Reconciling Elephant Conservation with Economic Development in Sumatra

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1.0 Introduction

The Sumatran elephant (Elephas maximus sumatranus) is the smallest of the three subspecies of the Asian elephant. Its numbers are estimated to be anything between 2,800 and 4,800 (Blouch & Haryanto 1984; Blouch & Simbolon 1985). Once widely distributed throughout the eight provinces of Sumatra, the animal has almost disappeared from two provinces and is under threat in the rest of the island from a host of development programmes such as logging, human re-settlement, establishment of large-scale plantation estates, oil exploration, mining, irrigation and agriculture. The conversion of primary forest into agricultural holdings has been one of the causes of conservation problems in Sumatra and the elephant has been among the large mammals most seriously affected by it. Development programmes have led to the annual elimination of tens of thousands of hectares of elephant habitat.

As their traditional migratory routes are blocked, habitats fragmented, the elephants are becoming increasingly confined to patches of forests that are surrounded by cultivated land. As Laws (1981) points out in the situation in East Africa, the situation in Sumatra too is reversing gradually "from one in which human islands existed in a sea of elephants, to a sea of people with elephant islands". These conditions have led to a dramatic increase in the scale of elephant depredations in Sumatra. In some cases the success of the development programmes has been threatened as a result of which, there has been a change in attitude by the planners in recognizing the need to take into consideration the ecological requirements of the elephant during the planning stage of any development programme. In return, the Directorate of Forest Protection and Nature Conservation (PHPA) which is primarily responsible for the conservation of elephant must match this recognition by the planners with realistic proposals to ensure the conservation of the species without leading to unacceptable conflicts. This paper is an attempt to reconcile elephant conservation with economic development in Sumatra.

2.0 Conservation of Elephant.

The human population of Indonesia currently estimated to be 170 million and concentrated in Java and Bali is growing at an annual rate of 2.1%, with no controlling mechanism in sight, and with a forecast which must be at best optimistic, of ultimately stabilizing at 400 million. In an effort to relieve the population pressure on the already over-crowded island of Java, the Government of Indonesia is currently resettling the surplus population on the so called "Outer Islands" of Sumatra, Sulawesi, Kalimantan and Irian Jaya. Such population over-spill into Sumatra would imply an even greater competition for land that is currently inhabited by the elephants. The population pressure is and will always be a real constraint on any attempt to find a rational solution to the long-term conservation of the elephant in Sumatra. Hence PHPA must adopt a realistic policy to ensure the long-term survival of the elephant in Sumatra by aiming to keep the elephant populations and human settlements as far apart as possible.

Given that our objectives is to ensure the long-term survival of the elephant in Sumatra, we must adopt a strategy that can achieve this objective. Parker (1984) recommended the protection of as many individuals as possible in as wide a range of habitats as is practical. This implies the fact that not all the elephants in Sumatra can be actively protected. Before such a strategy can be adopted, the PHPA must have clear information on the following:-

1. An approximate idea of the total number of elephants in Sumatra.
2. The number and size of discrete populations.
3. How such populations are distributed in space.
4. How many of these populations do in fact inhabit protected areas, and so can be actively protected.
5. What should be done with the populations that occur outside the protected areas?
6. What is the total extent of the protected areas in Sumatra.
7. How many of these areas are in fact large enough to hold viable elephant populations?

8. What can be done to enhance the survival prospects of the elephants inhabiting small areas?
9. What land-use practices can be accommodated along the periphery of the protected areas, without leading to unacceptable levels in elephant-human conflicts?
10. What is expected from other Government Departments, whose development programmes have been responsible in the past, for at least part of the current human-elephant problems in Sumatra?

2.1 Number of Elephants in Sumatra

On the basis of the surveys carried out by Blouch & Haryanto (1984) and Blouch & Simbolon (1985), between 2,800 and 4,800+ elephants are estimated to be present in Sumatra today, distributed mostly in six of the eight provinces (Table 1).

