Rhinoceros Action Plan

2012 - 2016

Sabah Wildlife Department
Ministry of Tourism, Culture and Environment

RHINOCEROS ACTION PLAN

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EXECUTIVE SUMMARY

The current (2010) number of living individuals of the Bornean subspecies of the Sumatran rhino (*Dicerorhinus sumatrensis harrissoni*; also known as the Bornean rhino) is possibly around forty or less. Sabah now offers the only likely prospect for saving this sub-species, and the best prospect for saving the species in Malaysia. Tabin Wildlife Reserve (1,220 square kilometers) and Danum Valley Conservation Area (430 square kilometers) each contain very small breeding populations of the rhino; and in addition, a few scattered rhinos persist in other parts of eastern and central Sabah.

There is a need to implement two major sorts of actions to stop the Bornean rhino from drifting to extinction, and to initiate a trajectory of increasing rhino numbers. The first method consists of implementing a policy of zero poaching and trapping of rhinos, anywhere in Sabah. The second method consists of the establishment and operation of a fenced, managed "Borneo Rhino Sanctuary" inside Tabin Wildlife Reserve, to be populated by rhinos translocated from other sites where those rhinos are unable to contribute to the species survival.

The argument that it is too late to save this rhino because of inbreeding is not valid. The African and Indian rhinos species were in a similar situation about a century ago, as were several other large mammal species such as the European bison, Arabian oryx and Pere David's deer, all of which were built up to much larger numbers with appropriate passion and action by a small number of people.

Two significant sources of financing for the Borneo Rhino Sanctuary have been secured during 2009 (the Malaysian national government, through the Sabah Development Corridor programme, and the Sime Darby Foundation).

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1 INTRODUCTION

1.1 Taxonomy

Based on morphological characters, Groves (1965) favoured separation of the Borneo form of the Asian two-horned or Sumatran rhinoceros (*Dicerorhinus sumatrensis*) as a distinct sub-species (*D. r. harrissoni*), with *D. r. sumatrensis* regarded as a single form occurring in Sumatra and Peninsula Malaysia. Based on mitochondrial DNA, however, Amato et al (1995) concluded that all Sumatran rhinos in Indonesia and Malaysia should be regarded as a single conservation unit. More recent (2010, unpublished, Zainal Z Z, pers. comm.) comparison of DNA from Sabah, Peninsular Malaysia and Sumatra also suggest that rhinos from all three areas are very closely related. These results are of great significance: the Sumatran rhinoceros is now so highly endangered that mixing of Bornean and Sumatran forms in captive situations represents a potentially significant means to increase the number of births.

Sumatran Rhinoceros in Malaysia (Sabah). Photo: Raymond Alfred

Sumatran Rhinoceros in Indonesia (Sumatera). (Photo: Raymond Alfred)

1.2 Legislation

According to the IUCN Red List (2009), the Sumatran rhinoceros is considered 'Critically Endangered', and the global population may be fewer than 250 mature individuals, with no subpopulation greater than 50 individuals and a decline of at least 25 % is expected within one generation. Under the provisions of the (Sabah) Wildlife Conservation Enactment 1997, the Bornean rhinoceros is totally protected.

1.3 Socio-ecology

The Sumatran Rhinoceros is mostly solitary except for courtship and child-rearing. It is the most vocal rhino species and also communicates through spraying urine, scraping soil with its feet and small trees with its horn, and twisting saplings. Individuals have home ranges: males believed to be up to 5,000 ha, females up to 1,500 ha, with females spaced apart, and males overlapping with other rhinos. Weights of mature Sumatran rhinos in Sabah are

Twisted Saplings (Photo: Raymond Alfred)

500 - 640 kg. Weights of rhinos held in captive conditions may be higher than those in the wild, a reflection of a higher quality diet and more food made available in captive conditions.

The Sumatran Rhino is a browser, with a diet predominantly of the leaves and twigs of saplings, small trees and lianas, and a daily intake of up to 60 kg. Feeding occurs mainly just before nightfall and in the morning. Over 100 plant species have been recorded as Sumatran rhino food, from a variety of plant families. The male rhino Tam, at Tabin Wildlife Reserve, appears to have developed a strong preference for a very few food species, all fast growing pioneer trees and woody climbers (such as *Spatholobus sp.*).[1]

Behaviour may be linked to keeping as cool as possible, necessary but difficult for an animal with low body surface area to mass ration in humid tropical forests. During the day the rhino wallows in mud wallows (presumably to cool and to maintain skin condition), which are developed and maintained by the rhino digging with the horn and feet. Wallowing occurs in bouts of about two to four hours. In rainy periods, rhinos tend to move to higher elevations, while in dry periods they stay nearer to larger rivers.

Mark of a Sumatran rhino horn on a tree trunk. Photo: John Payne

Females become sexually mature at the age of 6–7 years, males a little later. Based on observations of captive rhinos, sexual relationships begin with a courtship period characterized by increased vocalization, tail raising, urination and increased physical

[1] The Sumatran rhino diet is high in fibre, tannins and other indigestible and toxic compounds, and low in available protein. Some elements (notably sodium and phosphorus) maybe be limiting in the natural diet (Dierenfeld et. al, 2006). Iron overload is an issue of very significant concern in the health of Sumatran rhinos, especially as even natural browse diets appear to contain high levels of iron (Dierenfeld, et. al. 2006). It is possible that wild rhinos ingest the smectite clays which predominate in mud volcanoes and grey coloured clay soils found in parts of TWR, as a means to absorb toxic compounds in the diet. The possible significance of fruits in enriching or balancing the diet of wild rhinos is unknown.

contact, with both male and female using their snouts to bump the other in the head and genitals. Young Sumatran Rhino males are particularly aggressive with females, often injuring them during the courtship. The period of oestrus, when the female is receptive to the male, lasts about 24 hours and captive observations have placed its recurrence between 21–25 days. The gestation period is 15–16 months. The calf, which weighs 40–60 kg, is weaned after about 15 months and stays with the mother for the first 2–3 years of its life.

