveness		Based on results of Action 1
3.	Implement on pilot scale and monitor durability and effectiveness		Based on results of Action 2
4.	If successful, incorporate in Action Plan and implement on appropriate scale		Based on results of Action 3

B2.3 Develop new HEC mitigation tools

No.	Action	Responsibility	Timeline
1.	Identify methods and innovations with possible applicability	MoW, SMoW, DWC, research organizations, universities, innovators, other stakeholders	Commence immediately
2.	Develop methods/prototypes		Year 1 onwards
3.	Test effectiveness, practicality, durability and sustainability, and assess cost-benefit		Upon completion of Action 2
4.	Select methods/innovations based on results of Action 2 and pilot-test at appropriate locations, geographic- and time-scales		Upon completion of Action 3
5.	Based on results of Action 4, incorporate into the Action Plan if relevant		Upon completion of Action 4

B3. Incorporate HEC mitigation in development activity

B3.1. Large-scale planned projects

No.	Action	Responsibility	Timeline
1.	Prepare guidelines for measures to prevent creation and escalation of HEC, to be taken by developers when conducting large-scale developments in areas with elephants	MoW, DWC, CEA	Immediately
2.	Ensure that an assessment of HEC potential and its mitigation is included in the Terms of Reference of EIAs in projects that are proposed in landscapes shared by humans and elephants	CEA, project approving agencies	Immediately
3.	Ensure imposition of conditions in EIA process	MoW, DWC, CEA, project approving agencies	Upon preparation of guidelines
4.	Develop mechanisms for monitoring and ensuring implementation of conditions		Upon imposition of conditions

B3.2. Small-scale projects

No.	Action	Responsibility	Timeline
1.	Prepare guidelines for measures to prevent creation and escalation of HEC, to be taken by developers when conducting small-scale developments in areas with elephants	MoW, DWC, CEA, District Secretariats	Immediately
2.	Develop mechanisms for imposition, monitoring and ensuring implementation		Upon completion of Action 1

B3.3. Manage chena cultivation

No.	Action	Responsibility	Timeline
1.	Map and identify areas where chena cultivation could be permitted	MoW, DWC, FD, District Secretariats	Six months from start
2.	Develop mechanisms for regulating chena cultivation through an annual permitting system.		Upon completion of Action 1
3.	Implement annual permitting system, monitor and adapt as necessary		Completion of Action 2 onwards

C. MEASURES THAT WILL PROVIDE RESULTS IN THE LONG TERM

No.	Action	Responsibility	Timeline
1.	Appoint committee to develop a Master Plan for elephant management	Presidential Secretariat	Immediately

D. IMPLEMENTATION OF THE NATIONAL ACTION PLAN

D1. Presidential Task Force to Monitor the Implementation of Action Plan

No.	Action	Responsibility	Timeline
1.	Appoint a Presidential Task Force for monitoring the implementation of the Action Plan	Presidential Secretariat	Immediately

D2. Possible constraints in implementing the Action Plan

No.	Action	Responsibility	Timeline
1.	Ensure that there is no political interference in technical decisions and implementation actions	Presidential Secretariat	Immediately

D3. Revision of the Action Plan

No.	Action	Responsibility	Timeline
1.	Appoint committee to review and revise action plan as necessary, in coordination with the task force monitoring implementation	Presidential Secretariat, MoW	By end of year 1

SUMMARY OF PROPOSED BUDGET

The table below lists the suggested budget allocations for the first year of implementation of the National Action Plan. Details of each allocation are provided under the specified sections of the Detailed Action Plan.

Section	Action	Allocation (Rs. Million)
A	<i>Short term</i>	
A1.1.1	Village electric fences	600
A1.1.2	Paddy-field electric fences	300
A1.1.4	Non-community based electric fences	110
A1.1.5	Relocation of electric fences	55
A1.2.1	Assess medium-scale elephant drives	13
A2.2	Develop and clear specific locations	50
A2.3.1	Capture-translocation	10
A6	Awareness Program	10
	Total I	1,148
B	<i>Medium term</i>	
B1.1	Distribution survey	10
B1.2	Elephant census	10
B1.3	GPS-collaring of elephants	200
B1.4	Trial of habitat management	118
B2.1	Trenches	50
B2.2	Improve electric fence designs	50
	Total II	438
	Grand Total	1,586

DETAILED ACTION PLAN

BACKGROUND

Current Situation

Human-elephant conflict (HEC) is a major socio-economic, conservation and political issue in Sri Lanka. Over the past few years the intensity of HEC has shown a dramatic increase as demonstrated by indicators such as annual human deaths due to HEC and reported elephant deaths, which have steadily increased (Fig. 1). The highest annual figures so far were the 121 human deaths and 405 elephant deaths recorded in 2019.

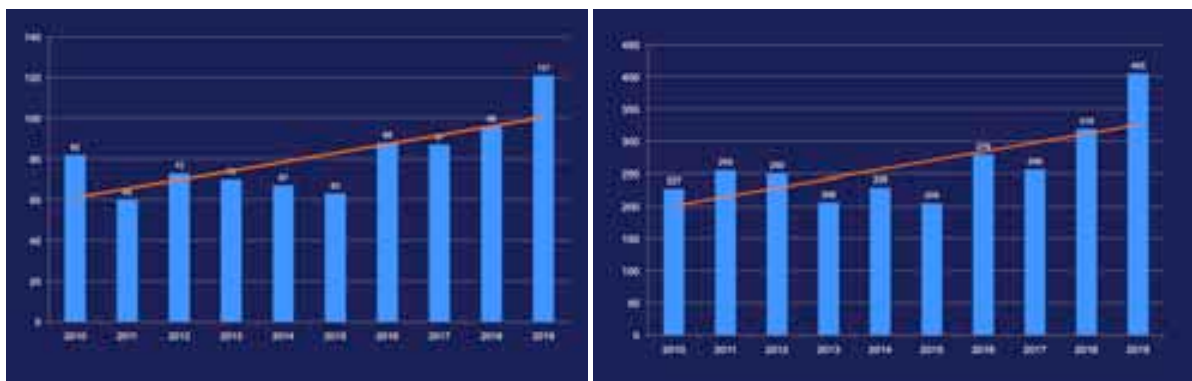


Figure 1. Left: Annual human deaths due to HEC; Right: annual elephant deaths reported; from 2010 to 2019.

Currently there are resident people in 82% of Sri Lanka, elephants are found in 62% of the country and in 44% of the country elephants and people live in the same landscape (Fig. 2)^[4]. Assuming there are around 6,000 elephants in Sri Lanka^[5], over 4,000 elephants are likely to use areas with people. HEC is very widespread in Sri Lanka and is currently reported from 19 Districts and 131 Divisional Secretariat Divisions encompassing almost the entire dry zone of the country (Fig. 2)^[6].

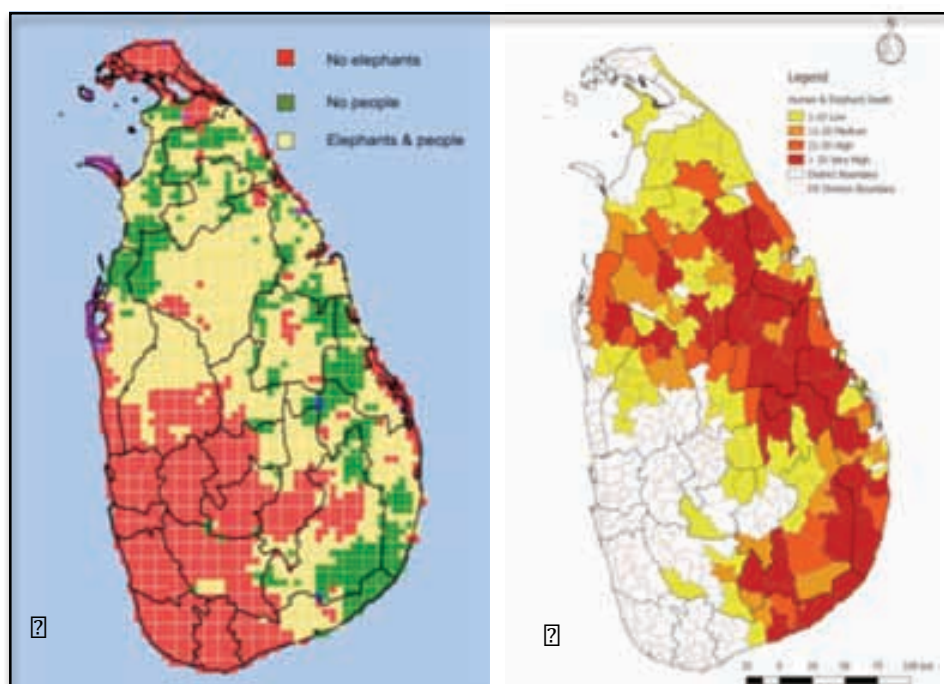


Figure 2. Left: Current elephant distribution^[4]. Right: Current distribution of HEC by DS division^[6].

Previous approach to HEC mitigation

The main approach to HEC mitigation over the past decades was formalized in 1959 by 'The Committee on Preservation of Wildlife' appointed by the government^[7]. The plan called for 'elephants to be driven along temporary corridors into permanent corridors and national reserves when development takes place' (Fig. 3). Consequently, the main approach to HEC mitigation since the 1950s was the attempt to confine elephants to protected areas. For over 60 years much effort and funds have been expended in pursuit of this goal. The main method of limiting elephants to protected areas is conducting 'elephant drives' and establishing electric fences on their boundaries^[8]. In addition, individual males identified as 'problem elephants' have been translocated to protected areas and more recently to elephant holding grounds.

The fact that elephants driven inside protected areas did not stay there, but back-tracked to their original locations, led the Department of Wildlife Conservation (DWC) to construct electric fences on the boundary of protected areas since the early 1990s. Currently there are around 4,500 km of fencing erected by the DWC as a HEC mitigation measure. While exact data are not available, a significant extent of these electric fences is on the administrative boundaries of the DWC. In many instances, such fences are between DWC and Forest Department areas due to the historical attempt to limit elephants to DWC protected areas, inter-agency issues and public and political pressure.

Such fences have elephant habitat on both sides of the fence and therefore elephants on both sides. Consequently there are no barriers between the elephants that are 'outside' the fence and developed areas (Fig. 4 & 5).

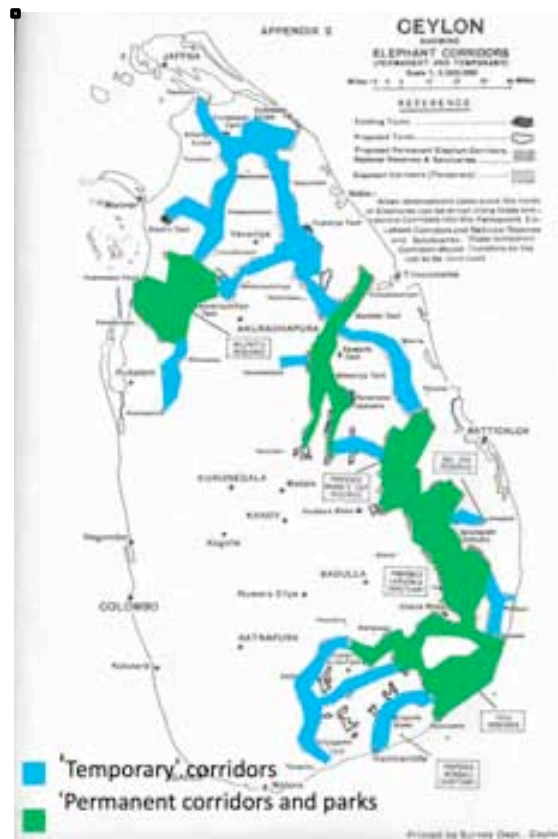


Figure 3. Areas elephants were to be confined to, as recommended in 1959^[7].