Table 1. The minimum and maximum number of elephants in Sumatra

Province	Minimum	Maximum
1. Aceh	600	850
2. North Sumatra	a few	a few
3. Riau	1,100	1,700
4. West Sumatra	a few	a few
5. Jambi	200	500
6. Bengkula	100	200
7. South Sumatra	250	650
8. Lampung	550	900
Total	2,800+	4,800+

Source: Blouch & Haryanto (1984); Blouch & Simbolon (1985).

2.2 Number and size of discrete populations

The surveys of Blouch & Haryanto (1984) and Blouch & Simbolon (1985) have identified at least 44 discrete elephant populations (Fig. 1) whose size ranges from less than 50 to 400 (Table 2). The largest populations with up to 400 elephants are found in Riau and Aceh provinces, which are important areas for economic development and so have been identified with chronic elephant depredations in the past. Some of the elephant populations in the heavily populated Lampung province are very small, consisting at times less than ten animals, and so have no long term viability.

Table 2. The number and size of the discrete elephant populations in Sumatra in 1985

	name	province	number
1.	Gunung Sulah*	Lampung	<50
2.	Gunung Tanggang*	Lampung	<50
3.	Gunung Betung*	Lampung	<50
4.	Way Kambas	Lampung	100-200
5.	Way terusan	Lampung	50-100
6.	North Barisan Selatan	Lampung/Bengkulu	50-100
7.	South Barisan Selatan	Lampung	>100
8.	Gunung Raya	Lampung	50-100
9.	Gunung Rindingan	Lampung	50-100
10.	Block 42	Lampung	<50
11.	Block 46	Lampung	50-100
12.	Block 44	Lampung	50-100
13.	Block 45 (Mesuji)	Lampung	>100
14.	Tunggal Buta	South Sumatra	<50
15.	Subanjeriji	South Sumatra	<50
16.	Air Semangus	South Sumatra	50-100
17.	Padang Sugihan	South Sumatra	>100
18.	Sungai Pasir	South Sumatra	<50
19.	Bentayan	South Sumatra	50-100
20.	Air Medak	South Sumatra	>100
21.	Air Kepas	South Sumatra/Jambi	>100
22.	Intan Hepta	Jambi	50-100
23.	Mendahara Ulu	Jambi	50-100
24.	Suban	Jambi	50-100
25.	Gunung Sumbing	Jambi	>100
26.	Batang Tebo	Jambi	50-100
27.	Sungai Ipuh	Bengkulu	>100
28.	Bukit Hitam	Bengkulu	<50
29.	Torgamba	Riau/North Sumatra	100-200
30.	Tanjung Medan	Riau	>50
31.	North Central Riau	Riau	200-300
32.	Koto Panjang	Riau	50-100
33.	Lipat Kain	Riau	50-100
34.	Langgam	Riau	>50
35.	South Central Riau	Riau	100
36.	Southern Riau	Riau	300-400
37.	Buantan	Riau	>50
38.	Siak Kecil	Riau	100-200
39.	Lower Rokkan	Riau	50-100
40.	Sinkinjang	West Sumatra	>50
41.	Singkil	Aceh	<50
42.	Western Gunung Leuser	Aceh	50-100
43.	Western Aceh	Aceh	200-300
44.	Eastern Aceh	Aceh	300-400

(* extinct by 1990)

2.3 Distribution of elephant populations

The distribution of elephant populations in Sumatra is discontinuous (Fig. 1). The establishment of large scale oil palm and rubber estates have almost squeezed the elephant out of North Sumatra province. Heavy human pressure has also pushed the animal out of West Sumatra province. The elephant populations in Aceh still enjoy a wide distribution and good numbers. But in Riau, they are scattered and are under heavy pressure from development activities. Protected areas are woefully