1.4 Past population trends

Rhinos were already rare in Borneo before recent times, so their optimum habitat requirements are unknown. Most likely, like other large mammals in tropical rainforests, they do best in dipterocarp-poor forests on fertile lowlands, where productivity of rhino food plants is likely to be highest. The fact that the ecologically similar Javan rhino and Malay tapir became extinct in Borneo before the expansion of the human population suggests that natural factors may have played a role in the low population density of rhinos. Pressure from hunting of rhinos for their horns (a mainstay of ancient Chinese medicine) has likely been ongoing over long periods. The Bornean rhino was widely distributed in at least some localities in eastern and central Sabah in the late nineteenth century (Payne, 1990), but the population was likely depleted below natural carrying capacity by that time. The species was already regarded as very rare and endangered in Sabah by 1961 (Burgess, 1961). Payne (1990) showed that isolated ones or twos of rhinos occurred in many parts of eastern Sabah as recently as the 1970s, but the species quickly became extinct at most sites during the 1980s. Davies and Payne (1982) noted that all Sabah rhino records compiled in 1981 showed that a natural salt source or mud volcano was present within a maximum of 14 km for all records, suggesting that the species distribution may be limited by access to certain minerals. More recently, it has been noted that all confirmed Sabah rhino records from late nineteenth century to present occur on sedimentary (most) and volcanic (some) derived soils, with none on crystalline basement and ultramafic rocks. Although overall rhino numbers have continued to decline in Sabah since 1980, the general pattern of rhino distribution (very small breeding populations in what are now Tabin Wildlife Reserve and Danum Valley Conservation Area, with a few scattered individuals elsewhere) has remained remarkably constant.

1.5 Major threats faced by rhinoceros today

1.5.1 Very low numbers

The Sumatran rhino is one of the most endangered animal species anywhere in the world. Less than 40 rhinos are believed to survive in Sabah. Even if half are females, and some are too old or too young to reproduce, perhaps only six to seven remaining rhinos have the potential to give birth. With a birth interval of three years under optimum conditions, no more than two rhinos are being born annually (Appendix 1). The Allee effect (Allee, 1931) refers to a phenomenon whereby a *positive correlation exists between of individual fitness (e.g. survival probability, fertility, reproductive rate) and population density of the species (Courchamp et al, 2008).* As numbers of individuals of a species decline to a low very level, the various factors associated with very low numbers (e.g. narrow genetic base, locally skewed sex ratio, difficulty in finding a fertile mate, reproductive pathology associated with long non-reproductive periods; see Appendix 1) conspire to drive numbers even lower, to the extent that death rate eventually exceeds birth rate, even with adequate habitat and zero poaching. In the absence of specific actions to bring Sumatran rhinos together and boost production of offspring, therefore, there is a strong possibility that the Sumatran rhino may go extinct even if protection of rhino habitats and rhinos can be maintained and improved.

1.5.2 Hunting and trapping

There is no quantitative information on the prevailing intensity of active rhino poaching, or of the risk of casual shooting of rhinos by hunters seeking other prey (Appendix 2). Snare traps set illegally in the border forests to catch wild mammals for meat pose a risk to rhinos, especially in Tabin Wildlife Reserve (Appendix 2). Indigenous Sabah hunters from the Silabukan area are active in hunting with illegal fire arms on the southern border of Tabin. Indonesian rhino poachers were active in the Danum area in the early 1990s, but it is not clear if such groups are still actively seeking rhinos in Sabah. At any time, a single rhino poaching or inadvertent trapping event may represent the tipping point that pushes the species to a trajectory of extinction in Sabah.

Hunters using a four-wheel drive vehicle (illegally) in Ulu Segama Forest Reserve. (Photo: Raymond Alfred)

1.5.3 Cause for optimism

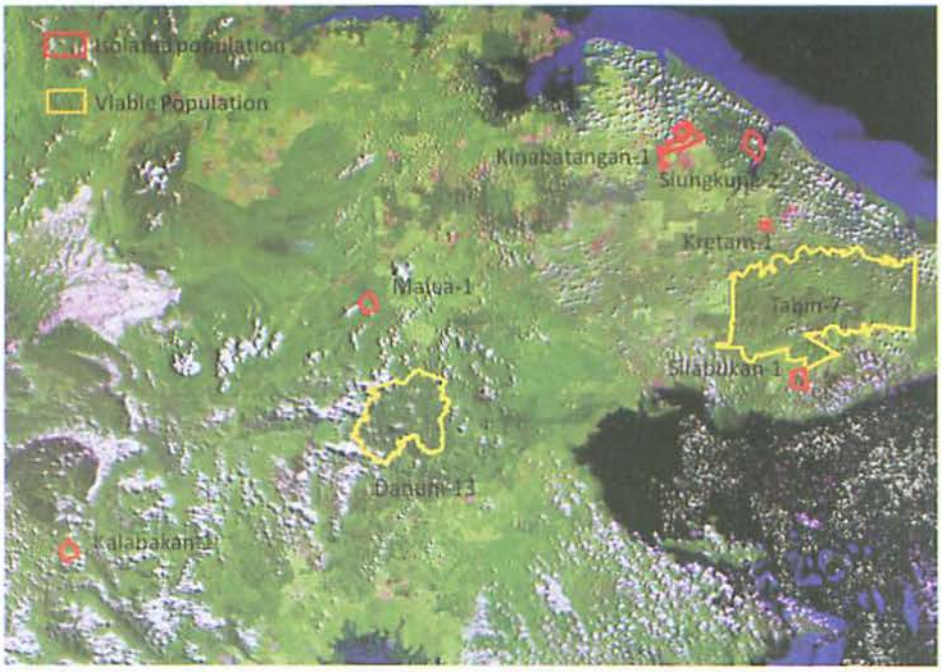
The rhino in Sabah represents one of the few examples of a tropical large mammal where forest loss is **not** a major issue threatening the species anymore. There is adequate habitat already. Conservation efforts can focus, therefore, exclusively on minimizing human-induced mortality and on bringing fertile females and males together.

Examples of fire-arms used by people living south of Tabin Wildlife Reserve. (Source: Borneo Post, 27 May 2010)

2 DISTRIBUTION IN SABAH AND REQUIRED ACTIONSON

2.1 Overview

The distribution of rhinos in Sabah may be divided into three geographical situations. There are two, very small rhino breeding populations, one in Tabin Wildlife Reserve (possibly up to 15 rhinos in 1,220 square kilometers, minimum 7+ rhinos); and another in and immediately adjacent to Danum Valley Conservation Area (13+ rhinos in 500 square kilometres). In addition, surviving in at least six scattered locations in eastern and central Sabah, there are a very few remnant rhinos, which are not viable long-term due to their very small numbers and limited remaining forest habitat (Map 1).



Location of viable population and isolated population in Sabah (Source: Alfred *et. al*, 2009)

2.2 Tabin Wildlife Reserve (TWR)

2.2.1 Site description

TWR is a category of Forest Reserve (www.forest.sabah.gov.my/caims/Tabin), under the authority of the Sabah Forestry Department. Sabah Wildlife Department has the powers to operate wildlife protection and conservation work within the Reserve. TWR consists of about 1,220 square kilometers of regenerating logged forest (this also includes the Mount Hatton Core Area of about 80 sq km of primary forest). There is a permanent government guard station of 13 staff run by Sabah Wildlife Department (http://www.sabah.gov.my/jhl) on the western border of Tabin, assisted by rhino protections units (RPUs) run by a non-governmental organization, BORA. Policy level aspects of the management of Tabin Wildlife Reserve come under a special committee chaired by Sabah Forestry Department. Sabah Forestry Department has three guard stations, on the north-east (at Sungai Lasun), south-west (at Sungai Ireton) and south-east (near Tungku) edges of Tabin, primarily to guard against illegal logging. Frequent routine air, ground and (off the north-east) boat surveillance is done around the

Camera trap picture of wild female rhino in Tabin Wildlife Reserve, April 2010 (Photo: Raymond Alfred)

entire TWR perimeter. A 1994 Tabin management plan is now out-of-date and a process is underway to develop a new plan. The Sabah government owned Tabin Wildlife Resort, a nature tourism operation, is situated near to the Sabah Wildlife Department base on the western edge of Tabin.