Construction of fences dividing elephant habitat increases conflict, as the elephants that are on the ‘outside’ lose access to parts of their home range (area usually used by a elephant or herd of elephants) ‘inside’ and are compelled to look for new resources in the adjacent developed areas (which are not protected by fences) (Fig. 4). Fences on administrative boundaries also encourage encroachment of Forest Department land ‘outside’ the fence, which further increases conflict with elephants.

To protect settlements and crop fields electric fences need to be constructed at the boundary between them and habitat used by elephants and fences within elephant habitat need to be re-located (Fig. 6).

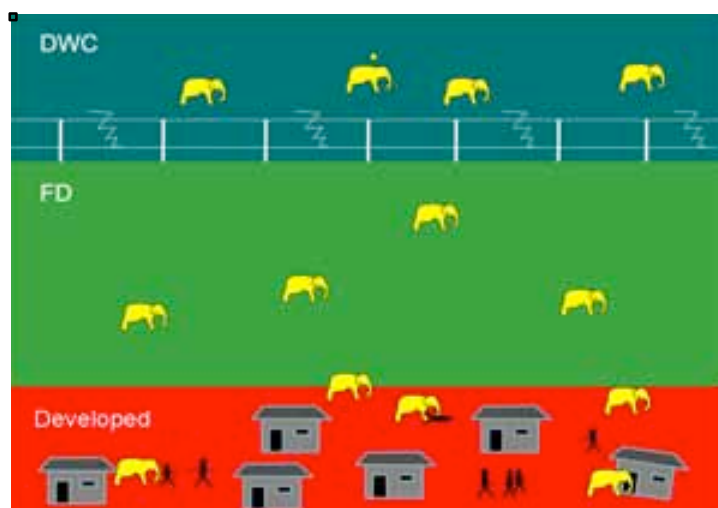


Figure 4. Illustration of the consequences of constructing electric fences within areas with elephants.

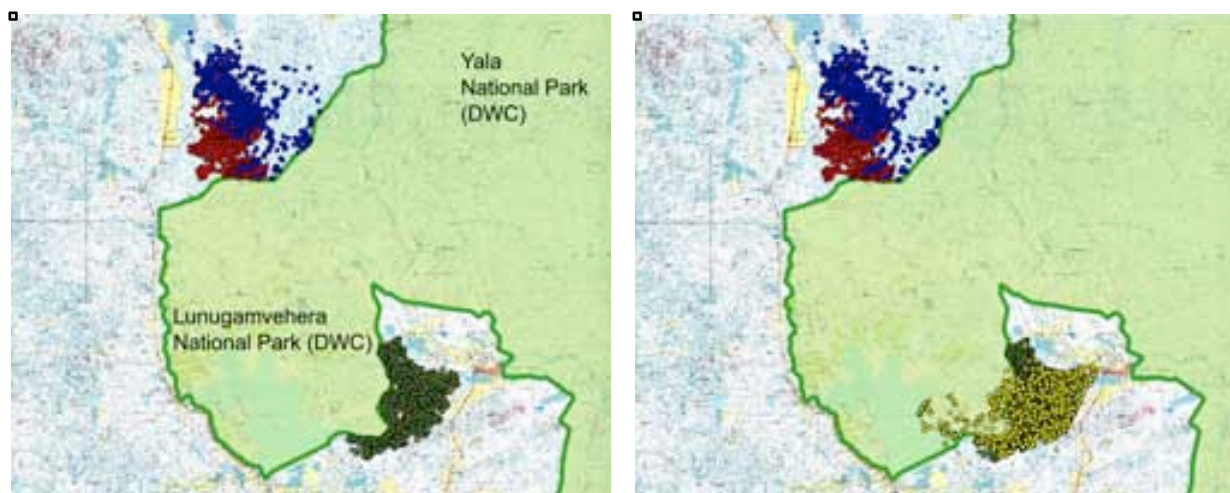


Figure 5. (Left) GPS tracking data of three elephant herds collared outside DWC areas, demonstrating in real life the impact of electric fences (green lines) located on administrative boundaries. The areas occupied by the collared herds are under the Forest Department. Coloured dots denote ranging of three adult females from the three herds, indicating the ranging pattern of approximately 150 elephants. Note: There are additional elephant herds inside the park, which were not collared. (Right) additional data of a male collared outside (yellow dots) showing that unlike the herds, the fences have no bearing on his moving in and out of the Park.

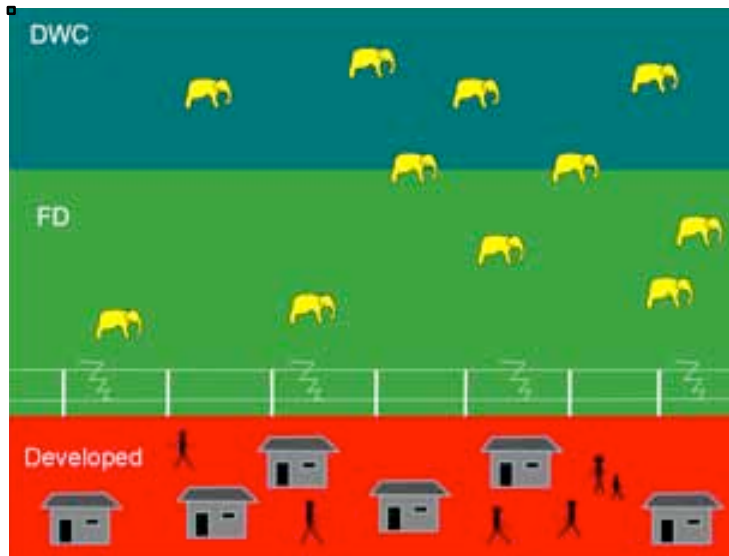


Figure 6. Illustration of the proper placement of electric fences to prevent elephant depredation

After over 60 years of attempting to restrict elephants to protected areas, today 70% of elephant range occurs in areas with resident people (Fig. 2), thus demonstrating its complete failure. HEC occurs entirely outside protected areas. In areas such as Polonnaruwa, Puttlam and Hambantota, electric fencing of protected area boundaries has been completed, but HEC continues to be a major issue. The failure of limiting elephants to protected areas, in spite of an immense effort by the DWC over many decades, sometimes at the cost of the life of DWC officers, is due to a number of biological and ecological reasons including elephant behaviour, and issues with carrying capacity.

Of particular relevance to HEC mitigation is the failure to remove problem-causing adult males from their home ranges and confine them to protected areas^[8,9,10,11]. The elephants that can be removed and confined are non-problem causing adult males and herds with females and young. When large numbers of elephants are driven into protected areas and fenced-in, they die of starvation, because any given area has a ‘carrying capacity’ determined by the availability of resources. This means that an area can support only a given number of elephants^[12]. As areas designated by us as ‘protected areas’ have been continuously occupied by elephants since centuries prior to such declaration, all protected areas in Sri Lanka are already at their carrying capacity, hence cannot accommodate large numbers of additional elephants.

It is also not practically possible, financially feasible or desirable from a biodiversity conservation point of view, to significantly increase the carrying capacity of protected areas^[12]. Theoretically, it costs approximately Rs. 2.4 million per year to increase the carrying capacity of a protected area by one elephant, which means that for the approximately 4,000 elephants living currently in areas with people, this would entail a cost of around Rs. 9,600 million per year^[12].

Elephants have a very strong attachment to their home range where they are born, grow up and live. Monitoring of translocated males by GPS-satellite collars has shown that some of them return to their home range even from distances of over 100 km^[9,10], *irrespective of the resources available in the release area*. Monitoring of herds driven into protected areas and confined there by electric fences has shown that they *do not explore the protected area* but remain in comparatively small areas in the direction of their home range^[8]. Therefore, even if

habitat management was done inside protected areas, it is unlikely that elephants that have home ranges outside can be kept there.

Elephant herds driven into protected areas and confined there by electric fences, overuse the habitat, leading to their death by starvation. Due to the overutilization of fodder in the area used by the new herds that were driven in, resident herds ranging entirely inside the protected area also suffer and die from starvation (see Section 1.3)^[8].

Such losses will negatively impact elephant populations in protected areas, hence reduce revenue from elephant-viewing based tourism, and result in the loss of future tourism potential. Handapanagala in Wellawaya is a case in point where hundreds of elephants used to gather in the dry season, rivalling the famous gathering at Minneriya-Kaudulla. In the 1990s these herds were driven into Yala and fenced in. Today the ‘gathering’ at Handapanagala is no more but HEC continues to be a major issue in Handapanagala. If the ‘gathering’ at Handapanagala still occurred, it could have been the centre of a thriving tourism industry in the region.

The main method of removing elephants from areas with people and moving them to protected areas is by ‘elephant drives’ (see Section 1.3)^[8]. Many large-scale elephant drives to remove elephants have been conducted in Sri Lanka over the past decades, particularly in relation to irrigation development. However drives have failed to eliminate elephants from any drive-area. Drives subject elephants to intense and prolonged conflict. Elephants respond to confrontation and driving by becoming aggressive towards people. Therefore, repeatedly subjecting elephants to drives, results in extremely aggressive elephants and severe escalation of the conflict in drive-areas.

Given that attempting to limit elephants to protected areas has failed and has caused escalation of HEC, persisting with the same approach will not effectively mitigate HEC. The main reason for the adoption of ineffective methods and pursuance of unachievable goals in HEC mitigation is because previous elephant and HEC management was based on unscientific thinking and political expediency rather than on scientific data.

While there was little scientific information available on elephant ecology and behaviour in the 1950s, when the current management approaches were devised, that is no longer the case. We now have sufficient scientific data to understand why certain interventions failed and what we can realistically do. By using the scientific data available and taking an adaptive management approach we can work on a solution to the problem of HEC.

Future direction

Elephants occurred throughout Sri Lanka in the past. For example, on 25th November 1751 a wild tusker entered the Fort of Colombo, killing two people. Wild elephants were captured by elephant kraals around Colombo, Matara and Kandy in the 18th century^[13]. In the 19th century, there were elephants around Nuwara Eliya and Horton Plains and elephant kraals in Labugama-Kalatuwawa and the Ratnapura District. The last kraal was held in Panamure in 1950^[13]. Elephants are absent from all these areas today.

In the past 60 years, elephants have been eliminated from 15.2% of their range (Fig. 7)^[4]. Currently elephants are absent from 38% of Sri Lanka, including almost the entire wet zone and dry zone urban centres. Their elimination from these areas has occurred mainly due to

development. High human-density areas and areas that elephants have been eliminated from, correspond very closely to each other (Fig. 7).

In most areas development is a slow process. Initially there is wilderness with elephants, but few or no people. Then gradually human presence increases. Both male elephants and herds composed of females and young remain in such areas and HEC is low. With time both human densities and HEC increase to moderate levels. Further development and increased human density results in the disappearance of herds, converting them to male-only areas. The disappearance of herds is due to gradual decline in elephant numbers, probably from reduced reproduction and survival (especially of juveniles) due to decreasing resources. Some shifting of home ranges of herds to less disturbed areas may also occur but would be limited by carrying capacity issues. Male-only areas have a high level of conflict, as there is greater human activity and higher densities of people, which results in frequent human-elephant encounters and interactions. If development continues in male-only areas, the males also eventually disappear, probably due to getting killed and moving to less developed areas, and they become exclusive human-use areas (non-elephant areas).

