

Sumatran Rhinoceros

Dicerorhinus sumatrensis



Global Heritage Species Program

Conservation Action Plan Prototype

DRAFT 2
1 May 1991

IUCN/SSC
Captive Breeding Specialist Group
in collaboration with
Asian Rhino Specialist Group
PHPA- Indonesia
DWNP- Malaysia



CBSG

INTRODUCTION

The concept of a Global Heritage Species Program (GHSP) originated in 1988. The idea is to carefully select a group of ecologically significant, culturally important, and publicly charismatic species that can be used as flagship and umbrella taxa to attract support for conservation not only of the species themselves but also their ecosystems. Since then, GHSP has been the subject of much discussion and development. An important component that has been emphasized during preliminary development has been the need to base Global Heritage Species Programs on biologically sound conservation action plans.

In April 1990, the Captive Breeding Specialist Group (CBSG) was invited by the Chairman of the IUCN Species Survival Commission (SSC) to lead preparation of one or two proposals for conservation action plans that could be used as prototypes for GHSP. Criteria considered to select candidates for prototype development included:

- (1) Candidates should be both umbrella and flagship taxa;
- (2) They should be taxa for which there is already considerable background and foundation, including population viability assessments, for this kind of program;
- (3) Hence, they should be taxa for which explicit and preferably quantitative goals and objectives can be formulated;
- (4) They should be taxa whose survival definitely depends on both *in situ* protection/management and captive propagation so that both the field and zoo communities can be actively involved.

CBSG immediately proposed the Sumatran rhino (*Dicerorhinus sumatrensis*) as a species which eminently satisfied these criteria. A first draft of a GHSP conservation action plan prototype employing Sumatran rhino was prepared in October 1991 by the CBSG. This draft plan was based closely on the Asian Rhino Specialist Group Action Plan (Khan 1989)

Naturally, development of these types of conservation action plans must be collaborative endeavors with scientists and managers in the range states. Therefore, this document was only a skeleton of a prototype conservation action plan for the Sumatran rhino. During November 1990, CBSG Executive Officer Foose consulted with wildlife officials in Indonesia and Malaysia to add flesh to the skeleton.

The skeletal proposal with some enhancements was presented at the IUCN SSC meetings in Perth, Australia 24-27 November 1991 by representatives of CBSG, the Asian Rhino Specialist Group, the Department of Forest Protection and Nature Conservation of Indonesia (PHPA), and the Department of Wildlife and National Parks (DWNP) of Malaysia. At Perth, the Steering Committee of the SSC encouraged further development of the prototype, especially at and through the Indonesian Rhino Conservation Workshop now proposed for Bogor, Indonesia 3-5 October 1991. The objective is a full proposal for a prototype action plan for presentation to SSC Steering Committee.