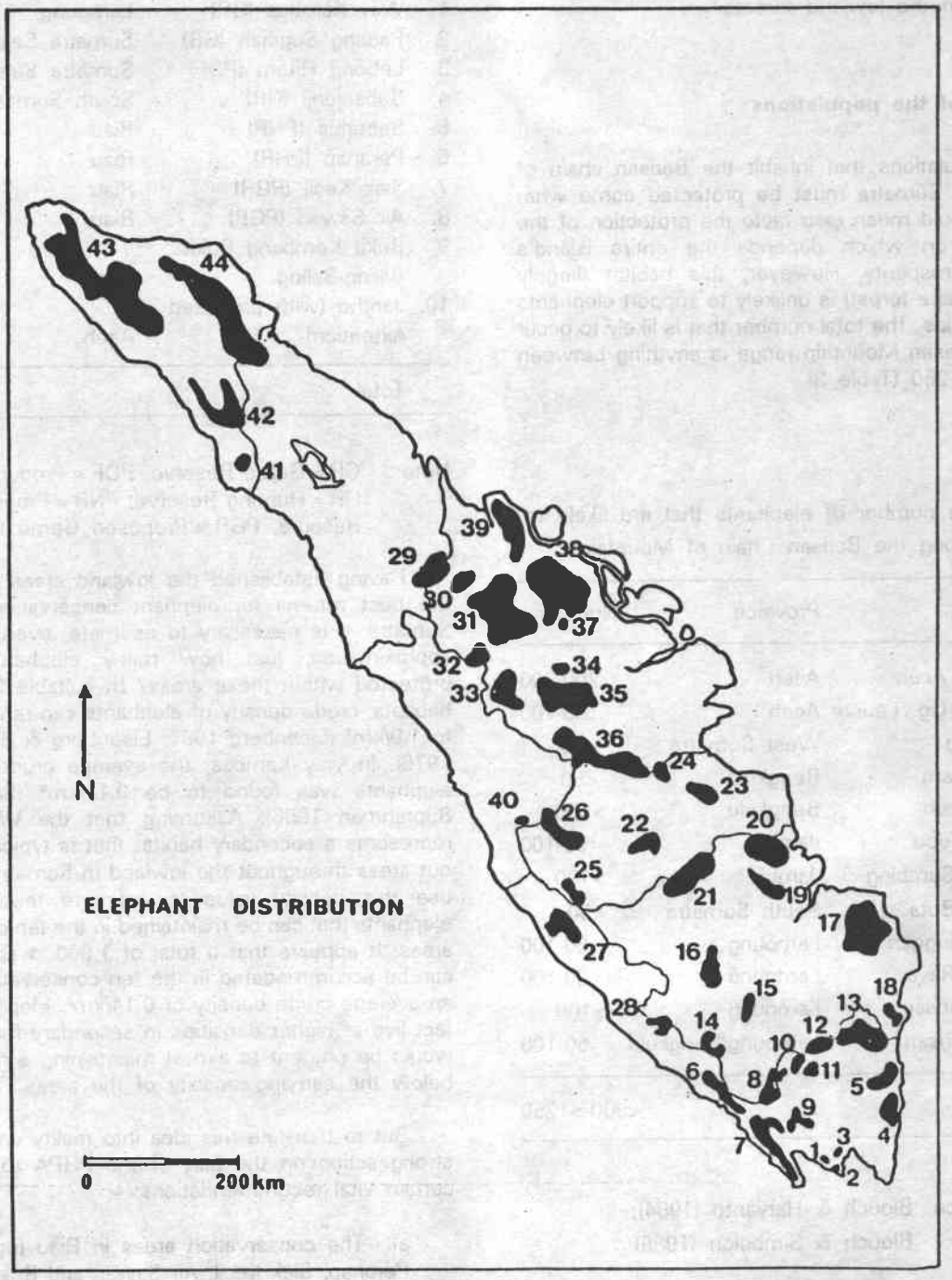


Fig. 1. Distribution of Elephant Populations in Sumatra, Indonesia

inadequate to accommodate all the populations in Riau. The situation in Lampung too is serious in that the animals are scattered in a man-dominated environment. The Barisan range of mountains that run along the spine of Sumatra support elephants but at much lower densities than the lowland forests.

2.4 Status of the populations

The populations that inhabit the Barisan chain of mountains in Sumatra must be protected come what may as it would mean *ipso facto* the protection of the watersheds, on which depends the entire island's agricultural prosperity. However, this habitat (largely primary montane forest) is unlikely to support elephants at high densities. The total number that is likely to occur along the Barisan Mountain range is anything between <900 and >1250 (Table 3).