Elephants cannot survive in completely developed areas, as there is no cover and forage. High intensity urban and industrial development based on sound planning, reliably and permanently excludes elephants from human areas. Elephants persist in areas with low intensity, small-scale, patchy development and low human densities. This is particularly an issue in expansion of low intensity agriculture, since the heterogeneous habitat provides elephants cover and foraging.

Once human-occupied areas are fully developed, elephants will be absent from them. As this will take decades, current HEC has to be managed and creation of new HEC prevented in the mid-term. Therefore effective HEC mitigation requires concurrent implementation of short-, medium- and long-term measures.

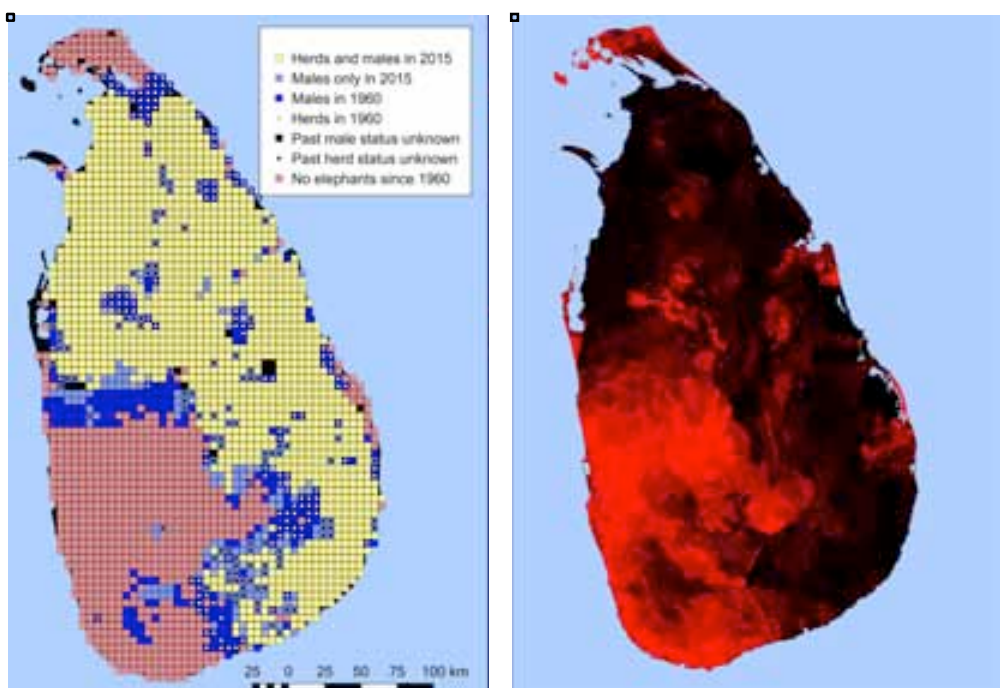


Figure 7. Left: Elephant distribution in 2015 and 1960^[4]. Right: Human density map – brightness is proportional to human density.

A. MEASURES THAT WILL PROVIDE RESULTS IN THE SHORT TERM

A1. Provide immediate relief from crop and property damage

A1.1. Electric fencing

Electric fencing is arguably the only effective method of preventing depredation by elephants that can be used at a scale relevant to HEC in Sri Lanka. Around 4,500 km of electric fences have been installed by the DWC as a HEC mitigation measure. However these fences have failed to effectively mitigate HEC, as they have been mainly used in an effort to limit elephants to protected areas and as boundary markers. Electric fencing is a tool and like any other tool, it is effective only if used properly. The correct use of electric fencing is to provide protection where it is needed and not as a boundary marker. Electric fences (and other barriers) for HEC mitigation should only be installed at the border between elephant habitat and human-use areas (see Section 1.1.4.).

Community-based electric fencing is the most effective measure for providing immediate relief to communities from elephants raiding cultivated fields and home gardens or causing damage to houses with stored grain. Community-based electric fencing differs from traditional electric fencing in that *it directly provides protection to communities where it is needed, rather than seeking to enclose elephants in designated habitats*. Community-based fences are mostly ‘enclosure’ fences (prevent elephants entering an area encircled by the fence), which prevent elephant intrusion into cultivated fields or settlements. They are built and maintained by the communities that are protected by them. In addition to providing the entire labour for construction and maintenance, bearing part of the cost of fence material by communities reinforces their sense of ownership and is crucial for its success.

There are two main types of community-based electric fencing: Permanent fences that protect settlements (village electric fences) and seasonal fences that protect seasonal cultivations such as paddy (paddy-field electric fences). Currently around 50 village electric fences and 25 paddy-field electric fences have been implemented in the Kurunegala, Hambantota, Trincomalee and Anuradhapura Districts and have been operating successfully for up to 12 years.

Community-based fences are for the direct benefit of communities. Fence construction is only the first step of a community-based fencing program. To be successful, community-based fencing programs require community engagement and a long-term commitment by implementation agencies. Simply putting up a fence around a village and expecting the villagers to maintain it, will lead to its failure. As experience has shown, agencies whose main responsibility is people’s welfare and development have extensive networks based among the people, an excellent relationship with communities and also authority over them. Hence, they are well placed to implement community-based fencing. The most appropriate implementation agency for village fences is the Divisional Secretariat and for paddy-field fences, the Department of Agrarian Development. Dedicated units responsible for community-based fencing should be established under Divisional Secretariats and the Department of Agrarian Development. Agencies implementing community-based fencing need to develop mechanisms for implementation and train officers in the various aspects of implementation.

A1.1.1. Village electric fences

Village electric fences protect villages by preventing elephant entering into them, thus eliminating damage to crops in home gardens, houses with stored paddy and ensuring the safety of residents. These fences are permanent structures constructed on the boundary of home gardens, which facilitates their maintenance by communities^[1,2].

Village electric fences are highly applicable to villages that can be entirely surrounded with a fence, making them ‘exclosure’ fences. Considering that elephants are mostly found in low-density human areas with heterogeneous habitat, there are many thousands of villages faced with elephant depredation, which can be immediately protected in this manner.

Where extensive developed areas are adjacent to areas with elephants, elephant depredation only occurs near the boundary. In such cases, it may not be possible or needed to enclose the entire developed area. Instead, a ‘linear fence’ (a long fence that does not enclose an area) along the boundary will be more applicable. It may also be difficult to get the entire community to buy into constructing and maintaining such fences, as those in the interior do not experience elephant depredation. In such situations fences need to be constructed and/or maintained by an external agency (see Section A1.1.4). However, if the perimeter households are willing to work together, community-based fencing maybe applicable.

Implementation mechanism

Villagers need to be made aware of village fencing through media campaigns (see Section A6) and through the Divisional Secretariats and Grama Niladhari network. The implementation agency would then transfer knowledge of fence construction to villagers according to the models developed^[1,2]. Implementation also requires setting up community organizations or co-opting existing organizations such as ‘Death Donation Societies’ (‘Maranadhara Samithi’) for fence construction, maintenance and management.

Table 1. Plan of implementation for village electric fences

No.	Action	Responsibility	Timeline
1.	A policy decision to be taken that Divisional Secretariats should implement community-based village electric fencing in collaboration with appropriate agencies	Presidential Secretariat	Immediately
2.	Develop training program, including manuals ^[1,2]	MoW, SMoW, Divisional Secretariats, other relevant agencies	Commence immediately
3.	Train 50 officers in implementation of community-based village electric fencing		2 months from commencement
4.	Procure material for 100 village electric fences		3 months from commencement
5.	Implement 100 village electric fences		By end of year 1
6.	Develop monitoring and evaluation protocols		3 months from commencement
7.	Monitor and evaluate		3 months on
8.	Upscale based on the results of year 1 and expand program to all Divisional Secretariat Divisions faced with HEC		Year 2 on

Estimate of funding required

The approximate cost of material for village electric fencing is around Rs. 550,000 per km. On average a fence protecting a village of around 100 families (consisting of dwellings and home gardens) will be about 10 km in length hence the material cost will be around Rs. 5.5 million. Additional costs of implementation, including transport, salaries for implementing officers etc., is estimated to be around Rs. 500,000 making the total cost of a fence around Rs. 6 million. The cost of protecting 100 villages will be around Rs. 600 million.

A1.1.2. Paddy-field electric fences

Paddy-field electric fences are put up seasonally during cultivation to prevent elephants from raiding the paddy. Paddy tracts have established farmer societies. Such societies can fence a paddy tract in 1–2 days. The fence is located at the perimeter of cultivated fields, which facilitates its maintenance by farmers. The farmers erect the fence when cultivation commences, remove it at harvest and store it in their village till the next season of cultivation. While paddy-field fences prevent most raids by elephants, the farmers still have to guard the fields but can reduce the level of guarding significantly.

Paddy-field fences are very successful in preventing elephant depredation as they are only deployed seasonally during active cultivation. If such fences are used as permanent fences, elephants are very likely to break them during the non-cultivation season when there are no people around. Once learned, such elephants will, also breach the fence during cultivation. Therefore, even if the non-cultivation period is short, it is mandatory to remove and re-install paddy-field fences.

The main stakeholders in paddy-field electric fencing are the farmers whose paddy-fields will be protected. The technical knowledge for fence construction needs to be provided to them through an appropriate agency.

Since elephant herds often visit the paddy fields to consume the leftover harvest immediately after the fences are taken down, it may provide an opportunity for tourism. However, such programs, if developed, should also benefit the communities involved.

Paddy-field electric fences are highly applicable to paddy-fields of up to a few hundred acres that can be surrounded with a fence, making it an enclosure fence. There are many thousands of paddy-fields that are faced with elephant depredation, which can be protected in this manner. Where the tracts are extensive, consisting of thousands of acres, elephant depredation occurs only at the perimeter. In such cases rather than enclosure fences, linear fences will be more applicable and multiple farmer societies may need to cooperatively maintain it.

Implementation mechanism

Farmers need to be made aware of paddy-field fencing through media campaigns and through the Agrarian Services (Govi Jana Seva) network. The implementation agency would then transfer knowledge of fence construction to farmers according to the models developed^[1,3].

Table 2. Plan of implementation for community-based paddy-field electric fences

No.	Action	Responsibility	Timeline
1.	A policy decision to be taken that the Department of Agrarian Development should implement community-based paddy-field electric fences in collaboration with appropriate agencies	Presidential Secretariat	Immediately
2.	Develop training program, including manuals ^[1,3]	MoW, SMoW, Department of Agrarian Development, Mahaweli Authority, other relevant agencies	Commence immediately
3.	Train 50 officers in implementation of paddy-field electric fencing		2 months from commencement
4.	Procure material for 200 paddy-field electric fences		3 months from commencement
5.	Implement 200 paddy-field electric fences		Next cultivation season
6.	Develop monitoring & evaluation protocols		3 months from commencement
7.	Monitor and evaluate		3 months on
8.	Upscale based on the results of year 1 and expand program to all areas faced with elephant depredation of paddy-fields		Year 2 on
9.	Explore possibility of incorporating into tourism plans that also benefit communities		Year 2 on

Estimate of funding required

The approximate cost of material for paddy-field electric fencing is around Rs. 250,000 /km. On average a fence protecting a paddy tract of around 100–200 acres will be around 5 km in length, hence the material cost will be around Rs. 1.25 million. Additional cost of implementation, including transport, salaries for implementing officers etc., is estimated at around Rs. 250,000, making the total cost of a fence around Rs. 1.5 million. The expenditure for protecting 200 paddy-fields will be around Rs. 300 million.