Surrounding most of Tabin Wildlife Reserve are large oil palm plantations. Only the north-eastern part of the Reserve is bordered by extensive natural mangrove and nipah swamp forests. Several oil palm plantation companies with large plantations adjacent to Tabin are members of the Roundtable on Sustainable Palm Oil (RSPO; www.rspo.org), including FELDA, Hap Seng Consolidated Berhad, Kuala Lumpur Kepong Berhad and PPB Oil Palms Berhad (the latter a part of the Wilmar group). However, only PPB and Hap Seng have to date contributed towards rhino and forest conservation. The PPB-owned Sabahmas Estate, adjacent to the northern part of the western TWR boundary, has a full-time law enforcement unit which keeps hunters, trappers and guns out of the estate.

2.2.2 Context and concerns

By law and policy, hunting is not allowed at all in TWR. Even though there have been no reports of rhino poaching Tabin over the past two decades, there certainly remains a strong risk of poaching here – most people in the region know that rhinos occur in Tabin, and the very long border with oil palm plantations and swamp forest is easy to breach. Groups of indigenous people and plantation workers sometimes enter the Reserve to fish and hunt for meat, to a distance of at least five kilometres from the boundary, some using dogs and spears, some using illegal fire-arms. Some members of the community at Silabukan frequently hunt illegally around and inside TWR, using illegal fire-arms, entering via plantations on motor-bikes so as to be able to be mobile off-road. Snare traps set in some parts of the border forests to catch wild mammals for meat may pose a bigger risk to rhinos in TWR than targeted poaching of the species.

SOS Rhino, subsequently established in 2004 as a not-for-profit company (SOS Rhino Borneo), which since end of 2008 has been known as Borneo Rhino Alliance (BORA), has maintained at least two rhino protection units (RPUs) at Tabin at all times. Until early 2008, the RPUs served to seek data on rhinos and to assist foreign volunteers visiting Tabin, as well as to act as a

deterrent to poachers. Since 2008, volunteers have not been invited to Tabin, and the focus of the RPUs is to act as a deterrent. Starting in 2010, public awareness and deterrence will be the major roles of the RPUs, and the RPUs will focus attention along the boundary areas of Tabin, rather than spreading effort too thinly in the central areas.

2.2.3 Main needs from 2010

Two main forms of action are needed regarding rhinos in Tabin Wildlife Reserve: (a) zero poaching and trapping of rhinos, and (b) development of Borneo Rhino Sanctuary (BRS; a managed, fenced facility similar to that already developed in Way Kambas, Sumatra, Indonesia; see chapter 5 and Appendix 3). Several rhinos will need to be brought into BRS as a means to fulfill the objective of bringing fertile females and males into a managed situation to boost chances of breeding. These two actions represent elements of a single programme based at Tabin. Clearly, security for rhinos inside the BRS needs to match that of wild rhinos. A third action is to seek and deploy one or more dedicated researchers to obtain better and more organized data on Tabin's rhinos and to analyse the data obtained.

2.3 Danum Valley Conservation Area (DVCA)

2.3.1 Site description

Danum Valley Protection Forest Reserve (also known as Danum Valley Conservation Area (DVCA; www.forest.sabah.gov.my/caims/Danum Valley); about 430 sq km) is surrounded on all sides by extensive logged forests, which afford some degree of natural protection. Hunters of high-value forest products (including rhino horn) from Indonesia have periodically entered the area on foot for many decades, however, and hunters also enter by road in the forests surrounding Danum (see for example (www.dailyexpress.com.my/news.cfm?NewsID=57161)). DVCA is managed under an established, legally-mandated management committee (www.searrp.org/contacts_management_committee.cfm).

Tam in a mud wallow. Photo: John Payne

A permanent base that has indirectly helped to dissuade poaching since 1985 is the Danum Valley Field Centre (www.searrp.org/danum.cfm). A ten year sustainable forest management plan has been prepared by Sabah Forestry Department for the 2,400 sq km of logged forest surrounding DVCA, and implementation (mainly forest restoration) is underway (www.forest.sabah.gov.my/download/2006/22f%20USM%20&%20Ulu%20Kalumpang.pdf).

Anti-poaching patrols are done around the Danum Valley area by teams with members from Sabah Wildlife Department, Sabah Forestry Department, Sabah Foundation, WWF-Malaysia and the Royal Malaysian Police. A WWF-Malaysia team conducts periodic patrols and monitoring work (including camera traps) within Danum Valley Conservation Area.

Camera trap picture of wild female rhino in Danum Valley, Febuary 2010 (Photo: Raymond Alfred)

2.3.2 Context and concerns

Groups of men from Indonesia (and possibly mainland Asia) sometimes enter the area, ostensibly seeking *gaharu* (agarwood) trees, but presumably also seeking rhinos. During a major survey for rhinos in DVCA in August 1992, footprints of rhinos and men, discarded cigarette packets, freshly abandoned camps, an injured barking deer, and a stockpile of rice, clothes and other items found on a remote hill top, showed that a group of Indonesians was pursuing rhinos in the Beatrice river catchment. Even though there have been no reports of rhino poaching in and around DVCA over the past two decades, knowledge of the existence of rhinos here is public domain knowledge, and there certainly remains a strong risk of poaching.

WWF-Malaysia has maintained a rhino and wildlife patrol team in and around DVCA since 2007. Starting in 2008, camera traps have been placed, and at least 10 photos of rhinos obtained.

2.3.3 Main needs from 2010

Two main forms of action are needed regarding rhinos in and around DVCA: (a) zero poaching and trapping of rhinos, and (b) continued monitoring of rhinos via camera trapping and footprints.