Table 3. The number of elephants that are likely to occur along the Barisan Chain of Mountains

	Name	Province	Number
43.	Western Aceh	Aceh	200-300
42.	Western Gg. Leuser	Aceh	50-100
40.	Sinkinjang	West Sumatra	<50
28.	Bukit Hitam	Bengkulu	<50
27.	Sungai Ipuh	Bengkulu	>100
26.	Batang Tebo	Jambi	50-100
25.	Gunung Sumbing	Jambi	>100
14.	Tunggal Buta	South Sumatra	<50
9.	Gg. Rindinggan	Lampung	50-100
8.	Gunung Raya	Lampung	50-100
7.	South Barisan	Lampung	>100
6.	North Barisan	Lampung/Bengkulu	50-100
	Total		<900->1250

Source: Blouch & Haryanto (1984);
Blouch & Simbolon (1985).

In contrast to the montane areas, the lowland forest habitates can maintain relatively higher elephant densities on account of the high productivity. Ten areas in the lowlands offer the best hopes for the long-term survival of elephants in Sumatra (Table 4).

Table 4. Lowland areas with the best potential for elephant conservation.

	name	province	areas (km²)
1.	Way Kambas (GR)	Lampung	1,235
2.	Padang Sugihan (GR)	Sumatra Selatan	750
3.	Lebong Hitam (PDF)	Sumatra Selatan	3,000
4.	Subanjeriji (HR)	South Sumatra	650
5.	Seberida (PNR)	Riau	1,200
6.	Peranap (PHR)	Riau	1,200
7.	Siak Kecil (PGR)	Riau	1,000
8.	Air Sawan (PGR)	Riau	1,400
9.	Bukit Kembang Bukit Baling-Baling	Riau	1,460
10.	Jantho (with proposed extention)	Aceh	1,880
	Total		13,775

Note: GR = Game Reserve; PDF = Production Forest; HR = Hunting Reserve; PNR = Proposed Nature Reserve; PGR = Proposed Geme Reserve

Having established the lowland areas which offer the best returns for elephant conservation efforts in Sumatra, it is necessary to estimate, even as a rough approximation, just how many elephants can be protected within these areas? In suitable South Asian habitats, crude density of elephants can range from 0.1 to 1.0/km² (Eisenberg 1981; Eisenberg & Seidensticker 1976). In way Kambas, the average crude density of elephants was found to be 0.14/km² (Santiapillai & Suprahman 1986). Assuming that the Way Kambas represents a secondary habitat that is typical of logged out areas throughout the lowland in Sumatra, we could use this density value to estimate the number of elephants that can be maintained in the ten conservation areas. It appears that a total of 1,900 is about all that can be accommodated in the ten conservation areas at an average crude density of 0.14/km². Elephants can in fact live at higher densities in secondary forests, but it would be prudent to aim at maintaining a number well below the carrying capacity of the areas.

But to translate this idea into reality would require strong action on the part of the PHPA to implement certain vital recommendations:-

a). The conservation areas in Riau (eg: Seberida, Peranap, Siak Kecil, Air Sawan and Bukit Kembang Bukit Baling-Baling) should be given legal status (At present they are designated simply as "prposed" and therefore amount to little more than "paper parks".)

b). These areas must be surveyed and properly demarcated and separated preferably from human settlements by suitable buffer zones.

c). The proposed nature reserve Jantho (80 km²) in Aceh is inadequate as an elephant reserve. However it could be much enlarged by incorporating the surrounding 1,200 km² block of protection forest and the 600 km² block of protection forest (Blouch & Simbolon 1985). The new reserve would then have a total areas of 1,880 km² and thus would be adequate to maintain a viable elephant population.

d). The Padang Sugihan Game Reserve is only 750 km² but it supports about 240 elephants, giving a crude density of 0.32/km² (Nash & Nash 1985; Nash 1987), which is one of the highest elephant densities known in South-East Asia. The Padang Sugihan elephants are about the maximum the reserve can support. Already there have been reports that some of the elephants have raided crops in the adjoining transmigration settlements. The problem is further compounded by the fact that forest fires within the reserve have also driven some animals out, leading to more conflicts with the human settlers nearby. The elephants are in turn threatened by harrassment and habitat degradation (Nash & Nash 1985; Nash 1987) within the reserve. Illegal logging takes place despite the fact it is a protected area. Loggers operate with impunity within the reserve, cutting trees well below the officially permitted diameter of 50 cm. In one sample study of 450 logs that were felled illicitly in the reserve, the average diameter was 33 cm, and some as small as 19 cm (Nash & Nash 1985; Nash 1987).