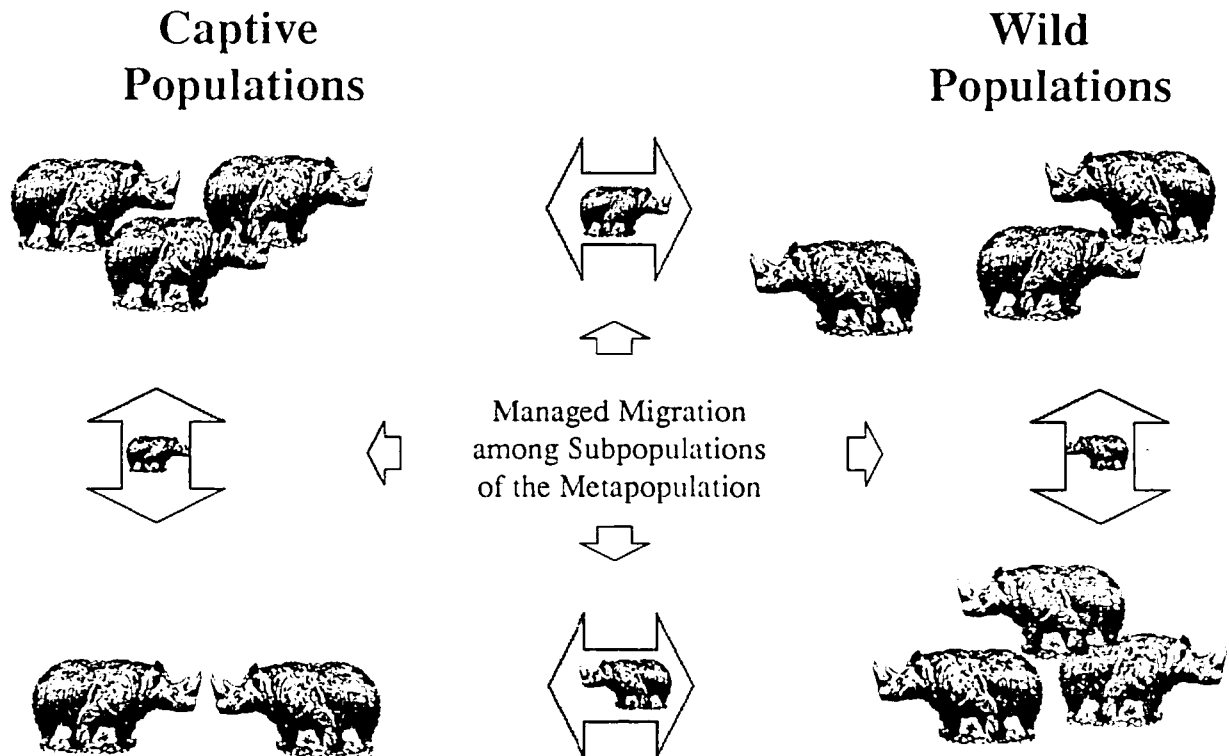
BIOLOGICAL PREMISES, GOALS, DESIDERATA

- Ideally, there should be linkage between the taxa selected for the Global Heritage Species Program and some strategic designation of the natural parts of the planet. In other words, there should be an attempt to preserve what might be generically referred to as "heritage areas" - with an explicit target, e.g. perhaps 10% of the natural areas of the planet with as much representation as possible of its ecosystems diversity.
- Therefore, the GHSP should select not only flagship (charismatic) species but also umbrella species, i.e. taxa for which the habitat required to sustain viable populations is sufficiently large to encompass appreciable parts of natural ecosystems.
- Further, GHSP candidates should be selected in such a way that the smallest number of taxa will encompass the greatest fraction of the natural areas of the planet. (As a consequence, megavertebrates may have preference; fortuitously, they may also be the most charismatic and hence desirable in terms of promoting the program).
- For each heritage species, a conservation action plan must be developed based on population viability assessment and conservation biology principles.
- Many if not most candidates for GHSP will be characterized by small populations and as such will be vulnerable to stochastic problems that can endanger survival just as much as can the more deterministic threats of habitat degradation and unsustainable exploitation. Environmentally, small populations can be devastated by catastrophes or decimated by less drastic fluctuations in the environment. Demographically, small populations can be disrupted by random failures in survivorship and fertility. Genetically, small populations lose heritable diversity needed for fitness and adaptability. The smaller and more fragmented the population, the greater these problems are and the more likely extinction is to occur.

Protecting endangered species from these problems entails development of populations that are sufficiently large and well distributed to survive the stochastic risks, i.e. intensively and interactively managed metapopulations that frequently have *ex situ* programs to reinforce *in situ* efforts. (Figure 1).

FIGURE 1

Metapopulation



- As a consequence, the conservation action plan should have specific quantitative objectives as countermeasures to the stochastic problems, e.g.
 - Insure 99% probability of survival and 95% preservation of diversity for next 100 years
 - Sustain 99% probability of survival and achieve recovery of evolutionary potential by end of next 100 years
 - Consequently, attain and maintain populations of quantitatively specified size and distribution to achieve these objectives.
- Performance toward achieving objectives should be measurable. This desideratum will be greatly facilitated if the objectives are quantitative.
- The action plans should be organized with modularized components and budgets, to facilitate implementation, funding, and evaluation.

GENERAL BACKGROUND ON SPECIES

- The Sumatran rhinoceros is a species of the South East Asian rainforest.
- The species was formerly distributed over much of South East Asia from eastern India through Myanmar (Burma), Thailand, peninsular Malaysia, and the islands of Sumatra and Borneo.
- The current and former distribution (and therefore the historic range that might be recovered) is depicted in Figure 2.
- The population is greatly reduced and fragmented. Approximately 500 to 1000 rhino are estimated to survive in 35 or more localities throughout South East Asia. The most significant known populations survive in Indonesia and Malaysia.
- The current distribution and estimated abundance as well as the potential carrying capacity of Sumatran rhino is presented in Table 1.
- Many of the individuals occur outside protected areas and viable populations (i.e. large enough to survive stochastic threats).
- Because numbers of the Sumatran rhino have become so reduced and fragmented, the species is subject to stochastic problems (environmental, demographic, and genetic) that can endanger its survival. (Khan 1989; Seal & Foose 1989).
- Three subspecies have been described for the Sumatran rhino:
 - Dicerorhinus sumatrensis*: Sumatra, peninsular Malaysia, Thailand
 - Dicerorhinus sumatrensis harrisoni*: Borneo
 - Dicerorhinus sumatrensis lasiotis*: Myanmar (Burma) and eastern India
- Additionally, the Asian Rhino Specialist Group has expressed concern that the populations on Sumatra may differ significantly from the populations in peninsular Malaysia and Thailand. Current descriptions of subspecies are based on non-genetic taxonomic methods. There has not been a rigorous analysis to determine if the described subspecies and or geographical varieties represent evolutionarily significant units that should be conserved as separate entities. Some research on molecular genetics of individuals from various regions is in progress.
- Among rhinos, the species seems particularly attractive and charismatic being normally covered by a prominent coat of hair and exhibiting a very varied repertoire of vocalizations and behaviors.