A1.1.3. Awareness campaigns

Implementation of community-based fencing would be facilitated by wider awareness of its effectiveness. Therefore conducting an awareness campaign about community-based fencing is an important aspect of their implementation (see Section A6).

A1.1.4. Non-community-based electric fences

Where extensive developed areas border elephant habitat, it may not be possible to take a community-based approach to electric fencing. In such situations, an external agency will need to construct and maintain electric fences. The design of such fences can be the same as that constructed currently by the DWC.

To be effective in preventing elephant incursions, the most important point in the construction of non-community-based fences also is, that they should be on the boundary of the developed area and should not have patches of habitat that offer cover and fodder for elephants in close proximity to the fence on the people's side. Such habitat patches prevent people from seeing elephants coming to the fence and vice versa, making it much more likely that elephants will break the fence. In determining the fence line, it must be noted that these fences are not for boundary demarcation of protected areas but expressly for preventing elephants from entering human habitations and causing damage.

If non-community-based fences are built on the perimeter of extensive tracts of paddy such as in Ampara, they should still be constructed and managed as seasonal fences, because large numbers (hundreds) of elephants use the paddy fields between cultivation seasons, consuming crop-residue and grasses that grow in them (Ipanella). Elephants using such fallow lands have no adverse impact on people and could even provide opportunities for community based elephant viewing tourism. As these fallow paddy fields are a critical food resource for elephants, attempts at preventing access to them in the dry season are likely to fail and – if successful – likely to increase conflict.

Implementation mechanism

Non-community-based fences have to be constructed and maintained by the implementation agency.

Table 3. Plan of implementation for non-community based fencing

No.	Action	Responsibility	Timeline
1.	Identify and map situations where non-community-based fencing needs to be done	MoW, SMoW, DWC, other relevant agencies	6 months from commencement
2.	Estimate extent of fencing required		End of 6 months
3.	Implement 100 km of electric fences		By end year 1
4.	Develop monitoring & evaluation protocols		3 months from commencement
5.	Monitor and evaluate		3 months on
6.	Upscale based on the results of year 1 and expand program to all areas faced with elephant depredation		Year 2 onwards

Estimate of funding required

Currently the cost of constructing non-community based electric fences by the DWC is Rs. 1.1 million per km. The cost of the program will depend on the extent of fencing that needs to be implemented (Table 3 Action #3). It is suggested to allocate Rs. 110 million for the construction of 100 km of non-community-based electric fencing in the first year.

A1.1.5. Relocate electric fences situated within 'areas used by elephants'

In many cases, DWC electric fences have elephants on both sides as they are on administrative boundaries of DWC protected areas and run through areas used by elephants. Note that 'areas used by elephants' are defined as habitats where elephants are resident year round or seasonally and excludes human areas that elephants may enter to raid.

The DWC and Forest Department currently endorse re-location of such fences to the boundary of areas used by elephants, which in most cases coincides with the boundary between the Forest Department and developed areas. With regard to the land classified as 'Other State Forest' (OSF) and its management, it is emphasized that elephants use OSFs extensively, particularly in the dry season (see Section C). Chena cultivation in OSFs is compatible with elephant presence and can be considered a 'time-share' with people using it for cultivation during the rainy season and elephants using it for fodder in the dry season^[14]. Therefore, OSFs should be on the 'elephant' side of fences. Seasonal cultivations in OSFs could be protected with seasonal electric fencing as with community-based paddy-field fences. However, converting OSFs to permanent agriculture and/or settlements or preventing their use by elephants when they are fallow, will increase HEC in surrounding areas, as large numbers of elephants depend on these areas for dry season fodder. Therefore, Land Development Ordinance permits or any other permits issued for chena cultivation, should clearly stipulate that no permanent cultivation or dwellings are permitted, so that the time-share concept between people and elephants is maintained.

Relocation of fences is applicable to all situations where electric fences have elephants resident on both sides of them.

Implementation mechanism

Map, survey and identify fences that have resident elephants on both sides. Remove fences that run through areas with elephants and relocate them to the boundary of area used by elephants. The maintenance of DWC managed fences has been delegated to the Civil Security Department (CSD) at present. While the DWC remunerates the CSD for this service, the CSD personnel maintaining the fences do not report to the DWC. This is a sub-optimal institutional arrangement for accountability. In order to improve the efficacy of the maintenance of the fences, the CSD personnel should also report to the Regional Assistant Director of DWC of the respective regions who need to monitor the overall effectiveness of fence maintenance.

Table 4. Plan of implementation for relocating electric fences within areas used by elephants

No.	Action	Responsibility	Timeline
1.	Formalize decision to relocate existing electric fences to the boundary of areas used by elephants	Presidential Secretariat, MoW	Commence immediately
2.	GPS map all DWC electric fences	MoW, SMoW, DWC	2 months from commencement
3.	Identify fences with elephants on both sides		3 months from commencement
4.	Prepare relocation plan and schedule, and make cost estimate		3 months from commencement
5.	Relocate 100 km of fences		By end year 1
6.	Develop monitoring & evaluation protocols		3 months from commencement
7.	Monitor and evaluate		3 months on
8.	Continue till all existing fences are relocated to the boundary of areas used by elephants		Year 1 on

Estimate of funding required

The cost depends on the extent of fences to be relocated. Some of the fence material will be reusable but additional fencing may be required. Costs need to be calculated based on the results of Action 1. Actions 1–4 do not require a specific allocation as it can be done through the regular allocation to the DWC. An allocation of Rs. 55 million is suggested as costs for the relocation of approximately 100 km of fencing, based on the premise that around 75% of the material could be reused. Hence, the cost of relocation will be around 50% of the cost of constructing a new fence. A more specific estimate of costs can be made on completion of Action 4.

A1.2. Elephant drives

Currently elephant drives are mostly conducted to remove elephants from landscapes, mostly from Forest Department areas. However, even after decades of repeated elephant drives, it has not been possible to eliminate elephants from any area by this method.

In elephants the females and young live in herds. Males leave the herd at puberty. They may join female herds temporarily and associate with other males in bachelor groups, but as adults they are mainly solitary (thani-ali). Most HEC incidents are due to some of these adult males. Elephants that can be driven out of an area by drives are mainly non-problem-causing adult males and herds. Almost all ‘problem-causing males’ and even some non-problem-causing elephants are not removed by such drives.

Elephant drives subject elephants to intense, sustained conflict. Therefore, elephants that are subjected to drives but remain in the drive area, respond by becoming extremely aggressive towards humans. Consequently, drives cause escalation of conflict in drive areas^[8].

Elephant drives can be divided into large-, medium- and small-scale drives.

A1.2.1. Discontinue large-scale elephant drives

Large-scale elephant drives cover hundreds of km². They usually drive elephants tens of km and last many months to over a year. The objective of large-scale drives is to eliminate elephants from an extensive landscape, usually a much larger area than the area identified for development. Such drives have been conducted repeatedly for decades, especially in relation to mega-irrigation and agricultural development projects.

Elephant herds removed from their home ranges by large-scale drives and confined to protected areas, die of starvation^[8]. Therefore, while increasing HEC, such drives are also extremely detrimental to elephant conservation. The DWC has discontinued such drives and the last major drive was conducted in 2005–2006 under the Walawe Left-bank Development Project^[8].

Where large-scale development projects are conducted in areas with elephants, commencing clearing of land and development at one point and expanding out in combination with a boundary electric fence that will grow in step with the development, will prevent elephant depredation of the developed area. It will also minimize the impact of the development on elephants, as it will be limited to the extent of habitat directly lost due to development. Such an approach will prevent pointless expenditure of funds and effort in failed elephant drives and will also minimize conflict escalation.

Table 5. Plan of implementation for large-scale elephant drives

No.	Action	Responsibility	Timeline
1.	Formalize policy decision to discontinue large-scale drives	MoW, SMoW, DWC	Commence immediately

A1.2.2. Assess medium-scale elephant drives

Medium-scale elephant drives last from a few days to weeks and drive elephants a few km, hence usually chase elephants around within their home ranges. They do not provide any lasting relief from elephant depredation, as the elephants remain in their home range. However – like all elephant drives – such drives are likely to cause escalation of conflict by increasing aggression in elephants^[8].

Where the home range of elephant herds is adjacent to a protected area or part in and part out of a protected area, medium-scale drives may result in their being driven into the protected area and fenced in. In such situations, due to exceeding of carrying capacity, herds that lose part of their range and herds that were resident entirely in the protected area can die of starvation, causing major harm to elephant conservation^[8].

Medium-scale drives are mostly conducted due to public and political pressure in the mistaken belief that they will resolve HEC. However, given that they actually increase conflict, their continuation is at cross-purposes with HEC mitigation.

Table 6. Plan of implementation for medium-scale elephant drives

No.	Action	Responsibility	Timeline
1.	Obtain 10 elephant GPS collars	MoW, MSoW, DWC, research organizations, universities	Commence immediately
2.	GPS collar two female herds and three adult males, for each of next two medium-scale drives conducted, assess behaviour, habitat use, body condition and health, 2 months before and one year after drive		Upon completing Action 1
3.	Collect data on HEC in the drive area before and after drive by conducting questionnaire surveys		
4.	Based on data from Actions 2–3 assess the impact of medium scale drives on elephant conservation and HEC, and decide on continuity		Upon availability of data

Estimate of funding required

The direct cost of an imported GPS collar from a reputed manufacturer is around US \$ 5,000 (~ Rs. 1 million). Therefore the cost of 10 collars is around Rs. 10 million. Allocation for collaring is estimated at Rs. 200,000 per elephant for a total of Rs. 2 million, as it will be conducted within the existing DWC framework. An allocation of Rs. 1 million is proposed for conducting studies. The rest of the activities do not need a separate allocation as they can be done within the normal functioning of the relevant agencies. Therefore the total funding required is Rs. 13 million.

A1.2.3. Small-scale elephant drives (chasing elephants)

Chasing elephants is incident dependent and undertaken to chase away elephants that have intruded into human locations such as settlements, villages and crop fields. In most cases people themselves chase the elephants away from such situations by confronting them. Where elephants cannot be chased away by people, the DWC is called upon to do so. Such action provides immediate relief from elephant raiding but – in common with other drives – increases aggression of elephants, hence increases HEC in the long-term.

While persisting with elephant chasing as a management action is likely to cause further escalation of HEC, it will need to be continued till other more effective short-term measures are put in place. However, limiting it to situations where it is absolutely essential and subjecting elephants to the minimum confrontation and aggression required, will help minimize increasing aggression of elephants, hence the rate of conflict escalation.

Data on chasing elephants such as how often the DWC is called upon to chase elephants, how often chasing is conducted, its increase or decrease, whether chasing away elephants becomes easier/harder, how often elephants have to be shot at etc. is currently not available. Therefore, such data should be collected as an on-going process. The chasing's impact on HEC and elephants needs to be determined, and its role in HEC mitigation and elephant conservation evaluated.