2.4 Other sites

2.4.1 Site descriptions

(a) Lower Kinabatangan Segama Wetlands (LKSW)

LKSW consists of coastal swamp forests of the lower Kinabatangan, Segama and Kretam rivers up to Tambisan island on the north side of the Dent Peninsula, incorporating mangrove, nipa swamps, nibong forests,

Camera trap picture of wild female rhino in LKSW, February 2007 (Photo: Raymond Alfred)

transitional and freshwater swamp forests. Most (78,803 ha) of this 100,000 ha region was designated as a Ramsar site in 2008 (www.sabah.gov.my /sabc/downloads/LOWER_KINABATANGAN_SEGAMA_WETLANDS%28SabahRamsar_Site%29.pdf). This represents Sabah's first and Malaysia's largest RAMSAR site, and includes Kulamba Wildlife Reserve, Kretam Virgin Jungle Reserve, Lot 1 of Kinabatangan Wildlife Sanctuary, Balat Dami Wildlife Reserve, Bukit Lawa-lawa and Siungkung island.

(b) Other locations

Other locations with reports of the presence of rhinos in recent years include : Kalabakan Commercial Forest Reserve, near the border with Kalimantan (rhino poached here in 2001); Malua Commercial Forest Reserve, some 20 km to the north of the main logging road between Silam and Kuamut (2007; reported by Kinabatangan Orang-utan Conservation Project) and apparently isolated from the Danum Valley rhino population; middle Kuamut River (2009; report to BORA from people of Dagat and Kuamut); and to the south-west of Maliau Basin (2009; report to BORA from Datuk Clement Jaikul).

The male rhino Tam just before his capture in a plantation, August 2008

2.4.2 Context and concerns

All rhinos living outside Tabin and Danum Valley consist of solitary individuals, or a very small number of individuals which are likely closely related. Thus, the prospects are very remote that any rhinos living outside Tabin and Danum Valley can contribute to the species survival. The best course of action is to attempt to bring as many of these isolated rhinos into BRS.

A very few rhinos (numbers unknown) live in LKSW, in fragmented coastal swamp forests, swimming between islands in the mangroves. This behavior is undoubtedly not because the rhinos "like" this habitat, but because they have no choice. All remaining dry land in this region is now oil palm or already protected forest. The forests in and around Kretam VJR, adjacent to LKSW, were the home of Tam the male rhino (living in an enclosure in Tabin Wildlife Reserve) until his capture and translocation in August 2008.

There certainly remains a strong risk of poaching in LKSW – most people in the region know that rhinos occur, and the entire area is potentially open to anyone, on foot or from boats. It is only the inhospitable nature of the swamp forests, and the fact that the very few rhinos here move from place to place in an unpredictable manner (presumably making water channel crossings on dark nights), that has allowed any rhinos here to escape poaching or trapping.

WWF-Malaysia has maintained a rhino patrol team in parts of LKSW since 2007. Starting in 2009, camera traps were placed in areas where rhinos had been detected, but to date no photos of rhinos have been obtained. No information exists on rhinos at sites where the species has been reported, other than LKSW.

2.4.3 Main needs from 2010

Three main forms of action are needed regarding rhinos in sites other than Tabin and Danum Valley: (a) zero poaching and trapping of rhinos, (b) continued monitoring of rhinos in LKSW via maintaining a network of informants in the adjacent oil palm plantations and villages, camera trapping and footprints, and (c) investigation of reports of rhinos at all sites, an making informed decisions on whether to attempt to rescue the rhinos for translocation to BRS.

3 PRIORITY NON-SITE SPECIFIC AND MULTI-SITE ACTIONS

Action 1: Institutional and regional support for zero poaching and trapping of rhinos

Implementation of measures to ensure zero poaching and trapping of rhinos, anywhere in Sabah, remains the key non-site specific and multi-site priority action. Site-specific actions (see Action 7) to minimize poaching and trapping risks need to be backed by the following Statewide and policy-level actions:

(a) awareness and support of all relevant law enforcement agencies in protecting rhinos,

Who	Main: SWD. Support: BORA, BCT, RMPD, SFD, YS. External: TRAFFIC
How	(1) Liaison between the agencies, (2) identification and use of informers, (3) Police action in areas with high risk for rhino poaching (e.g. persons with illegal fire-arms in Lahad Datu region)
When	Continuous

[2] e.g. see http://ngm.nationalgeographic.com/print/2010/01/asian-wildlife/christy-text for concerns over major traders turning attention to Sabah, now that most of the forests of of mainland South-east Asia and Sumatra have been "cleaned out" of large mammals

(b) networking amongst individuals in the key governmental and non-governmental agencies to be aware of possible interest of major wildlife trade "players" in Sabah rhinos ,

Who	Main: SWD. Support: BORA, BCT, ID, RMCD, RMPD, SFD, YS. External: TRAFFIC
How	(1) Individual informants to the agencies. (2) Liaison between the agencies;
When	Continuous

(c) senior plantation managers to minimise unauthorized entry to forest where rhinos exist, via their plantation, and to take punitive measures against workers setting snares inside forest.

Who	Main: plantation managers Support: BORA, BCT, RMPD, SFD, SWD.
How	(1) Liaison with senior plantation managers. (2) Encouragement to establish and maintain security arrangements (e.g. law enforcement units) in plantations adjacent to TWR. (3) Encouragement to use security measures as an indicator of achieving standards required for production of "sustainable palm oil" under schemes such as RSPO. (4) Anti-poaching and trapping actions taken by plantation managers to be given full support by SWD, SFD and RMPD
When	Continuous

Action 2: Rhino registry and management decision tree

A registry will be opened, maintained and updated as necessary for every rhino in Sabah for which specific information is available. The concept is similar to : (a) the Sumatran Rhino International Stud Book (compiled by J Christman, Disney's Animal Kingdom, 2008) maintained for the rhinos caught in Peninsular Malaysia, Sabah and Sumatra during the 1980s-90s, most of which have died; and (b) assessments made by the Sumatran Rhino Captive Management and Propagation Board, starting 2005, for all Sumatran rhinos in captive conditions globally, and maintained by International Rhino Foundation (IRF) and CREW, Cincinnati Zoo. The new Sabah registry differs and extends the concept by : (a) including specific wild rhinos for which information is available, and (b) providing information for which criteria (e.g. sex, approximate age, intensity of threat by poachers, accessibility) may be applied and upon which management decisions (e.g. continue monitoring, attempt recue, abandonment) may be made for both wild and captive individuals.

Who	Main: SWD. Support : BORA. External: CREW, IRF, SRS
How	Maintain and update information for every rhino in Sabah for which specific information is available Apply criteria to derive management decisions for each rhino
When	Continuous

Action 3: Identification of locations of reproductively isolated rhinos, and of female and male rhinos

This action may be regarded as specific support for Action 2. Rhino numbers can be expected to increase only if all possible measures are taken to ensure that fertile females and males meet and breed. In particular, young females must be given the opportunity to breed at the earliest possible age after maturity.