DISTRIBUTION OF THE SUMATRAN RHINOCEROS (*Dicerorhinus sumatrensis*)

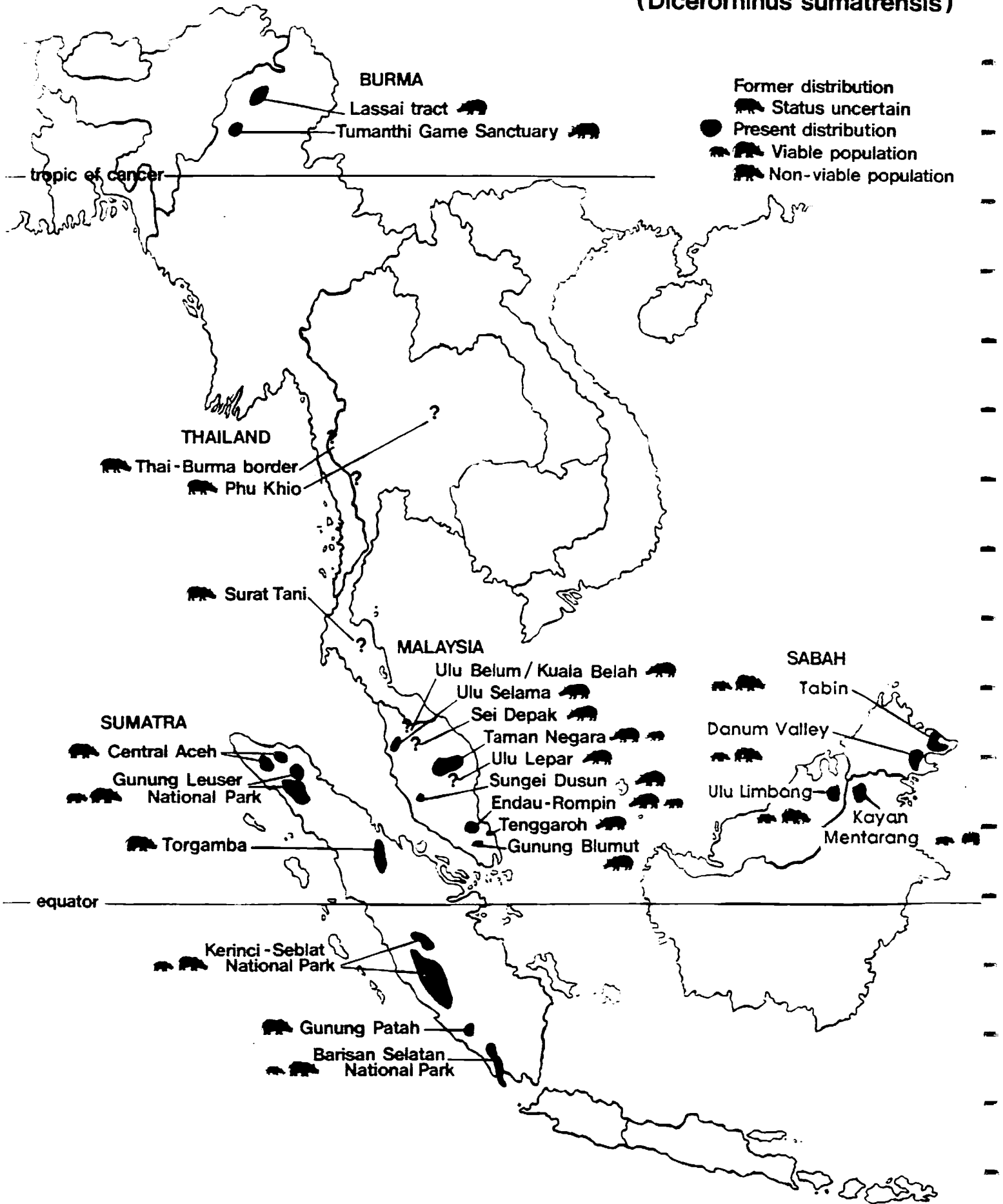


TABLE 1
DISTRIBUTION AND ABUNDANCE OF SUMATRAN RHINO
(From Khan 1989)