Table 7. Plan of implementation for small-scale elephant drives

No.	Action	Responsibility	Timeline
1.	Conduct awareness program for DWC field officers and other stakeholders to make them aware of the negative repercussions of chasing elephants on HEC and elephants	MoW, SMoW, DWC, research organizations, universities	Commence immediately and refresh annually
2.	Collect following data, compile by office and region per day, month and year: <ul style="list-style-type: none"> No. of requests for chasing elephants No. of requests complied with Assessment of effort Assessment of effectiveness 		Commence immediately, continue for 1 year
3.	Correlate collected data with level of HEC and evaluate role of chasing elephants in HEC mitigation and elephant conservation		Upon completion of Action 2
4.	Take policy decision on chasing elephants by DWC		Based on results of Action 3

Estimate of funding required

No specific allocation is required, as the identified actions can be conducted within the normal functioning of the agencies concerned.

A1.3. Distribution of elephant-firecrackers (*ali-wedi*)

Currently the DWC spends approximately over Rs. 100 million annually to purchase elephant-firecrackers. The average cost of a firecracker is around Rs. 100^[15]. This means that annually around one million firecrackers are thrown at elephants in confrontations, in consideration of only those supplied by the DWC.

Firecrackers are distributed free of charge to the public, solely for confronting elephants and chasing them. However, confrontation and chasing invariably leads to reciprocal aggression by elephants. Thus, while providing immediate relief, firecrackers create a bigger problem for the future. Already the widespread and indiscriminate use of elephant-firecrackers has made elephants habituated to them. Therefore, many elephants cannot be chased away anymore. This also creates a problem for the DWC because the DWC is called upon to chase elephants when people cannot chase them away. When elephants are unresponsive or react with aggression to elephant-firecrackers, the DWC is left with no option other than using shotguns. Elephants that have been shot at will become even more aggressive towards people, leading to further escalation of conflict.

While the continued use of elephant-firecrackers will keep increasing the conflict, given the current state of HEC and public expectations, it is not possible to stop it. Therefore firecracker distribution will have to be continued till other more effective short-term measures take effect, obviating the need to be constantly chasing elephants.

Table 8. Plan of implementation for elephant-firecrackers

No.	Action	Responsibility	Timeline
1.	Issuance of fire crackers – continue at current level	MoW, SMoW, DWC	Ongoing
2.	Collect data on <ul style="list-style-type: none"> • Expenditure on purchasing firecrackers • Distribution of firecrackers by office and region • Level of HEC Collate data per day, month and year		Commence immediately
3.	Assess data, correlate with level of HEC and evaluate role of distribution of firecrackers in HEC mitigation and elephant conservation		Upon availability of data
4.	Take policy decision on distribution of firecrackers		Based on results of Action 3

Estimate of funding required

No specific allocation is required as the identified actions can be conducted within the normal functioning of the agencies concerned.

A2. Reduce death and injury of people caused by elephants

A2.1. Awareness programs

Awareness is key to reduce death and injury due to elephants. While some incidents may be accidental, irresponsible behaviour by people is the cause of many human deaths and injuries due to elephants. Such incidents are entirely preventable.

An interaction between one of the millions of people and one of the thousands of elephants that share the landscape can occur at any point in space and time over almost half the country. Thus it is mainly the particular individuals who are involved in an incident, who have to take preventive action at the instant of the incident. They and/or those responsible for their wellbeing need to take preventive actions before the incident. Therefore, awareness is key to reducing human death and injuries due to elephants.

Contributory factors that could be addressed in such a program are drunkenness, entering elephant habitat at night, confronting and harassing elephants, irresponsible behaviour in the presence of elephants etc. Similarly, minimizing accidental incidents by planning ahead and taking precautions etc. can be promoted through awareness.

Implementation mechanism: See Section A6

A2.2. Develop and clear specific locations

Some injuries and deaths caused by elephants occur because of accidental encounters on roads. Such instances could be reduced by under-brushing a 5–10 meter strip on either side of rural roads to increase visibility. Similarly, the installation of street lamps (which could be solar powered) may provide more visibility and security at night. These activities could be incorporated into rural development projects.

Table 9. Plan of implementation for developing/clearing areas

No.	Action	Responsibility	Timeline
1.	Coordinate with Road Development Authority, rural development projects and local authorities to inform them of the requirements and develop plans for implementation	MoW, SMoW, relevant agencies	Commence immediately
2.	Under brushing/clearing of a strip on either side of rural roads where appropriate		0–3 months, regular maintenance
3.	Installing street lamps		By end of year 1

Estimate of funding required

An allocation of Rs. 50 million is suggested for year 1 of implementation. It is recommended that implementation of the program thereafter is included in the budgetary allocation of the relevant agencies.

A2.3. Removing ‘problem-elephants’

Individual elephants that venture into human habitations and crop fields regularly and act with aggression towards humans, can be termed ‘problem-elephants’^[11]. They are the elephants most likely to cause human death and injury and to damage houses in search of stored grain. Such problem-elephants are almost exclusively adult males.

Currently we do not know what percentage of adult males behave in such manner, how often they engage in such behaviour, whether they only behave so at a particular time of the year or period of their lives etc. Obtaining such information requires to collar crop-raiding males and to study them (see Section B1.1.2).

However, elephants are not naturally aggressive towards humans and it is mainly their experiences with people that make them aggressive. ‘Problem-elephants’ are created by confrontation and aggression towards elephants. Therefore, the only effective HEC mitigation is to stop creating such individuals.

A major proportion of the elephants that are killed due to HEC are likely to be problem-elephants. The continued escalation of the conflict, even with approximately 1000 elephant deaths reported in the three-year period 2017–2019, indicates that removal of ‘problem-elephants’ cannot effectively mitigate the conflict. Whether it should be done in response to public pressure consequent to HEC incidents, is debatable.

A2.3.1. Capture-translocation

Monitoring of translocated elephants released to national parks with GPS collars showed that in addition to intensifying HEC and causing its wider spread, it was also very detrimental to the elephants translocated^[9,10]. These factors led to the DWC deciding to release captured elephants into a ‘holding ground’, an area surrounded by a very strong (maximum security) physical fence and an electric fence, instead.

The first such holding ground constructed in 2009 in Lunugamvehera was 25 km². It was a failure and was abandoned. Subsequently a 10 km² holding ground was constructed in Horowpothana. Captured elephants have been released to the Horowpothana holding ground since 2013. Of three elephants that were collared and released into the holding ground, all stayed close to the fence and did not use most of the holding ground. One collar dropped off after 107 days, one elephant died inside and the third escaped and returned to the site of capture^[10]. Other than this, no information on the elephants released to the current holding ground at Horowpothana is available. If most elephants die, or escape and create conflict again, releasing elephants into a holding ground is not a viable option.

In the absence of information, the usefulness of holding grounds as a HEC mitigation measure and its impact on elephant conservation cannot be assessed. Data should be collected and analysed in order to decide whether capture-translocation to holding grounds should be continued in its current form, modified and adopted, or discontinued. Therefore, it is proposed to continue translocation to the Horowpothana holding ground but with monitoring, assessing the results and deciding its future role.

If holding grounds are found to be non-viable, whether translocation to protected areas should be reconsidered as an alternative, needs to be evaluated.

Table 10. Plan of implementation for capture-translocation

No.	Action	Responsibility	Timeline
1.	Obtain 10 elephant GPS collars	MoW, SMoW, DWC	Commence immediately
2.	GPS collar next 10 elephants released into the holding ground, assess their behaviour, habitat use, body condition and health	MoW, SMoW, DWC, research organizations, universities	Commence immediately
3.	Collect data on the numbers of elephants put in the holding ground, and the numbers that remain inside, die inside and escape		Commence immediately
4.	Collect data on HEC in the areas around the holding ground by conducting questionnaire surveys		Commence immediately
5.	Based on data from Actions 3–4 assess the impact of holding grounds on elephant conservation and HEC and decide on continuity		Upon availability of data

Estimate of funding required

The direct cost of an imported GPS collar from a reputed manufacturer is around US \$ 5,000 (~ Rs. 1 million). Therefore the cost of 10 collars is around Rs. 10 million. Since these collars will be put on elephants that are captured anyway, no separate allocation for collaring is needed. The rest of the activities do not need a separate allocation as they can be done within the normal functioning of the relevant agencies.

A2.3.2. Capture-domestication

Practically all ‘problem-elephants’ are aggressive adult males. Taming of such males takes a long time (months to years), is difficult, extremely expensive and likely to have a high mortality rate. Therefore it is not a viable HEC mitigation method.

The last two times ‘problem-elephants’ were captured and taming was attempted are illustrative: In the first instance a captured male was taken to the Pinnawala Elephant Orphanage but could not be tamed after more than two years and was finally released into the Horowpothana elephant holding ground. In the second instance a captured male was given to the Maligawa and after immense expense for treatment, died of chain cut injuries on the legs.

A2.3.3. Culling

Given the socio-cultural and religious sensibilities of Sri Lanka, an official policy of culling elephants is not acceptable. Additionally, given the global attention on elephants and the ‘Endangered’ status of the Asian elephant, such a policy would attract worldwide condemnation of Sri Lanka. Therefore it is not a viable HEC mitigation method.

A3. Provide reparation for people's losses

A3.1. Compensation

Currently a well-accepted scheme is implemented through the DWC and Divisional Secretariats for providing compensation in case of death and injury caused by elephants. In addition, some compensation is paid for property damage through the DWC, which is also routed through the Divisional Secretariats. Further strengthening these programs, streamlining the payment process, making them more accessible and making their availability common knowledge would be desirable.

While the public would also welcome compensation of crop losses, such programs are very open to abuse and given the scale of conflict in Sri Lanka, are difficult to implement. Therefore, compensation of crop losses is not recommended. Instead crop insurance should be promoted (see Section A3.2).

Table 11. Plan of implementation for compensation

No.	Action	Responsibility	Timeline
1.	Continue, strengthen and expand existing programs	DWC, District Secretariats, Divisional Secretariats	Commence immediately

Estimate of funding required

No additional allocation is required, as the identified actions should be continued within the normal functioning of the agencies concerned.

A3.2. Insurance

A3.2.1. Life and injury

Insurance policies offered by insurance companies that cover life and injury would also cover injury and death caused by elephants. However, such occurrences mostly involve people who are unable to bear the premium for such schemes and/or are unaware of their availability.

Coordination with insurance companies to offer life and injury cover on concessionary rates, as CSR programs and as add-ons to other insurance policies, is needed. Additionally insurance policies to specifically address death and injury caused by elephants have to be developed and their availability made well known in areas with elephants through awareness campaigns (see Section A6).

Table 12. Plan of implementation for life and injury insurance

No.	Action	Responsibility	Timeline
1.	Coordinate with appropriate agencies to develop and popularize policies covering death and injury due to elephants	MoW, SMOw	Commence immediately

A3.2.2. Crop and property damage

Currently the Agricultural Insurance Board supposedly conducts a crop insurance program that covers a number of crops including paddy and losses due to elephants are also covered under it. However, many rural communities that suffer from crop depredation by elephants are not aware of such programs.

Also the current program does not cover damage to stored paddy by elephants. Extending the program to also cover such losses and developing additional policies that specifically cover property damage by elephants would be desirable. Policies covering damages to electric fencing by any cause would further enhance the implementation of community-based fencing.

Coordination with the Agricultural Insurance Board and other agencies offering crop insurance is required to extend their policies to losses caused by elephants. Such schemes need to be made easily accessible by rural communities and they also need to be made aware of these options (see Section A6).