Given the high elephant density observed in Padang Sugihan reserve, it would be a fail safe measure if this reserve could be linked with the larger (3,000 km²) Lebong Hitam production forest to its east. Such a move would greatly increase the area for elephants from 750 km2 to 3,750 km² and will relieve the current pressures on the Padang Sugihan reserve as well.

But there are currently disturbing reports of forest fires even within the Lebong Hitam production forest that have destroyed up to 10,000 ha of peat swamp forest! Unless strong measures are taken now to prevent the recurrence of forest fires, even such an extensive area as Lebong Hitam would be useless as a refuge for the surplus elephants from the Padang Sugihan Game Reserve.

So, with the best of efforts and will, it might just be possible to protect between 2,800 and 3,000 elephants in Sumatra, one third of which inhabit the Barisan mountain range, while two thirds occur in the lowlands.

2.5 Elephants outside protected areas.

A decision must be made as to what should be done with the elephants that occur outside the protected areas. The home range of elephants do in fact overlap with the production forests in Sumatra. If such substantial areas do in fact accommodate the entire annual home range of a population, then the area is best managed as a multiple-use forest where elephants can co-exist with man and might even benefit from "limited human use of forested uplands, including selective logging for local consumption, traditional hunting, bamboo extraction and slash and burn agriculture" (McNeely 1978). The " Managed Elephant Range " concept was put forward by Olivier (1978) and offers a great potential to reconcile economic development and elephant conservation and so ought to be at least given a try.

If a population of elephants is causing unacceptable levels of depredations, then a decision must be made if the animals have to translocated to another reserve or captured for domestication and training. The PHPA have staff who are well experienced in both operations. They have successfully driven whole herds of elephants in 1982 and 1984 in Southern Sumatra and Lampung provinces, away from problem areas. If the number of elephants that are causing the problem is small (less than ten animals), then it would be more economical to capture them using chemical immobilization for either release into another reserve or for domestication and training.

In areas where elephants have become a problem as a direct result of economic development (eg: establishment of oil palm, rubber, sugar cane plantations), the onus of establishing elephant barriers (eg: electric fence, ditch etc.) must be on the development agency and not on the PHPA. At present all elephant problems, irrespective of their source of origin, are brought to the PHPA's "doorstep" to be resolved. Given the low budget on which the PHPA operates, it would be grossly unfair to expect the PHPA alone to solve all the elephant problems.

2.6 Protected areas in Sumatra

With a total area of 47.7 million ha, Sumatra is the second largest island in the Indonesian archipelago. 64.3% of the land area is officially designated as forest land (Anon 1984). The primary forest cover amounts to 42% (UNDP/FAO 1982). Protected areas (i. e: National Parks, Nature Reserves, Game Reserves, Recreation Parks, Hunting Reserves and Protection Forests) account for 17.2% of the total land area. As far as the elephant conservation is concerned, there are 28 areas in Sumatra whose total area is 48,448 km2 (Santiapillai 1987). But 50% of the areas are still in the "proposed" category and so do not have the full legal protection they deserve. However not all of them represent prime elephant habitat. About 65% of the areas is mountainous. The home ranges of at least 17 out of 44 elephant populations are within these protected areas, and they account for a maximum of 2,500 animals

2.7 Areas with potentially viable elephant populations

There are 13 areas in Sumatra (actual and proposed) which are over 1,000 km² in extent and so might be adequate to accommodate viable populations. However, size of a reserve alone is no guarantee for the viability of an elephant population. What is important is to determine the productivity of the area. Small areas can in fact support high densities of elephants in comparison to large areas. A good example is the Padang Sugihan Game Reserve which despite its small size (750 km²) supports a much higher elephant density than the largest conservation area in Sumatra, the Kerinci-Seblat National Park (14,846 km²).