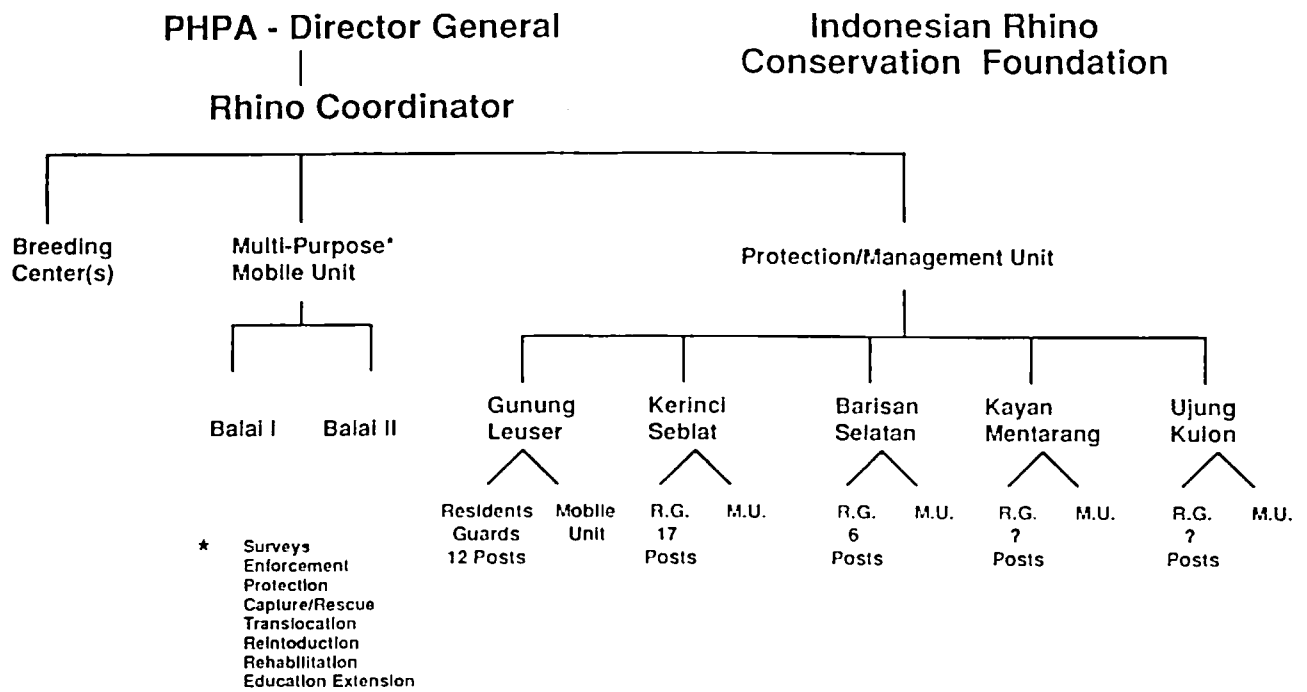
Country	Location	No of Rhino	Habitat Availability		Protection Status	Potential Carrying Capacity
			Presently (K.m ²)	Potentially (K.m ²)		
Burma	Schwe-u-daung	Perhaps survives	207	?	Game sanctuary	?
Burma	Tamanthi	Perhaps survives	2,150	?	Game sanctuary	?
Burma	Lassai tract	6-7	?	?	Unknown	?
Indonesia (Kalimantan)	near Sabah border	Perhaps survives	?	?	Unclear	?
Indonesia (Sumatra)	Gunung Leuser	130-200	1,400	8,000	National Park but disturbance & poaching	140-800
Indonesia (Sumatra)	Gunung Patah	Numbers unknown	400	500	No information	40-50
Indonesia (Sumatra)	Kerinci Seblat	250-500	5,000	10,000	Little protection proposed National Park	500-1,000
Indonesia (Sumatra)	Gunung Abong-abong and Lesten-Lukup	15-25	?	?	Not protected	?
Indonesia (Sumatra)	Berbak	Perhaps extinct	?	?	Nature Reserve	?
Indonesia (Sumatra)	Torgamba	Very few	?	?	Being deforested	?
Indonesia (Sumatra)	Barisan Selatan	25-60	700	3,600	National Park, deforestation occurring	70-360
Malaysia (Peninsula)	EndauRompin	10-25	1,600	1,000-1,600	Reserve, National Park proposed	110-160
Malaysia (Peninsula)	Taman Negara	22-36	4,400	4,400	National Park	220-440
Malaysia (Peninsula)	Sungai Dusun	3-4	40	140+	State Wildlife Reserve	15
Malaysia (Peninsula)	Gunung Belumut	3-5	230	230	Wildlife Reserve proposed	23
Malaysia (Peninsula)	Mersing Coast	5-6	?	Probably none	Being deforested	0
Malaysia (Peninsula)	Sungai Depok	2-4	?	Probably none	Being deforested	0
Malaysia (Peninsula)	Sungai Yong	3-5	?	Probably none	No information	0
Malaysia (Peninsula)	Kuala Balah	2-4	?	Probably none	Being deforested	0
Malaysia (Peninsula)	Bukit Gebok	2	?	None	Being deforested	0
Malaysia (Peninsula)	Krau Reserve	1	500	500	Insecure	50
Malaysia (Peninsula)	Sungai Lepar	2	1,000	0	Unprotected and being deforested	0
Malaysia (Peninsula)	Ulu Atok	1	?	?	No information	?
Malaysia (Peninsula)	Ulu Selama	6-7	?	?	Unprotected	?
Malaysia (Peninsula)	Ulu Belum	2-4	?	?	Insecure	?
Malaysia (Peninsula)	Bubu Forest	2	?	?	No information	?
Malaysia (Peninsula)	Kedah	1	?	?	Insecure	?
Malaysia (Sabah)	Tabin Reserve	20+	1,200	1,200	Perhaps protectable	120
Malaysia (Sabah)	Kretam/Dent Peninsula	8	1,000	0	Being converted to agriculture	0
Malaysia (Sabah)	Danum Valley	10	2,000	2,000	Perhaps protectable	200
Malaysia (Sarawak)	Limbang	5-15	600	600	Protection proposed	60
Thailand	Phu Khico	Perhaps survives	1,560	?	Protected area	?
Thailand	Tenasserim Range	6-15	?	?	Insecure	?
Thailand	Khao Soi Dao Reserve	Perhaps survives	745	?	Protected area	?
TOTAL			536-962			1,548-3,278