Table 13. Plan of implementation for crop damage insurance

No.	Action	Responsibility	Timeline
1.	Coordinate with appropriate agencies to develop and popularize policies covering crop damage due to elephants	MoW, SMoW	Commence immediately

Estimate of funding required

No specific allocation is required, as the identified actions should be conducted within the normal functioning of the agencies concerned.

A4. Reduce death and injury of elephants caused by people

Some actions that cause death and injury of elephants, such as shooting, electrocution and hakka-patas (jaw-bombs), primarily occur as a result of attempts to prevent raiding by elephants. Other actions, such as snares, target other animals, but elephants, particularly young ones, frequently get caught in them and suffer injuries. Hakka-patas may have originated as a method for procuring bush meat but is increasingly used to target elephants and is now the method responsible for the highest number of elephant deaths. Many of these activities can best be countered by awareness (see Section A6), resulting in social rejection, peer pressure and emphasis on national religious and cultural values to desist. Other causes such as train and vehicle collisions and falling into agricultural wells and concrete lined irrigation channels are accidental.

A4.1. Prevent intentional killing/injuring of elephants

As the majority of intentional killing of elephants is due to HEC, the most effective way of preventing it is effective HEC mitigation through non-confrontational methods (see Sections A1.1 & A1.2). In addition, awareness (Section A6) and increased prosecuting of offenders would help.

A4.1.1. Conduct awareness programs

See Section A6.

A4.1.2. Prosecution of offenders

Although hundreds of elephant deaths are reported annually (the total for the last four years was 1,263, of which 636 were identified as intentional killing of elephants), very few have been prosecuted and even less convicted. Data on the number of cases filed, number of convictions etc. are currently unavailable. However, strengthening the legal capacity of the DWC, together with improving capabilities in conducting investigations and prosecution, perhaps jointly with crime investigation and legal agencies of the government, is desirable.

Table 14. Plan of implementation for prosecution of offenders

No.	Action	Responsibility	Timeline
1.	Coordinate with appropriate agencies to strengthen and develop investigative and prosecution capabilities of the DWC	MoW, SMoW, DWC	Commence immediately
2.	Collect data on the number of cases filed against elephant killing/injury and number of convictions		Commence immediately
3.	Compile data on annual basis and place in the public domain		By end of each year

Estimate of funding required

No specific allocation is required, as the identified actions should be conducted within the normal functioning of the agencies concerned.

A4.2. Prevent accidental death/injury of elephants

Accidental deaths and injury of elephants occur due to rail and vehicle collisions, falling into agricultural wells and perhaps due to ingestion of agro chemicals. The number of non-intentional deaths of elephants reported over the last four years was 117. Detailed information on such occurrences is currently not available and needs to be collected for addressing the issue.

Table 15. Plan of implementation for preventing accidental death/injury of elephants

No.	Action	Responsibility	Timeline
1.	Identify issues to be addressed and what data needs to be collected	MoW, SMOw DWC, relevant agencies	Commence immediately
2.	Collect relevant data and assess locations, extent and causative factors for accidental deaths		Commence immediately
3.	Coordinate with appropriate agencies to develop and implement effective actions		Upon data availability

Estimate of funding required

No specific allocation is required, as the identified actions should be conducted within the normal functioning of the agencies concerned.

A4.3. Minimize/eliminate management actions that cause death and injury of elephants and/or modify them to prevent detrimental effects on elephants

Capture-translocation, elephant drives and construction of electric fences within elephant habitat can all cause elephant morbidity and mortality.

- Capture-translocation See Section A2.3.1
- Elephant drives See Section A1.2
- Fencing within elephant habitat See Section A1.1.4

A5. Prevent loss of elephant range and habitat

Loss of range and habitat due to conversion to human-use areas is of direct detriment to elephants. Also by increasing HEC it causes problems for both, people and elephants. Habitat loss that occurs due to planned development can be mitigated to some extent by remedial measures. What cannot be mitigated has to be considered a cost of development. However, habitat loss due to unplanned development, such as encroachment, should be prevented.

A5.1. Prevent encroachment of state land

Encroachment of state lands, particularly protected areas under the DWC and the Forest Department, as well as reservoir beds, road and stream reservations etc. occurs regularly and should be prevented. In many cases, removal of encroachers will be necessary. While encroachment is illegal under present statutes, in some cases implementation is curtailed due to political interference.

Table 16. Plan of implementation for preventing encroachment of state land

No.	Action	Responsibility	Timeline
1.	Prevent political interference in implementing the law with regard to illegal encroachments in state land	Presidential Secretariat	Immediately
2.	Set up a task force to identify and address specific cases and re-locate encroachers providing adequate alternatives to them	Presidential Secretariat, MoW, relevant agencies	Commence immediately

Estimate of funding required

No specific allocation is required, as the identified actions should be conducted within the normal functioning of the agencies concerned.

A5.2. Prevent livestock herding inside protected areas

The herding of cattle and buffalos inside protected areas under the DWC and the Forest Department is a common occurrence and is likely to be detrimental to elephants and other wild herbivores due to competition for food. No data on the extent of the issue and its impact is currently available. While livestock grazing in protected areas is illegal under present statutes, in some cases implementation is curtailed due to political interference.

Table 17. Plan of implementation for preventing livestock herding in protected areas

No.	Action	Responsibility	Timeline
1.	Prevent political interference in implementing the law with regard to livestock grazing in protected areas	Presidential Secretariat	Immediately
2.	Conduct studies on the extent of the issue and its impact	MoW, SMoW, DWC, Forest Department, research organizations, universities	Commence immediately
3.	Develop plan for alternative management of cattle in coordination with agencies responsible for livestock management	MoW, SMoW, DWC, Forest Department	Based on results of action 2
4.	Implement plan		Year 2 onwards

Estimate of funding required

No specific allocation is required, as the identified actions should be conducted within the normal functioning of the agencies concerned.

A6. Conduct awareness campaigns

Awareness is a critical component of implementing most of the activities outlined in this Action Plan. It is of particular importance with regard to short-term activities such as reducing death and injury of people from elephants, providing relief from elephant depredation, reparation of losses, and reducing death and injury of elephants due to people. Therefore awareness, as it relates to all these aspects, is addressed together in this section.

A few examples of messages and information that could be conveyed and emphasized in awareness programs are:

Reducing human death and injury

- Elephants are very large, powerful and potentially dangerous animals
- In all instances we should keep as much of a distance from elephants as possible
- Elephants are mostly active at night, hence we should be more careful during the night
- Elephants are not naturally aggressive towards people
- Confronting elephants by subjecting them to aggression and harassing them, results in reactive aggression by elephants, which may cost your life or another's
- Wherever possible we should plan ahead and take preventive action that will keep us safe from elephants such as:
 - Using alternate transport that provides a better margin of safety instead of walking or using a bicycle at night
 - Improving visibility of roadsides by managing vegetation and getting street lamps installed
 - Installing a protective barrier such as a 'pita-weta'/ditch along the path from the house to the outhouse
 - Installing a simple early-warning system such as tin cans strung along a wire

Safeguarding crops and property

- Information about village electric fences and paddy-field electric fences
- Indiscriminate use of ali-wedi habituates elephants and makes them non-responsive to them, therefore limit their use to essential situations

Reparation of losses

- Information about insurance and compensation schemes

Reducing death of elephants due to people

- Illegality of killing elephants
- Illegality and suffering and deaths caused by
 - Hakka-patas
 - Snares
 - Electrocution

Awareness needs to be conducted at multiple levels including:

- National
- Community

- Special target groups
 - Development agencies – government / international
 - Investors – BOI private
 - Funding agencies
 - Political authority
 - Clergy
 - Schools
 - National Planning & Regulatory Authorities
 - Journalists, media personnel
 - NGOs

It is proposed to develop a comprehensive awareness campaign with the help of professionals and that a dedicated fund be set up for it under the MoW. Funds need to be made available on an annual basis.

Table 18. Plan of implementation for awareness campaign

No.	Action	Responsibility	Timeline
1.	Facilitate the conducting of awareness programs based on existing material, especially through mass media	MoW, SMoW, DWC, Forest Department, NGOs, media organizations, local authorities	Commence immediately
2.	Develop awareness campaign in coordination with relevant agencies		Commence immediately
3.	Estimate costs for campaign		6 months from commencement
4.	Set up fund and disbursement and management mechanisms	MoW, SMoW	Upon completion of Action 3
5.	Coordinate media campaign	MoW, SMoW, media organizations	Year 2 onwards

Estimate of funding required

An allocation of Rs. 10 million is proposed in year 1, as some of the identified actions should be conducted within the normal functioning of the agencies concerned. However, further allocations will need to be made based on cost estimates developed under Action 3 of Table 18.

B. MEASURES THAT WILL PROVIDE RESULTS IN THE MEDIUM TERM

In the medium-term HEC will have to be managed in areas where elephants and people share the landscape, till development converts them to exclusive human-use areas. In order to minimize the increase of HEC while developing shared areas, it is imperative that elephant presence, movement paths and resource use is taken into account when planning the development. Past experience has shown that HEC escalates when these factors are not considered.

B1. Obtain baseline information to guide development and management

Preventing and minimizing HEC caused by development requires baseline data on elephant and HEC distribution, elephant movement paths and elephant habitat and resource use, in order to prioritize areas for development. This information should form the basis when choosing sites for development projects.

B1.1. Conduct elephant and HEC distribution surveys

When selecting areas for development, prioritizing male-only areas would significantly decrease HEC, as they would be rapidly converted to non-elephant areas. In contrast, development of male and herd areas will take much longer, first making them male-only and therefore high-conflict areas, hence result in the escalation of HEC.

Data is currently available for elephant and HEC distribution in 2015^[4,6]. Given the extent and rapidity of development over the last few years in areas with elephants, in particular in the north and east, the elephant distribution landscape continues to change ever more rapidly. Therefore, elephant and HEC distribution maps should be updated at least every five years by repeating the survey using the same methodology, particularly in relation to the border areas of distribution^[4]. Providing public access to the data is essential and would facilitate its use in development planning and decision-making.

Table 19. Plan of implementation of elephant distribution surveys

No.	Action	Responsibility	Timeline
1.	Host currently available data on web in interactive manner with public access at a site such as < https://www.nsd.gov.lk/geoportal >	MoW, SMoW, DWC, research organizations, universities	Commence immediately
2.	Conduct survey every 5 years, using same methodology		Commence in 2021
3.	Update distribution maps		Upon completion of survey

Estimate of funding required

While the funds required will depend on the extent of the area to be surveyed, it is proposed that a sum of Rs. 10 million be set aside for this purpose.

B1.2. Conduct elephant census

The number of elephants in a given area may have implications for managing HEC. Therefore, it is proposed that a trial of population assessment be conducted in a limited area using different methodologies such as water hole counts, individual identification by photographic cataloguing, individual identification by genetic fingerprinting from dung extracted DNA, and line and strip transects estimating dung densities. If a reliable method is found, it could be applied to wider landscapes. In conducting the trial, different methods should be replicated at different time periods in the same area, providing information on within method variance.