2.8 Small areas

If resources are limiting, small areas are poor bets for long term conservation programmes. However, if it is indeed possible, every effort must be made to link small reserves with a nearby large reserve by forest corridors. For such corridors to be really effective, they should be broad (at least a minimum of 5 km wide), and established along the banks of the river.

2.9 Compatible land-use practices

Ideally, all protected areas where elephants occur, should be established as far away as possible from human settlements. If this is not possible, then a suitable buffer zone should be established in between the reserve and the human settlements. Elephants respond to edges, the transition zone between forest and grasslands in a positive way (Seidensticker 1984). Much of the elephant depredations in Sumatra is due to the establishament of crop lands by the side of the reserve, thereby creating a diversity of habitats for the elephant. The patch of land that lies between human settlements and elephant reserve should have "zero appeal" to the elephants to deter them from leaving the forest. This could be achieved by maintaining heavily grazed areas along the periphery of the reserve, establishing plantations that are not preferred by elephants (eg: Eucalyptus), or livestock husbandry instead of cash crop plantations.

2.10 Other Government Department assistance

The elephant problem must be looked upon as the collective responsibility of a number of Government Sectors that include Transmigration, Forestry (logging), plantations (oil palm, rubber, coconut, sugar cane etc.), Swidden agriculture, Mining, and power (hydro-electric and oil explorations) etc. Transmigration has been identified as an agent of forest desruction and much of the blame for the previous appalling failures of transmigration schemes is due to the scant attention the planners paid to site selection. A careful assessment of each forest block set aside for transmigration should be made before it is cut. Despitethe ambitious, well meaning efforts of the Government, the transmigration programme cannot possibly solve the demographic problems of Indonesia when human population growth in Java alone adds 2 million a year. The target for resettlement during 1984-1989 was 800,000 families (Ross 1984). The answer must lie in increased literacy, enhanced standard of living and the acceptance of the virtue of having small families. Transmigration is a fact of life in Indonesia, but it is a policy that cannot go on forever. As Ross (1984) points out, if the programme continues at the present rates of settlement untill all arable land is used, it would require an additional 5-10 million ha of land every five years, which must come from the forests.

The tropical rainforests of Sumatra contain a very high proportion of commercially valuable timber species. On an average, these forests contain as much as 200 m³/ha of commercial sizes trees (GOI/IIED 1985). In Sumatra, timber production means harvesting of old growth timber from natural forests. The commercially valuable dipterocarp species take about 70 years to attain the 60-70 cm dbh (diameter at breast height).

The Department of Forestry has laid down strict limits to the exploitation of commercial timber species. The regulations stipulate that a minimum diameter of 50 cm dbh and a cutting cycle of 35 years, leaving more than 25 trees per ha of commercial species of dbh 20 cm or greater (GOH/IIED 1985). As long as timber extraction is carried out selectively and within strict limits, it can enhance the carrying capacity for elephants (Santiapillai 1987). In practice however, given the economics of timber extraction, logging companies often cut trees well below the official limit of 50 cm dbh. Selective logging in Indonesia entails the removal of up to 20 trees/ha which can cause up to 40% damage to the residual stand (Kartawinate et al., 1981). There is also profligate waste of timber at the point of extraction. Loggers often extract lower number but exploit larger areas. The rate of overall timber exploitation far exceeds any attempts of reforestation and rehabilitation. As far as the elephants are concerned, they do not have any escape routes to move from a disturbed area to another less distributed area. Shelton (1985) offers a practical solution to this problem which is to maintain unlogged buffer strips along the water courses to link a concession area with corridors of mature forest.

An ingenious way to maintaining areas of older forests as wildlife habitats within a logging concession is to cut it in a checkerboard pattren (Shelton 1985). It is worth quoting in full: "In a forest reserve managed on a 50-year rotation, which is fairly typical in Malaysia today, a block amounting to one fiftieth of the reserve would be logged each year. If alternate blocks were left unlogged until the second 25 yaers, there would always be at least 25 blocks of 25 to 49 year-old logged forest distributed evenly throughout the reserve. These blocks would be adjacent to more recently logged blocks, which would thus have a nearby refuge and source of seeds and animal colonizers". Such a system provides the best opportunity for the management and conservation of elephant outside the protected areas in Sumatra.