RANGE STATES COMMITMENT, RESOURCES, INFRASTRUCTURE

- An Action Plan has been formulated by the IUCN SSC Asian Rhino Specialist Group. This Plan has been based on preliminary population viability assessments for the species. The Plan has specific and quantitative objectives for conservation action on the Sumatran rhino.
- National conservation strategies for the Sumatran rhino are being developed in both of the currently major range states: Indonesia and Malaysia.
- The Indonesian strategy provides for 3 major types of activities: *in situ* protection and management employing both resident and mobile rhino units; translocations; captive propagation. An Indonesian Rhino Conservation Service has been proposed (Figure 3).
 - Activities and budgets to implement this Indonesian strategy are being formulated in modules.
 - Indonesia has organized an Indonesian Rhino Conservation Foundation to recruit support and coordinate activities for implementation of its rhino conservation strategy.
- Malaysia has already developed a very effective rhino unit for conservation of its rhinos. A similar kind of rhino unit is being contemplated for Indonesia.
- The Association of South East Asian Nations (ASEAN) provides the organizational infrastructure to facilitate multinational cooperation and coordination for conservation of this species.
- An Association of South East Asian Zoos has also been organized.

FIGURE 3
INDONESIAN RHINO CONSERVATION SERVICE

Tentative Organization of Indonesian Rhino Conservation Service



BIOLOGICAL GOALS AND OBJECTIVES

- Preliminary population viability analyses for the Sumatran rhino recommend:
 - A total population of at least 2,000 to 3,000 to achieve an effective population size (N_e) of at least 500.

Larger populations are desirable and may be necessary for viability if further studies validate each of the described subspecies and/or regional varieties as conservation units to be conserved separately.
 - Populations of 700-1000 in each of the major regions of the range Sumatra; Borneo; peninsular Malaysia; and Thailand; and Northern Myanmar (Burma)/eastern India.
 - Distribution of the total population over at least 6 major sanctuaries.
 - Each sanctuary capable of accommodating a minimum of 100 rhino. Preferably, at least 2 sanctuaries capable of accommodating at least 400-500 rhino.
- These recommendations provide for a 99% probability of survival relative to demographic and environmental stochasticity and an genetically effective population size of 500 which should maintain adequate genetic variation to permit the evolutionary process to continue if the disjunct populations are managed interactively and intensively as a metapopulation.

Examples and results of Population Viability Analyses are presented in Appendix 1.