Some rhinos may exist within extensive forest areas, but be isolated from other rhinos of the opposite sex. This is because individual rhinos, after leaving their mother's home range, are likely to develop and maintain specific home ranges of a few thousands of hectares or less, which might or might not overlap with the range of another rhino of the opposite sex. It cannot be assumed, therefore, that all rhinos in extensive forests will contribute to the species survival if left in situ. For example, the rhino known as Puntung was monitored from 2007 onwards, inside Tabin Wildlife Reserve, but no evidence was obtained of any other rhino entering her approximately 1,500 hectare home range. Rhinos in Malua Forest Reserve may be reproductively isolated from rhinos in DVCA. Some rhinos in the east side of DVCA may be reproductively isolated from those in the south-west of DVCA.

Site-specific actions need to be backed by the following Statewide actions :

(a) Attempt to identify the sex of rhinos wherever they occur, focusing on identification of young individuals, and whether their home range overlaps with that of other rhinos, in order to decide if capture and translocation to BRS is advisable.

Who	Main: BORA, SWD. Support: BCT, informants
How	Reports from local people, workers, hunters etc, seeking and monitoring of footprints and other rhino signs, camera traps
When	Continuous

(b) A programme to collect samples of rhino faeces and analyse the rhino DNA

Who	Main: BORA, SWD. (laboratory work to be decided) Support: BCT, informants, researchers
How	All relevant persons to collect faecal samples; laboratory analysis; trained tracker dogs may help to improve chances of obtaining rhino faeces
When	At all times

Action 4: Build capacity of staff involved in rhino conservation

Who	Main: BORA, CREW, IZW, SRS, SWD, UMS
How	Field, sanctuary, laboratory etc as needed
When	Continuously, as needed

Action 5: Develop sustainable funding for rhino conservation in Sabah

Existing support by private sector grants, foundations and NGOs, as well as governmental funding, cannot be relied upon indefinitely to sustain the actions outlined in this Action Plan.

Who	Main : BORA, SWD
How	Explore opportunities (seek possible philanthropists, foundations, corporations, conservation NGOs etc.); develop and implement a marketing plan (depends on success with possible donors, and if rhino conservation can be linked to income generation)
When	2010 onwards

4 PRIORITY IN SITU SITE SPECIFIC ACTIONS

Action 6: Monitoring and protection of wild rhinos

Location	Activity	Who	When
TWR	Monitoring and protection patrol; liaison with plantation managers and others contacted locally; destruction of all snares found	BORA, SWD	Monthly
	Legal hunting to be permitted only for pigs and deer inside plantation boundaries; restrictions on purchase of shotgun cartridges; confiscation of illegal fire-arms; prosecution of persons illegally entering TWR	RMPD, SFD, SWD	At all times
	Prepare monitoring and protection evaluation reports	BORA, SWD	Six-monthly
DVCA	Monitoring and protection patrol; liaison with plantation managers and others contacted locally; destruction of all snares found	SWD BCT	Monthly
	Legal hunting to be permitted only for pigs and deer inside plantation boundaries; restrictions on purchase of shotgun cartridges; confiscation of illegal fire-arms; prosecution of persons illegally entering DVCA	RMPD, SFD, SWD, YS	At all times
	Prepare monitoring and protection evaluation reports	SWD BCT	Six-monthly
LKSW	Monitoring and protection patrol; liaison with plantation managers and others contacted locally; destruction of all snares found	SWD BCT	Monthly
	Legal hunting to be permitted only for pigs and deer inside plantation boundaries; restrictions on purchase of shotgun cartridges; confiscation of illegal fire-arms; prosecution of persons illegally entering Forest Reserves	RMPD, SFD, SWD	At all times
	Prepare monitoring and protection evaluation reports	SWD BCT	Six-monthly

Action 7: Surveys and reports on rhinos in other locations

Location	Activity	Who	When
South-west of Maliau Basin	Conduct survey to seek rhino	BORA	2012
	Make report with follow-up recommendations	BORA	2012
North part of Malua Forest Reserve	Conduct survey to seek rhino	BORA, SFD, SWD	2012
	Make report with follow-up recommendations	BORA, SFD, SWD	2012
Middle Kuamut River	Conduct survey to seek rhino	BORA, YS	2012
	Make report with follow-up recommendations	BORA, YS	2012
Other sites	Obtain reports from any sources; conduct surveys and make reports for follow-up	BORA, SWD,	2010 onwards

5 PRIORITY EX SITU ACTIONS

Action 8: Develop and manage BRS

Borneo Rhino Sanctuary (BRS) consists of managed, fenced facilities similar to those at SRS at Way Kambas in Lampung, Sumatra (See Appendix 3). The purpose is to bring together rhinos in a single managed facility in order to increase prospects for breeding of rhino. Rhinos will be maintained, monitored and cared for in individual paddocks (about 2 ha each) under natural forest cover inside TWR. Fencing is necessary to ensure that rhinos brought to Tabin do not wander away in an effort to return to their place of capture. Full time dedicated care is needed, to prevent poaching and to monitor and manage the rhinos brought into BRS from elsewhere.

Activity	How	Who	When
Maintain and improve interim facilities for captive rhinos at TWR	As needed, with financing from Yayasan Sime Darby, BORA, Government of Sabah and Malaysia, and other sources	BORA, SWD	2010 - 2012 (after which basic BRS long-term facilities should be operational)
Maintain and improve staff quarters, utilities and facilities	As needed, with financing from Yayasan Sime Darby, BORA, Government of Sabah and Malaysia, and other sources	BORA, SWD	2010 onwards, as needed
Provide continuous veterinary care for rhinos in captive conditions in TWR and conduct reproductive status assessments	Health care provided and supervised by senior veterinarian; reproductive assessments for all "new" rhinos and periodically for all rhinos	BORA, SWD, IZW, CREW	2010 onwards, continuous

Activity	How	Who	When
Develop road access to BRS site, long-term BRS infrastructure and associated facilities	According to agreed plans, with financing via Sabah Development Corridor and 10th Malaysia Plan	SWD, BORA	2010 onwards, with completion in 2012
Maintain BRS and its rhinos	According to agreed arrangements whereby BORA will provide staffing and management in support of SWD	BORA, SWD	2010 onwards, continuous
Increase rhino population in BRS (see Action 9)	Rescue rhinos from isolated and other non-viable situations, and bring to BRS; conduct all possible activities to promote successful breeding	BORA, SWD, with IZW, SRS and CREW assistance where necessary	2010 onwards
Monitor and improve operation of BRS	Constant monitoring and annual evaluation, with changes instituted as necessary	BORA, SWD	Continuous monitoring, annual evaluation reports, with improvements as needed

Action 9: Rescue and translocate rhinos to BRS

A key and necessary action following from Actions 2, 3, 7 and 8 is to "rescue" and translocate to BRS those rhinos which are deemed to be reproductively isolated and/or unable to contribute to the species survival and/or needed to contribute to the purpose of BRS. Selection of rhinos to be brought to BRS will depend to a large extent on objective criteria applied to Actions 2, 3 and 7, but action will also need to be taken on any unplanned opportunities that may arise (e.g. if a rhino leaves forest and enters a plantation).