The need to control the current rates of deforestation in Sumatra cannot be overstated. Logging operations *per se* are not responsible for large scale conservation of forests. These actions however expose the forest by providing access to many people along the logging roads, to the interior (Ross 1984). Roads in a normal logging operation in the high forests of Sarawak represent 4% of the total area logged (Hong 1987).

The department of Forestry must explore the possibility of using trained elephants in timber extraction within production forests, as is the case in Thailand and Burma. The Elephant Training Centres in Sumatra cannot hope to provide trained elephants to replace modern machinery but could assist in some way the extraction of timber from say, swampy areas where no machinery can function economically.

Soil erosion is perhaps the most serious environmental impact of logging (Hong 1987). The use of trained elephants in timber extraction within production forests can greatly reduce the negative impact of logging.

Plantation estates such as oil palm, rubber, sugar cane, coconut etc. have reaped enormous profits in the past but have not responded substantially to mitigating the current spate of elephant-human conflicts in areas where their activities have displaced the elephants. Proper environmental impact analysis must precede any new establishment of oil palm or other plantations. The oil palm is a much preferred food item of the elephant and so in the absence of effective elephant barriers, enormous elephant damage to oil palm trees will be inevitable. Appropriate electric fencing in Peninsular Malaysia could reduce elephant damage by more than 95% (Ratnam 1984). Electric fencing provides the most cost effective way of reducing elephant depredation under conditions prevailing in humid tropics (Blair & Noor 1981).

Shifting cultivation is often accused of causing much forest destruction. However, much of the damage to the forests is caused by the so called "Shifted cultivators" rather than by traditional slash and burn cultivators. As Ross (1984) points out, shifting cultivation in its classical form is the only self sustainable system of agriculture in the tropical rainforest. It becomes destructive only when their numbers exceed the carrying capacity of the forest. Compared to the amount of forest logged commercially, the primary forest opened by swidden farmers in Sarawak is only a small fraction (Hong 1987).

3.0 Conclusion

Elephant problems in Sumatra can never be completely eradicated. They can however be reduced substantially if much thought is given to the elephant in the planning stage of many of the island's development programmes. The PHPA alone cannot deal effectively with the elephant depredations. It would need the active support and generous financial assistance from both Governmental Departments and International Organizations. International philanthropy to date has paid more attention to helping with extraction of timber rather than reforestation and rehabilitation of degrarded areas.

The conservation of elephants in the face of growing economic development and increased human population growth calls for a provincial approach. Each province should establish a Task Force to deal with the elephant problems in that province on a respond-to-crisis basis. Each Elephant Task Force (ETF) should include a veterinarian trained in the use of cap-chur gun to tranquilize problem elephants if they need to be captured and translocated elsewhere.

The provincial ETFs should be under the control of a Director of Elephant Conservation whose Department would be responsible for the control, management and conservation of elephants in Sumatra.

The elephant Training Centres should provide trained elephants for use in forestry, wildlife and tourism. Trained elephants should be seen as an asset to economic development. Incentives must be given to individuals or companies that use trained elephants in hauling logs to using heavy machinery. Trained elephants performed a number of useful jobs during the Dutch colonial period; they ranged from hauling artillery during the war to hauling telegraph posts during peace. Capturing "problem elephants" and training them for useful service to man seems to be more humane and meaningful than shooting them as pests. The Elephant Training Centres in Sumatra should incorporate programmes to start breeding elephants in captivity. Elephants are slow breeders no doubt, but that should not prevent the PHPA in making a start in this direction. If elephants are to be trained for use in forestry operations, then they should be self-sustainable. Otherwise, there is a hidden danger that these training centres would simply become the raison d'etre for more captures from the wild.

The PHPA should base its policies on sound ecological research. This can only come about if increasing number of its staff are trained in wildlife management, and such trained personnel are in fact based in the field to address the problems and provide the appropriate solution. Unless and until this happens, wildlife conservation in Sumatra would be nothing more than an art of the possible.

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