- Attaining and sustaining viable populations of these sizes will require at least 20,000 to 30,000 sq. km. of tropical forest habitat (based on estimates by Sumatran rhino researchers of carrying capacity of 1 rhino/10 km²). Because not all habitat within protected areas will be appropriate for the rhino, actual area required for populations of these sizes is probably on the order of 40,000 to 60,000 km².
- Based on these analyses, The Action Plan of the IUCN SSC Asian Rhino Specialist Group recognizes 7, possibly 8, major existing sanctuaries and populations as viable for the Sumatran rhino. (Recent reports suggest a 9th viable situation may exist in Kayan Mentarang in Kalimantan.) The Action Plan recommends that field efforts at protection and management initially be concentrated on these sanctuaries. The major conservation action needed are anti-poaching activities and habitat protection, management, and rehabilitation.

For each sanctuary explicit quantitative objectives can be established for the minimum sizes of the populations to be sustained and thus the area of natural habitat to be protected and managed:

<u>Country</u>	<u>Sanctuary</u>	<u>Area</u> <u>(km²)</u>	<u>Current Population</u>	<u>Target Population</u>
Indonesia	Gunung Leuser	8,000	130-200	400
	Kerinci Seblat	10,000	250-500	500
	Barisan Selatan	3,600	25-60	100
	Kayan Mentarang	16,000	Some	500
Malaysia				
Peninsula	Endau Rompin	1,600	10-25	100
	Taman Negara	4,400	22-36	200
Sabah	Tabin	1,200	20+	100
	Danum Valley	2,000	10	100
Sarawak	Ulu Limbang	1,000 *	5-15	100

* Will require enlargement of protected area from current 600 km²

These 7-9 sanctuaries contain much biological diversity that will also be conserved by protection/management actions implemented for the Sumatran rhino. (All are accorded "A" Priority by MacKinnon & MacKinnon (1986).

<u>Sanctuary</u>	<u>Area</u>	<u>Mammals</u>	<u>Birds</u>	<u>Herps</u>	<u>Invertebrates</u>	<u>Plants</u>
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Information to be provided from species lists compiled by each country involved.

- Additionally, the Sumatran rhino formerly occurred (and perhaps still precariously survives) in other major sanctuaries to which the species could be restored by recolonization from captive propagation or translocations.

<u>Country</u>	<u>Sanctuary</u>	<u>Area (km²)</u>	<u>Current Population</u>	<u>Target Population</u>
Indonesia				
Kalimantan	Kutai	2,000	0	
Malaysia				
Peninsula	Krau Reserve	500	1	50
Thailand				
	Phu Khieo	1,500	0	100
	Khao Soi Dao	750	0	50
Myanmar (Burma)				

- These sanctuaries also contain much other biotic diversity that could and would be conserved by protection/management actions implemented for the Sumatran rhino.

Sanctuary Area Mammals Birds Herps Invertebrates Plants

Information to be provided from species lists compiled by each country involved.

- The Action Plan also recommends development of a captive population of at least 150-225 rhino, depending on the number of e.s.u.'s finally validated. A population of this size will preserve 90% of the average genetic diversity of the population for the next century and once the target size is attained produce 7-10 rhinos per year for return to the wild (assuming an annual growth rate of about 5%).
- The Action Plan recommends biochemical genetic studies as soon as possible to investigate if the subspecies or regional populations do represent e.s.u.'s.

PRIORITY ACTIONS

PHASE 1: Years 1990-2000

- Improve protection and management of the 7 to 9 sanctuaries for the actually or potentially viable populations. The goal will be to attain and sustain at least the target populations. Action required is more intensive anti-poaching measures as well as efforts to arrest and reverse habitat degradation.

<u>Country</u>	<u>Sanctuary</u>	<u>Requirements</u>	<u>Cost</u>	
			<u>Capital</u> <u>Unit Total</u>	<u>Operation</u> <u>Per Year</u>
Indonesia:	All	- Rhino Service Coordinator		\$15,000
		- Hdqs./Office	\$60,000	12,000
		- Equipment		
		- 4-Whl Drv Vhicl	25,000	25,000
		- Office (Computer/Fax, etc.)		25,000
		- 2 Multi-Purpose Mobile Units (\$14000/mo. operation)		336,000
		- 32 Persons (\$3000/yr/person)		96,000
		- Equipment		
		- 12 4-WhlDrvVhicl	25,000	300,000
		- 2 Lorries	75,000	150,000
		- Communication		30,000
		- Other		40,000
		- Internal Travel		50,000
		- Total	630,000	509,000
	Gunung Leuser	- Park Coordinator		10,000
		- Mobile Unit		144,000
		- 12 Persons (\$3000/yr)		36,000
		- Resident Unit:		
		- 12 Guard Posts (3 Type A; 5 Type B; 4 Type C)	25,000	300,000
		- 58 Guards (\$2500/yr)		145,000
		- Equipment:		
		- 3 4-WhlDrvVhicl	25,000	75,000
		- 8 Motor Bike		
		- Communication		10,000
		- Field Equipment		20,000
		- Total	\$405,000	395,000