Female rhino Gelogob in night stall, undergoing routine health care
Photo: John Payne

Activity	How	Who	When
Identify rhinos that are candidates for rescue and translocation to BRS	Identification based on information from Actions 2, 3 and 7. Opportunistic cases (e.g. rhinos located unexpectedly at forest edge or in plantations)	BORA, SWD	2010 onwards
Capture and translocate selected rhinos to BRS	For cases based on information from Actions 2, 3 and 7: by pitfall or surface traps For opportunistic cases: by any appropriate methods	BORA, SWD	2010 onwards

Action 10: Ensure best use is made of all rhinos

All rhinos which are rescued and/or are already in captive conditions in Sabah, and which are or appear to be non-reproductive, should be utilized as far as possible to contribute to the species survival.

Who	SWD, BORA, IZW
How	(1) The old female rhino Gelogob (a remnant of the 1980s-90s captive breeding programme) to be treated to promote ovulation. Eggs to be cryo-preserved for possible in vitro fertilization. (2) Any other infertile rhinos rescued and brought to BRS to be treated, if possible, to contribute towards the species survival. (3) For rhinos which are unable to provide gametes for reproduction, consideration will be given to using the rhino(s) for nature tourism, where part of the proceeds from tourism revenues will go towards rhino conservation work.
When	2010 onwards

Action 11: Ensure BRS contributes to global efforts to save the Sumatran rhino

Who	SWD, BORA, IZW, CREW, SRS
How	Obtain and cryopreserve sperm from Tam, freeze; discuss with institutions with female Sumatran rhino, in Indonesia and USA; make available sperm from Tam to impregnate female Sumatran rhinos in captive facilities outside Sabah
When	2010 onwards

LIST OF ABBREVIATIONS

BECA	Bornean Elephant Conservation Alliance
BES	Bornean Elephant Sanctuary
BORA	Borneo Rhino Alliance
CI	Confidence Interval
CSR	Central Sabah Range
DID	Department of Irrigation and Drainage
EAP	Elephant Action Plan
EIA	Environmental Impact Assessment
EPD	Environment Protection Department
FMP	Forest Management Plan
FMU	Forest Management Unit
FR	Forest Reserve
HEC	Human Elephant Conflict
LKWS	Lower Kinabatangan Wildlife Sanctuary
MER	Managed Elephant Range
PDP	Plantation Development Programme
PHVA	Population Habitat Viability Analysis
REDD	Reducing Emissions from Deforestation and Forest Degradation
SAP	State Action Plan
SECU	Sabah Elephant Conservation Unit
SFD	Sabah Forestry Department
SWD	Sabah Wildlife Department
TWR	Tabin Wildlife Reserve
UNESCO	United Nations Educational, Scientific and Cultural Organisation
VHF	Very High Frequency
WCE	Wildlife Conservation Enactment

REFERENCES

Alfred, R & Sanggul. R. 2009 Distribution of Rhinoceros in Sabah Based on Recce Survey. Technical Report, WWF-Malaysia.

Allee, W C 1931 Animal Aggregations. A study in General Sociology. University of Chicago Press, Chicago.

Amato, G., D. Wharton, Z.Z. Zainuddin and J.R. Powell. 1995. Assessment of conservation units for the Sumatran rhinoceros. Zoo Biology 14: 395-402.

Burgess, P F 1961. Wildlife Conservation in North Borneo. Malay Nat. J. 21st Anniversary Edition. Pp.143-151.

Courchamp, F, Berek, L & Gascoigne, J 2008 Allee effects in ecology and conservation. Oxford University Press, UK.

Cranbrook, E. of 2009. Late quaternary turnover of mammals in Borneo: the zooarchaeological record. Biodiversity and Conservation 1572-9710 (Online), Springer Netherlands.

Davies, A G & Payne, J 1982 A Faunal Survey of Sabah. WWF-Malaysia, Kuala Lumpur.

Dierenfeld, E S, Kilbourn, A, Karesh, W, Bosi, E, Andau, M & Alsisto, S 2006 Intake, utilization and composition of browses consumed by the Sumatran rhinoceros (Dicerorhinus sumatrensis harissoni) in captivity in Sabah, Malaysia. Zoo Biology 25:417-431

Groves, C P 1965 Description of a new subspecies of rhinoceros, from Borneo. Saugetierkundliche Mitteilungen 13 (3): 128–131.

Hermes, R., T. B. Hildebrandt, C. Walzer, F. Göritz, M. L. Patton, S. Silinski, M. J. Anderson, C. E. Reid, G. Wibbelt, K. Tomasova and F. Schwarzenberger. 2006. The effect of long non-reproductive periods on the genital health in captive female white rhinoceroses (Ceratotherium simum simum and C. s. cottoni). Theriogenology 65: 1492-1515.

Johnson, C 2006 Australia's mammal extinctions: a 50,000 year history. Cambridge University Press, Cambridge.

Payne, J 1990 The distribution and status of the Asian two-homed rhinoceros *(Dicerorhinus sumatrensis harrissoni)* in Sabah Malaysia. Project 3935. World Wildlife Fund-Malaysia, Kuala Lumpur.

Schaffer, N 2001 Utero-Ovarian Pathological Complex of the Sumatran Rhinoceros (Dicrerorhinus sumatrensis). (Pages 76-77 in: Schwamnler, H, Foose, T, Fouraker, M and Olson, D, Recent Research Elephants and Rhinos. Abstracts of the International Elephant and Rhino Research Symposium, Vienna, June 7-1 1, 2001)

Skafte, H 1964 Rhino Country. London: Hale.

APPENDIX 1

FACTORS CONTRIBUTING TO THE ENDANGERED STATUS OF RHINO IN SABAH

Birth rate

The only information on inter-birth interval for the Sumatran rhino comes from Cincinnati Zoo, where three young were born at intervals of 2 years and ten months between 2001 and 2007. For wild Sumatran rhinos, actual birth interval is likely to have been less in recent decades, because of the paucity of sites with fertile females and males present.

Cranbrook (2009) points to the long inter-birth interval of these taxa, and refers to Johnson's (2006) modeling of different levels of off-take applied to large mammals, whereby a small increase in juvenile mortality can hold recruitment rates below a level needed to replace breeding adults. If Danum and Tabin are each assumed to contain 15 rhinos, and that about half are females, and that of those females some are too old or too young to reproduce, perhaps only three or four rhinos in each area will be reproductively active. With a birth interval of three years under optimum conditions, only one rhino will be born into each population annually – this would explain the apparent zero rate of population increase in these protected areas. Even this may now represent an optimistic scenario.