Table 20. Plan of implementation of elephant census

No.	Action	Responsibility	Timeline
1.	Identify area for census trial	MoW, SMoW, DWC, research organizations, universities	Commence immediately
2.	Identify methodologies for conducting census		Commence immediately
3.	Conduct census using different methodologies		Upon completion of Actions 1&2
4.	Analyse data and choose appropriate methods and geographic scale for elephant census		Upon completion of Action 3
5.	Conduct elephant census at appropriate scale		Based on results of Action 4

Estimate of funding required

While the funds required will depend on the methodologies identified and the extent of the area to be surveyed, it is proposed that a sum of Rs. 10 million be set aside for testing different methodologies.

B1.3. GPS-collaring of elephants

GPS-tracking of elephants provides data on elephant ranging patterns, habitat and resource use. Whilst there are many beliefs about the movement of elephants, much of it has been proven wrong by GPS-tracking data. Using actual data from elephants in taking management and development decisions would make it possible to prevent future increase of HEC.

Tracking data identifies critical elephant movement paths and use of critical resources, which can be used to guide development, so that elephants are not obstructed by developmental activities. If not, elephants will be forced to overcome such obstructions by moving through the developed area and/or through new areas that are semi-developed, such as villages, leading to escalation of HEC.

Collaring elephants can provide an unbiased evaluation of the efficacy of HEC mitigation actions and help modify them to make them more effective. For example, a concern that is often expressed is whether protecting villages with electric fences would result in elephants moving into more developed areas. GPS-tracking of elephants in areas where villages are protected can provide actual evidence for or against such concerns. Similarly, collaring elephants that are subject to drives provides an actual view of the results of the drive. Collaring elephants put in holding grounds would indicate what happens to them. Tracking data will also clearly show how elephants respond to habitat management.

Tracking data can also indicate what management actions should be taken in particular situations. For example tracking elephants in areas where train and vehicle collisions with elephants occur, can help choose between management options such as overpasses, electric fencing, speed restriction etc. Tracking crop raiding males would indicate patterns of raiding and whether they raid year round or at a particular time, how often they raid, in what situations they raid etc., which may indicate appropriate measures for its prevention.

Elephants collared should provide a representative sample of elephant ranging patterns therefore sufficient numbers of males and females should be collared in a given area:

- To guide development, prioritize collaring of elephants that range outside protected areas and particularly in areas slated for development.
- The average home range size of elephants is around 200 km², elephants are present in around 40,000 km² of Sri Lanka and elephants and people share the landscape in around 29,000 km². Therefore, a representative sample covering all of Sri Lanka and the ranging of males and herds would require the collaring of around 300 elephants.
- To assess the success of particular management actions and to determine what specific actions are appropriate, additional elephants need to be collared in relation to those activities.
- To collar, elephants have to be put under anaesthesia or deep sedation, which carries a risk to the elephant and those conducting the operation. Therefore such risks should be assessed and measures taken to minimize and manage them, such as the use of radio-darts, provision of adequate resources, equipment and protocols to address emergencies etc.

The veterinary section of the DWC does not have the capacity to undertake such high numbers of collaring, as it has to be done in addition to their regular work. For example of 40 collars obtained under ESCAMP, in a period of almost three years it has been possible to

collar only 31 elephants. Therefore collaring at a scale relevant to managing HEC requires the setting up of a special dedicated unit.

Table 21. Plan of implementation for GPS radio-collaring of elephants

No.	Action	Responsibility	Timeline
1.	Make data from elephants collared under ESCAMP available for decision making *	MoW, SMoW, DWC	Immediately
2.	Purchase 100 collars		Commence procurement process immediately
3.	Set up a new unit for collaring		Commence immediately
4.	Collar 100 elephants	MoW, SMoW, DWC, research organizations, universities	Complete before end year 1
5.	Provide public access to the tracking data by hosting on the web at a site such as < https://www.nsd.gov.lk/geoportal >		Once collaring commences
6.	Analyse the data continuously and use for management and guiding development		Once collaring commences
7.	Procure additional collars based on completion of collaring and identification of needs & continue actions 4-7		Year 2 on

* Data from elephants collared under ESCAMP was not available for the preparation of this Action Plan.

Estimate of funding required

The direct cost of an imported GPS collar from a reputed manufacturer is around US\$ 5,000 (~ Rs. 1 million). Therefore the cost of 100 collars is around Rs. 100 million. Specific costs for setting up a collaring unit and the collaring operations need to be assessed by the relevant agencies. However, an approximate cost for setting up a unit composed of two veterinarians and 8 team members with 2 vehicles, and collaring 100 elephants could be around another Rs. 100 million. Therefore, the total cost in year 1 would be around Rs. 200 million.

B.1.4. Conduct trial of habitat management

Given the critical importance of deciding whether elephants can be attracted to and will remain in areas where habitat management is done and whether higher densities of elephants can be maintained by growing fodder, it is proposed that a trial of habitat management be conducted. The main aspects that need to be monitored are the cost-benefit, change in productivity as a result of the intervention and use by elephants and other wildlife before and after the habitat change. The results of these will define the role that habitat management can play in mitigation of HEC.

Table 22. Plan of implementation

No.	Action	Responsibility	Timeline
1.	Identify an area where habitat management could be done	MoW, SMoW, DWC, FD, District Secretariats, research or- ganizations, universities	Start immediately
2.	Select 10 plots of approximately 100 ha for habitat management trial		Based on comple- tion of Action 1
3.	Select 5 treatments of habitat management (could be 5 crops or permutations of fewer crops with different methods of cultivation or ground preparation)		Based on comple- tion of Action 2
4.	Randomly assign each of five treatments with 2 replicates each		Based on comple- tion of Action 3
5.	Assess the use of each experimental plot by elephants and other animals by conducting dung counts based on transects and sampling plots, every 3 months for two years		Upon completion of Action 1 for 2 years
6.	Assess vegetation in each plot, based on sampling plots, by recording diversity and abundance every 3 months for two years		Upon completion of Action 1 for 2 years
7.	Radio collar 2 female elephants from different herds and 5 males in the area of habitat management. Monitor their use of the habitat management area and other areas		At start
8.	Conduct habitat management		After 1 year of Actions 5, 6 & 7
9.	Analyse vegetation profile and abundance, and elephant and wildlife use, of the sampling plots before and after habitat management		After 2 years of Actions 5, 6 & 7
10.	Conduct cost-benefit analysis, impact on elephants and determine relevance to HEC mitigation		Upon completion of Action 9

Estimate of funding required

Habitat management of 1,000 ha at an estimated cost of Rs. 100,000 /ha would cost around Rs. 100 million. The direct cost of an imported GPS collar from a reputed manufacturer is around US\$ 5,000 (~ Rs. 1 million). Therefore, the cost of 10 collars is around Rs. 10 million. Allocation for collaring is estimated at Rs. 200,000 per elephant for a total of Rs. 2 million, as it will be conducted within the existing DWC framework. Therefore the cost of collaring including collars would be Rs. 12 million. An allocation of Rs. 4 million is proposed for vegetation and wildlife use studies for two years. Thus the total allocation proposed is Rs. 116 million.

B.2. Develop and improve HEC mitigation tools

Currently there are no methods that prevent elephant depredation that work 100%, are universally applicable to all situations or that do not have any drawbacks. Many of the barrier methods have limited applicability and/or elephants learn to overcome them. With repeated exposure, elephants become habituated to most deterrent measures. Therefore, refinement of existing methods and development of new methods and innovations, to prevent elephant depredation, is of value.

B 2.1 Trenches

The use of trenches as a barrier for elephants is based on the premise that elephants do not jump across obstructions as they weigh too much for the impact to be borne by their legs. Therefore, when faced with a trench, elephants will try to get over it by striding across it. If the trench is too wide for an elephant to stride across, it will try to get in and climb out of it. Therefore, the principle in construction of trenches as elephant barriers is that it should be too wide for an elephant to stride across and too narrow for an elephant to get in. However, elephants come in different sizes and it is not possible to figure out a width that works for all.

Trench construction over long distances is difficult because of variation in soil conditions, presence of rocky substrate etc. Trenches may also obstruct drainage of surface water, leading to issues with irrigation. Additionally, it is not possible to construct trenches across roadways, water ways etc. Elephants will cross through any gaps left in a trench system, negating the effectiveness of trenches. Trenches will also obstruct the movement of other animals, hence, have a wider impact than just on elephants.

The biggest problem with trenches is that they fill up with water when it rains and the sides cave in. Elephants will also put weight on the sides of trenches and actively break them down. Elephants can also go down and clamber up very steep gradients by sliding down on their backs and using their knees to climb up. Lining trenches with concrete can stabilize the sides and prevent the sides caving in. However, such stabilization tends to be very expensive, in the order of tens of millions of Rupees per km. Use of different methods or material for stabilization may make trenches more cost-effective.

Trenches have been tried in combination with DWC electric fences at the Pelwatte Sugar and the Lunugamvehera National Park in the south and Kathnoruwa in the northwest, but proved ineffective. Private landowners in the Puttlam area have tried trenches by themselves as a barrier but without success. Small trenches as a protection against elephants breaking electric fences by dragging tree trunks onto them has had some success in the Galgamuwa area. Therefore modifications of trenches should be tried out and tested on a pilot scale and incorporated in the Action Plan if found to be effective.

Table 23. Plan of implementation for trenches

No.	Action	Responsibility	Timeline
1.	Develop modifications of trenches	MoW, SMOw, DWC, research organizations, universities	Commence immediately
2.	Build test trenches and assess cost, durability and effectiveness		By end of year 1
3.	Implement on pilot scale and monitor durability and effectiveness		Based on results of Action 2
4.	If successful, incorporate in Action Plan and implement on appropriate scale		Based on results of Action 3

Estimate of funding required

It is proposed to allocate Rs. 50 million to test trench modifications in the first year. Tests would need to run for at least a year before their effectiveness can be assessed.

B 2.2. Improve electric fence designs

Current designs of electric fencing are fairly effective if they are located, constructed and maintained properly. However, elephants sometimes break even such fences. Modifications to fences such as ‘hanging fences’ have been found to be more effective than current designs – for example around the Hambantota garbage dump. Therefore, they should be tested at an appropriate geographic and time scale and if they are proven to be more effective, should be adopted with additional modifications needed to facilitate implementation at a wider scale.

Table 24. Plan of implementation for improving electric fence design

No.	Action	Responsibility	Timeline
1.	Develop modifications of electric fences	MoW, DWC, research organizations, universities	Commence immediately
2.	Build test fences and assess cost, durability and effectiveness		Based on results of Action 1
3.	Implement on pilot scale and monitor durability and effectiveness		Based on results of Action 2
4.	If successful, incorporate in Action Plan and implement on appropriate scale		Based on results of Action 3

Estimate of funding required

It is proposed to allocate Rs. 50 million to test electric fence modifications in the first year. Tests would need to run for at least a year before their effectiveness can be assessed.

B2.3. Develop new HEC mitigation tools

Investigating new approaches to different aspects of HEC mitigation, such as new methods, equipment or material, should be encouraged.

Table 25. Plan of implementation for developing HEC mitigation tools

No.	Action	Responsibility	Timeline
1.	Identify methods and innovations with possible applicability	MoW, SMoW, DWC, research organizations, universities, innovators, other stakeholders	Commence immediately
2.	Develop methods/prototypes		End of year 1 onwards
3.	Test effectiveness, practicality, durability and sustainability, and assess cost-benefit		Upon completion of Action 2
4.	Select methods/innovations based on results of Action 3 and pilot-test at appropriate locations, geographic- and time-scales		Upon completion of Action 3
5.	Based on results of Action 4, incorporate into the Action Plan if relevant		Upon completion of Action 4

Estimate of funding required

No specific allocation is required in year 1, as the identification and development of methods or prototypes are expected to take at least one year, which should be conducted within the normal functioning of the agencies concerned. Any inventors or agencies developing new tools should find resources for their development. Once such methods/prototypes are developed, funds will need to be allocated based on the estimated costs for the next steps (Table 25, Action 3 onwards).