<u>Country</u>	<u>Sanctuary</u>	<u>Requirements</u>	<u>Cost</u>			
			<u>Capital</u>	<u>Operation</u>		
			<u>Unit</u>	<u>Total</u>	<u>Per Year</u>	
	Kerinci Seblat	- Park Coordinator			\$10,000	
		- Mobile Unit			144,000	
		- 12 Persons (\$3000/yr/person)			36,000	
		- Resident Unit:				
		- 17 Guard Posts (8 Type A; 5 Type B; 4 Type C)	25,000	425,000	85,000	
		- 93 Guards (\$2500/yr/person)			232,500	
		- Equipment:				
		- 8 4-Whl Drv Vehicle	25,000	200,000		
		- 13 Motor Bike	2,500	32,500		
		- Communication		10,000		
		- Field Equipment		20,000		
		Total		687,500	507,500	
	Barisan Selatan	- Park Coordinator			10,000	
		- Mobile Unit:			144,000	
		- 12 Persons (\$3000/yr/person)			36,000	
		- Resident Unit:				
		- 6 Guard Posts (2 Type A; 2 Type B; 2 Type C)	25,000	150,000	30,000	
		- 30 Guards (\$2500/yr/person)			75,000	
		- Equipment:				
		- 2 4-Whl Drv Vehicle	25,000	75,000		
		- 4 Motor Bikes	2,500	10,000		
		- Communication		10,000		
		- Field Equipment	20,000			
		- Total		\$245,000	295,000	

<u>Country</u>	<u>Sanctuary</u>	<u>Requirements</u>	<u>Cost</u>	
			<u>Capital</u> <u>Unit Total</u>	<u>Operation</u> <u>Per Year</u>
	Kayan Mentarang	- Park Coordinator:		\$10,000
		- Mobile Unit:		
		- 12 Persons (\$3000/yr/person)		36,000
		- Resident Unit:		
		- 10+ Guard Posts	25,000 250,000	50,000
		- 50+ Guards (\$2500/yr/person)		125,000
		- Equipment:		
		- 4 4-WhlDrvVhicle	25,000 100,000	
		- 10 Motor Bikes	2,500 25,000	
		- Communication		10,000
		- Field Equipment		20,000
		- Total	\$405,000	221,000

Ujung Kulon (Javan Rhino)

INDONESIA TOTAL **\$2,372,500 1,927,500**

<u>Country</u>	<u>Sanctuary</u>	<u>Requirements</u>	<u>Cost</u>		
			<u>Capital</u>		<u>Operation</u>
			<u>Unit</u>	<u>Total</u>	<u>Per Year</u>
Malaysia:	All	Rhino Unit	?	?	?
Peninsula	Taman Negara	Resident Unit:	?	?	?
		Endau Rompin	Resident Unit:		?
		- 4 Guard Posts	110,000	440,000	
		- 4 Quarters @20,000	80,000		
		- Utilities/Infrastruct.	10,000		
		- Office/Storage	20,000		
		- Equipment:	40,000	160,000	
		- 1 4-Whl Drv Vhicle	20,000		
		- Patrol Boats	10,000		
		- Radios, Cameras	8,000		
		- Camping Equip.	2,000		
	Total		600,000		
Sabah	Tabin	Resident Unit:			?
			- 3 Guard Posts	110,000	330,000
		- 4 Quarters @ 20,000	80,000		
		- Utilities/Infrastruct.	10,000		
		- Office/Storage	20,000		
		- Equipment:	40,000	120,000	
		- 1 4-Whl Drv Vhicle	20,000		
		- Patrol Boats	10,000		
		- Radios, Cameras	8,000		
		- Camping Equip.	2,000		
		Total		450,000	
	Danum Valley	Resident Unit:			?
		- 1 Ranger Post	110,000	110,000	
		- 4 Quarters @ 20,000	80,000		
		- Utilities/Infrastruct.	10,000		
		- Office/Storage	20,000		
		- Equipment:	40,000	40,000	
		- 1 4-Whl Drv Vhicle	20,000		
		- Patrol Boats	10,000		
	- Radios, Cameras	8,000			
	- Camping Equip.	2,000			
	Total		\$150,000		

<u>Country</u>	<u>Sanctuary</u>	<u>Requirements</u>	<u>Cost</u>	
			<u>Capital</u> <u>Unit Total</u>	<u>Operation</u> <u>Per Year</u>
Sarawak	Ulu Limbang	Resident Unit:		?
		- 2 Ranger Post	110,000	220,000
		- 4 Quarters @ 20,000	80,000	
		- Utilities/Infrastruct.	10,000	
		- Office/Storage	20,000	
		- Equipment:	40,000	80,000
		- 1 4-Whl Drv Vhicle	20,000	
		- Patrol Boats	10,000	
		- Radios, Cameras	8,000	
		- Camping Equip.	2,000	
		Total		300,000
TOTAL MALAYSIA			\$1,500,000	?
TOTAL INDONESIA AND MALAYSIA			\$3,872,550	?