Reproductive tract pathology

At least half the female rhinos caught between 1984 and 1995 had reproductive tract pathology (Schaffer, 2001), a phenomenon associated with lack of breeding and carrying of fetuses to successful birth that appears to particularly afflict rhinos (Hermes *et. al*, 2006). The fact that at least some wild female Sumatran rhinos have exhibited this pathology at time of capture indicates that not all wild female rhinos are breeding, presumably due to insufficient fertile males to meet and mate.

Skewed sex ratio

A period of active capture of rhinos from sites in Sumatra in 1959, and from Sumatra, Peninsula Malaysia and Sabah where forest was being

converted to plantations between 1984 and 1995 and Sabah revealed differences in sex ratio. Of nine rhinos caught in the Siak River area, Riau, Sumatra, in 1959, only one was a male (Skafte, 1964). At that time, Riau was largely forest-covered. Of twenty rhinos caught at various locations in Sumatra between 1985 and 1992, a period of accelerating forest loss, eleven were females. Later, in September 2005, two immature female rhinos were caught (named Rosa and Ratu), each having apparently moved into inhabited semi-forest areas from Bukit Barisan Selatan and Way Kambas National Park respectively. Of twelve rhinos caught in Peninsular Malaysia between 1984 and 1994 from several separate regions, nine were females. Since female Sumatran rhinos are believed to have smaller home ranges than males, and siting of rhino traps was based on well-used rhino paths, and the sample size is small, this bias towards females is not unexpected. Yet a severe bias in sex ratio in the opposite direction was observed in Sabah where, between March 1987 and November 1995, a total of ten rhinos were captured. Of those, nine were caught within an area of about 120,000 hectares which would up to around 1980 have been contiguous forest cover. Of the nine, one was a mature female and eight were mature males. Although the sample size is small by normal standards in biology, there are unlikely to have been many, if any, rhinos not located during the conversion of 120,000 ha of forest. Thus, the remnant rhinos in this small population were almost all mature males. The tenth rhino, caught in April 1989, was a young female (named Lun Parai) that had arrived near a major road and which may have come from Tabin Wildlife Reserve, the nearest large block of forest some 25 km away in a straight line. Not much can be gleaned from these records and a similar situation will not happen again, as there is now much less forest and much fewer rhinos. It is clear, however, that a biased sex ration may occur in very small populations of Sumatran rhino. The observations from Sabah also suggest that female rhinos, potentially easier to locate than males because of their presumed use of smaller areas, had already been selectively taken by hunters before the start of government-sponsored trapping for a captive breeding programme. Also, despite the very small sample size, the three cases of young rhinos moving out of forest into areas inhabited by humans suggests that young adult rhinos may tend to move far from their natal area.

APPENDIX 2

HUNTING AND TRAPPING OF RHINOS

Targeted poaching

Targeted poaching of rhinos appears to have declined. A team of people, believed to be Indonesians, was actively following rhinos in the Beatrice river area of Danum Valley in August 1992, fortuitously during a large-scale rhino survey. The last known targeted rhino poaching was of a female rhino in the Nuntun river valley, near the Salihar timber camp in Kalabakan Forest Reserve in March 2001. Although Indonesian (and possibly mainland Asian) gaharu gatherers are still encountered by Yayasan Sabah field staff and others in Ulu Segama, Malua and Kuamut from time to time, it is not clear if they are also actively pursuing rhinos. Hunters are said to periodically seek the rhino(s) in the Kinabatangan – Segama wetlands.

Casual hunting

Hunters targeting pigs and deer, some with a licence, many without, are active in and around Ulu Segama and Tabin. There is a significant concern that such hunters may shoot at any rhino encountered. In the interests of rhino conservation, therefore, it would be safest to prohibit legal hunting in areas where rhinos exist, and to prioritise anti-poaching efforts in the same areas.

Snare traps

As examples, (a) the only successful case of people killing a rhino being brought to court in Sabah occurred in 1981, where logging camp workers caught an infant rhino in a snare trap set for pig or deer inside Tabin Wildlife Reserve; (b) there is inside Tabin Wildlife Reserve a female rhino (named *Puntung*) with her front left foot lacking all the normal three hoofs, assumed to have been caught in a snare trap but able to escape; and (c) Tam the rhino caught in August 2008 still bears the clear marks of a snare wound on his right front leg. In the past (1980s up to around 2007), there were reports of people glimpsing rhinos with a missing foot, and/or ropes around their body or feet, in and around the Tabin area.

APPENDIX 3

BORNEO RHINO SANCTUARY (BRS)

The BRS concept dates from a July 2007 workshop, held in Kota Kinabalu in July 2007, arranged by SOS Rhino Sabah and Sabah Wildlife Department, with participation by many local, national and international experts. The workshop participants agreed that (1) Sabah rhinos are heading to extinction largely because numbers of fertile individuals is low and these rhinos are not meeting and reproducing, and (2) Sabah's rhinos need to be concentrated into one designated area in order to promote breeding.

Following that, a task force was established, chaired by Sabah Wildlife Department, with members from other governmental and non-governmental agencies. The task force decided to seek a site to which scattered rhinos outside Tabin and Danum could be brought, in order to have a greater number of genetically unrelated rhinos at one managed site. Eight sites were reviewed between November 2007 – February 2008, including Tabin and Danum. Following preliminary identification of Taliwas in Ulu Segama Forest Reserve, Tabin was subsequently chosen as the best location overall for a fenced sanctuary to which scattered isolated rhinos should be brought. The main reasons for selecting Tabin included : existence of extensive and forest habitat known to be suitable for rhinos; and the option at a later stage to mix existing and introduced rhinos for breeding.

The 2007 workshop did not prescribe how rhinos should be concentrated. Some experts believed that Sabah should follow the model used at Way Kambas, Sumatra, established in 1998. In this model, rhinos are held individually in adjacent 10 hectare forest paddocks, with constant monitoring. Individual females and males are brought together when the female is receptive. However, Tabin (along with all other available potential sites) differs from Way Kambas, in being undulating and steep terrain. The arrangement of paddocks in Way Kambas depends on flat terrain. At the time the Sabah concept for a rhino sanctuary was being discussed initially, (mid 2007 – mid 2008) the rhinos in Way Kambas (three females, two males) had not reproduced. Other experts believed that a better approach

was to catch as many rhinos as possible, and release them into a single very large forest enclosure, with rhinos allowed to mate without human interference.

In November 2008, African rhino translocation expert and veterinarian Dr Jacques Flamand, visited several potential "sanctuary" sites Sabah. He suggested that the single large enclosure model should be tried, as Way Kambas had not succeeded in breeding rhinos, while large enclosure models had worked well in Africa for rhinos. In December 2008, a 4,500 hectare perimeter road for a large enclosure was identified in Tabin. Agreement was reached by Sabah Forestry Department to build such a large fenced sanctuary. Formal agreement was achieved in a Cabinet paper in May 2009.