B3. Incorporate HEC mitigation in development activity

Planned development that occurs in areas with elephants, needs to incorporate measures to prevent HEC in project plans and it must be ensured that those measures are implemented fully. HEC mitigation should be considered an integral part of the development project and integrated into the project planning process from the conceptual design stage. Importantly, the plans should also include strategies and funding to mitigate any HEC that might arise or increase in the surrounding areas directly due to the development project, as well as indirect and cumulative impacts of the development project through secondary developments that occur consequent to the project.

It is equally or even more important to prevent unplanned/unsanctioned development (encroachment) in areas with elephants, if HEC escalation is to be prevented. However only planned (sanctioned) development will be discussed here as encroachment has already been discussed under Section A5.1.

The main developmental activity that creates conflict with elephants is agricultural development and associated activities such as tank construction or rehabilitation and irrigation. In addition, infrastructure development and construction may obstruct elephant movement paths and access to critical resources and thereby increase conflict.

Currently most developmental activities in areas with elephants occur without the developer taking appropriate measures to prevent increase of HEC as a result of the development. With a few exceptions, this holds true for development done by government agencies, non-governmental organizations, companies and individuals. It will not be possible to manage HEC if this state of affairs is continued.

B3.1. Large-scale planned projects

Large-scale planned development already undergoes an EIA process where conditions compelling the developer to take adequate safeguards to prevent and manage HEC due to the project can be imposed. For this to be effective, the regulatory authorities should be well aware of the issue, which could be addressed under Section A2.1.

In a number of cases, although the CEA as the regulatory authority gave conditional approval, the conditions were not adhered to by the implementing agency. Therefore it is imperative that there is an effective monitoring and punitive process that ensures implementation of imposed conditions.

Table 26. Plan of implementation for incorporating HEC mitigation in large-scale projects

No.	Action	Responsibility	Timeline
1.	Prepare guidelines for measures to prevent creation and escalation of HEC, to be taken by developers when conducting large-scale developments in areas with elephants	MoW, DWC, CEA	Immediately
2.	Ensure that an assessment of HEC potential and its mitigation is included in the Terms of Reference of EIAs in	CEA, project approving agencies	Immediately

	projects that are proposed in landscapes shared by humans and elephants		
3.	Ensure imposition of conditions in EIA process	MoW, DWC, CEA, project approving agencies	Upon preparation of guidelines
4.	Develop mechanisms for monitoring and ensuring implementation of conditions		Upon imposition of conditions

Estimate of funding required

No specific allocation is required, as the identified actions should be conducted within the normal functioning of the agencies concerned.

B3.2. Small-scale projects

The cumulative impact of small-scale development projects may even exceed that of large-scale projects. Small-scale projects do not undergo an EIA process. Therefore a different procedure needs to be formulated to address the impacts caused by them.

Assessing the cumulative impact of small projects on HEC and the measures that can be taken for preventing the genesis and escalation of HEC as a result of such development is critical for managing HEC. Similar to large-scale projects, it should be followed with a mechanism for monitoring and ensuring the proper implementation of recommended measures.

Table 27. Plan of implementation for incorporating HEC mitigation in small-scale projects

No.	Action	Responsibility	Timeline
1.	Prepare guidelines for measures to prevent creation and escalation of HEC, to be taken by developers when conducting small-scale developments in areas with elephants	MoW, DWC, CEA, District Secretariats	Immediately
2.	Develop mechanisms for imposition, monitoring and ensuring implementation		Upon completion of Action 1

Estimate of funding required

No specific allocation is required, as the identified actions should be conducted within the normal functioning of the agencies concerned.

B3.3. Manage chena cultivation

Chena or slash-and-burn agriculture is a widespread practice and has been a traditional form of cultivation of longstanding but is generally regarded as being environmentally destructive. It is responsible for the production of a significant proportion of dry zone vegetables hence is an important economic activity. In the past, chena was largely conducted as a shifting-cultivation with a single or a few seasons of cultivation before moving to another location. At the time patches of mature forests were cut and burnt for chena (nava-deli hena). The cycle of cultivation in such a system was probably 25 years or longer.

However, cutting mature forest for chena cultivation is no longer acceptable as it is unsustainable and leads to loss of forest cover. Similarly, chena cultivation on hill slopes is also unsustainable, as it leads to erosion and loss of topsoil, making such lands barren with little vegetative cover. At present most chenas do not ‘shift’ but are cultivated annually for extended periods of time. Most chenas of today are simply seasonal cultivations and/or have short cultivation cycles of less than five years.

However, pioneer species of plants still germinate and grow in the chenas during the non-cultivation period in the dry season and are the favoured food plants of elephants. Therefore, chena lands continue to be very important foraging areas for elephants in the dry season. In contrast, inside the mature forests of protected areas there is little dry season fodder. Seasonal cultivation of chena lands and the ability of elephants to move between such lands and protected areas benefit elephant conservation. As elephants use the chena lands when there is no cultivation, it does not cause HEC.

However, a major issue with chena cultivation is, that chenas tend to be converted to permanent cultivations and settlements. Such conversion is a major reason for the creation of HEC as it happens at the level of individuals and in elephant habitat. Therefore managing chena cultivation needs to prohibit cutting of mature forest or cultivation on hill slopes, and ensure that chena lands are not converted to permanent cultivation.

Table 28. Plan of implementation for managing chena cultivation

No.	Action	Responsibility	Timeline
1.	Map and identify areas where chena cultivation could be permitted	MoW, DWC, FD, District Secretariats	Six months from start
2.	Develop mechanisms for regulating chena cultivation through an annual permitting system.		Upon completion of Action 1
3.	Implement annual permitting system, monitor and adapt as necessary		Completion of Action 2 onwards

Estimate of funding required

No specific allocation is required, as the identified actions should be conducted within the normal functioning of the agencies concerned.

C. MEASURES THAT WILL PROVIDE RESULTS IN THE LONG TERM

The long-term management of elephants requires a comprehensive plan. It should be developed in consultation with the MoW, DWC, Forest Department, District Secretaries, Mahaweli Authority, Irrigation Department, research organizations, universities, development agencies, national planning and regulatory authorities and other stakeholders.

Therefore, it is proposed that a separate committee be set up under the Presidential Secretariat to develop a Master Plan for elephant management. It is critical that this should be commenced immediately.

Some of the areas that need to be addressed:

- Comprehensive information on the practicality, effectiveness and cost-benefit of many management actions is not available at present. However, such data is a prerequisite for developing a comprehensive management plan. Some of the management actions on which data needs to be collected, analysed and reviewed are:
 - Limiting elephants to particular areas
 - Confining elephants in holding grounds
 - Habitat management by growing grass, clearing invasive plants (e.g. cactus and *Prosopis* in Bundala), and rehabilitating water bodies
 - Location, functionality and effectiveness of electric fences on protected area boundaries
 - Location, functionality and effectiveness of trenches on protected area boundaries
 - Impact of confrontation on aggression in elephants
 - Impact of habitat succession and livestock grazing on elephants
- Identifying and delineating elephant ranging areas consisting of Elephant Conservation Areas (ECA), Managed Elephant Reserves (MER) and forest connectivity (corridors) to ensure the free movement of elephants.
 - Such delineation should take into account elephant habitat use and movement patterns based on tracking data and future developmental requirements
 - It may need to include resettlement of certain villages and reshaping of existing protected areas, for which guidelines require to be developed and implemented, the success monitored and implementation adapted as necessary.
 - Other State Forests (OSF) are an important part of elephant habitat. In many cases they connect larger forest patches and elephants use them as corridors/stepping stones to travel from one reserve/habitat to another in search of fodder or for behavioural requirements such as finding mates, without coming into conflict with people. Linking OSFs used by elephants to Forest and Wildlife Reserves will contribute to reducing HEC. Loss of such OSFs will result in elephants moving through developed areas and human habitations to fulfil their needs, which will greatly aggravate HEC and make its effective management impossible. Therefore, identifying, mapping and securing such OSF areas, is of critical importance.
 - Taking available forest and wildlife areas and other forest/habitat under state agencies into consideration, it is of paramount importance to establish forest/habitat linkages where possible. Such establishment requires feasibility,

site tenacity and suitability studies using tracking data, remote-sensing data and groundwork. The DWC has already identified many of these areas under its 2014 HEC Management Plan and they need to be secured if not already done.

- Ensuring that adequate resources are available in perpetuity for the elephant populations in delineated areas, particularly in respect of fodder and water resources.
 - Identifying areas important for elephant use and managing them as linkages or additions to existing Wildlife and Forest Reserves or as a reserve complex to meet the habitats requirements of elephants and other species.
 - Conducting trials of increasing food resources for elephants through habitat management and assessing costs, practicality and effectiveness through monitoring increase in productivity and elephant and wildlife use of managed areas.
 - Conducting trials of increasing water resources for elephants and assessing cost, practicality and effectiveness through monitoring elephant and wildlife use of the created resources.
 - Monitoring the health and demography of elephant populations subject to different management regimes to assess their impact on the elephants.

- Ensuring that elephants do not venture out of areas designated for them.
 - Developing suitable barriers, testing them, assessing cost-benefit and long-term effectiveness and, if effective, incorporating them in the Master Plan.

- Assessing the spatial and temporal distribution of elephants with numbers and other baseline information as necessary for such assessment and ensuring that management decisions are based on the analysis.

The above is not a complete list of the aspects that need to be addressed but only indicates the complexity of developing a long-term Master Plan for elephant management.

Table 29. Plan of implementation

No.	Action	Responsibility	Timeline
1.	Appoint committee to develop a Master Plan for elephant management	Presidential Secretariat	Immediately

D. IMPLEMENTATION OF THE NATIONAL ACTION PLAN

D1. Presidential Task Force to Monitor the Implementation of Action Plan

The Action Plan has to be implemented by multiple institutions and stakeholders, therefore proper coordination is essential. In addition, it is critical that close monitoring of implementation of the Action Plan takes place. In order to ensure institutional coordination and expediency in implementation, it is recommended that a Presidential Task Force be appointed. The task force should set up a hierarchy of supervisory bodies at local, regional and national levels.

Table 30. Plan of implementation

No.	Action	Responsibility	Timeline
1.	Appoint a Presidential Task Force for monitoring the implementation of the Action Plan	Presidential Secretariat	Immediately

D2. Possible constraints in implementing the Action Plan

Short-term political decisions and political interference in technical decisions and implementation actions has been a major cause for aggravation of HEC in the past several decades. If this National Action Plan is to succeed in mitigating HEC, it is essential that decisions and implementation actions be based on science and available data.

Table 31. Plan of implementation

No.	Action	Responsibility	Timeline
1.	Ensure that there is no political interference in technical decisions and implementation actions	Presidential Secretariat	Immediately

D3. Revision of the Action Plan

It is proposed that the Action Plan be reviewed periodically every two years of implementation.

Table 32. Plan of implementation

No.	Action	Responsibility	Timeline
1.	Appoint committee to review and revise action plan as necessary, in coordination with the task force monitoring implementation	Presidential Secretariat, MoW	By end of year 1

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