- **Implement measures to reduce/reverse human encroachment and recover/rehabilitate habitat in these sanctuaries.**

<u>Country</u>	<u>Sanctuary</u>	<u>Requirements</u>	<u>Cost</u>
Indonesia	Gunung Leuser	Relocate settlers	\$470,000
		Rehabilitate derelict land	375,000
		Buffer zone mgmt.	225,000
		Education extension	15,000
		Total	1,085,000
	Kerinci Seblat	Relocate settlers	780,000
		Rehabilitate derelict land	625,000
		Buffer zone mgmt.	375,000
		Education extension	30,000
		Total	1,810,000
	Barisan Selatan	Relocate settlers	160,000
		Rehabilitate derelict land	625,000
		Buffer zone mgmt.	50,000
		Education extension	10,000
		Total	845,000
	Kayan Mentarang	Relocate settlers	780,000
Rehabilitate derelict land		625,000	
Buffer zone mgmt.		375,000	
Education extension		10,000	
Total		\$1,790,000	
INDONESIA TOTAL			\$5,530,000

<u>Country</u>	<u>Sanctuary</u>	<u>Requirements</u>	<u>Cost</u>
Malaysia			
Peninsula	Endau Rompin		
	Taman Negara		
Sabah	Tabin		
	Danum Valley		
Sarawak	Ulu Limbang		

- Finalize any uncompleted gazettment of major sanctuaries.

<u>Country</u>	<u>Sanctuary</u>	<u>Action</u>
Indonesia	Gunung Leuser	
	Kerinci Seblat	
	Barisan Selatan	
	Kayan Mentarang	
Malaysia		
Peninsula	Endau Rompin	
Sabah	Tabin	
	Danum Valley	
Sarawak	Ulu Limbang	

- Conduct more intensive surveys to verify the status of the Sumatran Rhino in Kalimantan, esp. along Sabah and Sarawak border, Thailand, and Myanmar.

<u>Country</u>	<u>Area</u>	<u>Requirements</u>	<u>Cost</u>
Indonesia	Kalimantan		
Thailand			
Myanmar			

- Depending on results of survey, be prepared to institute specific *in situ* protection/management and or captive propagation programs oriented toward recovery of the populations.

Country Area Action Cost

- Conduct the biochemical studies necessary to validate e.s.u.'s within the species.
- Conduct research to improve knowledge of the ecological characteristics and requirements of the species.

Research Cost

- Translocate rhino as appropriate to achieve metapopulation strategy.
- Continue development of captive propagation programs both in range and non-range states. In range states, place emphasis on the captive propagation programs of the wildlife departments (PHPA in Indonesia and DWNP in Malaysia) especially at facilities developed within *in situ* sanctuaries. The goal will be to develop a self-sustaining captive population of at least 150-225 rhino which can then be used to produce animals for return to natural sanctuaries.

Country Requirements Cost

Indonesia PHPA Rhino Breeding
Center(s)

Malaysia

 Peninsula Sungai Dusun

 Sabah Sepilok

 Sarawak ?

Thailand

North America

Europe

Australia

- Conduct research in the reproductive biology of and technology for the species to facilitate intensive and interactive management of wild and captive populations.
- Provide training in both *in situ* and *ex situ* technologies.

<u>Training</u>	<u>Activity</u>	<u>Cost</u>
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- Support public education programs at both national and local (i.e. neighborhood of sanctuaries) for rhino.

<u>Country</u>	<u>Action</u>	<u>Cost</u>
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Indonesia	Local Extension Programs	
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	TV Programs	
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Malaysia	TV Programs	
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Singapore	TV Programs	
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- Assist specific efforts to reduce further the trade in rhino horn in both producer and consumer countries:

<u>Country</u>	<u>Action</u>	<u>Cost</u>
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Indonesia		
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Malaysia		
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Singapore		
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Hong Kong		
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Taiwan		
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China		
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Japan		
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Thailand		
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Myanmar		
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Laos		
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PHASE 2: Year 2000 and Beyond

- Commence recolonization and recovery process in areas where the rhino has disappeared:

Thailand:

Myanmar:

Indochina:

India:

Indonesia:

Malaysia:

APPENDIX 1

POPULATION VIABILITY ASSESSMENT: SUMATRAN RHINO

To be included in final version

(Preliminary results available in Khan (1989) and Seal & Foose (1989, 1991)).

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