It was intended that the 4,500 ha BRS boundary would consist of three main elements : (a) a narrow gravel perimeter road (a road is necessary to allow frequent monitoring by vehicle, and emergency fence repairs or other actions – without a new road extension, the furthest point of the Sanctuary is two days' walk from the nearest road), (b) 3 strands of electrified fence along the roadside (a method used commonly in Sabah to prevent elephants from entering oil palm plantations; the wires carry very short, harmless pulses of 5 - 9 kilovolts) and (c) an additional visual cue to show rhinos (and other wildlife) the presence of the electrified fence (painted stones or markers on the fence posts). Rhinos would be sensitized to electrified fence before being released into BRS, so they know it gives a shock. It was anticipated that falling trees, elephants and pigs would frequently push down the electrified fence, and so minimum once-daily monitoring would be needed to allow the fence to be re-erected at any breach.

However, the single large enclosure concept in Tabin has significant problems. The chosen alignment for the large single-enclosure BRS had a perimeter of about 33 kilometres, through rainforest on predominantly rugged terrain. Of that, about 11 km is already existing road, while the remainder (about 22 km) was old overgrown logging roads, that would need major rebuilding. The 22 km of new road would cross 9 rivers and about 100 small ephemeral streams and water courses. The establishment of a fenced area with perimeter road in such conditions is probably unprecedented for wildlife conservation in South-east Asia.

Subsequently, through 2009 onwards, the following issues became increasingly apparent:

- There is a growing realisation that there are extremely few fertile rhinos remaining that, for logistical and other reasons, can be caught and moved to the fenced sanctuary in Tabin (the very large sanctuary model assumed that several fertile rhinos could be located and captured within a few years)

- The bulk of evidence from Indonesia and Malaysia is that a high percentage of adult Sumatran rhinos (female and male) are infertile; close management is needed to treat and manage the infertility; putting rhinos in a single large enclosure without close human monitoring may mean releasing rhinos that cannot breed.

- In February 2010, it was confirmed that a young female rhino in Way Kambas is pregnant; previously, there were concerns by some experts that stress due to human presence and monitoring was the reason for no successful breeding between 1998-2009; now it is clear that the Way Kambas model can work; the problem previously was that the old male was infertile and the young male too young to breed.

Although much effort was put into pursuing the 4,500 hectare sanctuary proposal, it was subsequently considered that the Way Kambas model should be used in Tabin, however, because - in view of the above three reasons - this model is expected to have a greater chance of success. Specifically, it is recommended for Tabin that there will be five paddocks of about 2 hectares each (for individual rhinos, with close monitoring and treatment as necessary); in phase 2, a larger enclosure (about 250 hectares) can be added if deemed necessary, for mixing of fertile rhinos under natural conditions. In early 2010, a specific site was identified for the BRS infrastructure. The site is based on (1) availability of about 20 hectares of nearly flat land under forest cover that will allow construction of small individual paddocks, and (2) proximity (about 4 km) to existing Tabin headquarters.

APPENDIX 4 - Some institutions relevant to Sabah rhino conservation

Institution	Description	Role
Borneo Rhino Alliance (BORA) www.borneorhinoalliance.org	NGO devoted to saving the rhino from extinction in Sabah	Delegated to develop and operate some rhino conservation mechanisms, including BRS
Cincinnati Zoo www.cincinnatizoo.org/earth/crew	The only zoo globally to have successfully bred Sumatran rhinos (three individuals)	Information derived from captive breeding, and a possible situation to attempt artificial insemination for Sumatran rhinos
Institute for Tropical Biology and Conservation (ITBC), Universiti Malaysia Sabah UMS)	Sabah's main academic institution relevant to rhino conservation	Provides support for rhino conservation via BORA
International Rhino Foundation www.rhinos-irf.org	An international, USA based NGO devoted to supporting rhino conservation	Provides technical expertise and funding for rhino conservation work (for Sumatran rhinos in Indonesia)
IUCN SSC Asian Rhino Specialist Group	One of many formalized specialist groups under the purview of IUCN	Provides Sabah with an international expert body for discussion and sharing of information and conservation plans on Asian rhinos
LEAP (Land Empowerment Animals People) www.leapspiral.org	An NGO concerned with environment and rural communities in Sabah	Supports BORA

Institution	Description	Role
Lebnitz Institute for Zoo and Wildlife Research (IZW) www.izw-berlin.de	An institution for applied research into wildlife issues, notably reproduction in large mammals	Provides technical expertise and transfer of knowledge for rhino reproduction
Ministry of Tourism, Culture & Environment http://kepkas.sabah.gov.my/home	State Ministry for environment and tourism; Sabah Wildlife Department comes under this Ministry	Provides support at State government level for rhino conservation
Royal Malaysian Police Force	National Police Department, with stations and posts at Lahad Datu, Tungku, Silabukan, Maruap, Tundun Buangin, Sukau, Kota Kinabatangan and other places near to rhino habitats	Provides support and security for rhino related law enforcement
Sabah Development Corridor	Mechanism for channeling financial support from the national government to Sabah for a wide array of development programmes	The official programme document, page 189, section 7.4.9 Rhino Rescue Program, states : "guaranteeing the sub-species protection is no longer sufficient to ensure its survival. .. Lack of breeding and inbreeding .. now present the most immediate threat. .. it will be necessary to establish a closely-managed population in a designated area..".
Sabah Forestry Department www.forest.sabah.gov.my	State forestry authority	Management authority for almost all rhino habitat in Sabah

Institution	Description	Role
Sabah State Cabinet	Highest decision-making body for specific issues relating to Sabah's wildlife and natural resources	Approved establishment of BRS in Tabin Wildlife Reserve (May 2009)
Sabah Wildlife Department www.sabah.gov.my/jhl	State wildlife authority	Responsible for rhinoceros conservation in Sabah
Sumatran Rhino Global Management and Propagation Board (GMPB)	An ad hoc grouping, founded in 2005, to develop and manage a Global Sumatran Rhino Propagation Program, involving all the countries and institutions maintaining Sumatran Rhino in managed breeding centers, and the major sponsors of the centers and programs	Provides Sabah with an international expert body for discussion and sharing of information and conservation plans, specific to Sumatran rhinos
WWF-Malaysia http://www.wwf.org.my/about_wwf/what_we_do/species_main/rhino/index.cfm	WWF-Malaysia, under the Borneo Species Programme, implements the WWF's species and habitat conservation strategy. The programme is supported by WWF's network, including corporate sectors.	Works closely with SWD and BORA to provide manpower and financial support for rhino conservation in Sabah
Yayasan Sime Darby www.yayasansimedarby.com	The Foundation of the world's major palm oil producer	Provides financial support for development of BRS
Zoo Leipzig	A major Eurpoean zoo with an interest in endangered tropical wildlife	Provides financial and other support via IZW

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