

## **BREEDING PROGRAM FOR SUMATRAN RHINOCEROS (*Dicerorhinus Sumatrensis*) CONSERVATION: PAST, PRESENT, AND FUTURE**

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### **INTRODUCTION**

The Sumatran rhinoceros or Two-horned hairy rhinos (*Dicerorhinus sumatrensis*) is now the most endangered and the most threatened rhino among the five surviving rhino species in the world. Estimates indicate that the numbers of wild Sumatran rhino was reducing very rapidly over the last 2 decades and now there remain less than 100 individuals in the whole world. Numbers are now so low that we may see the rhino finally vanish in the coming decade, if we do not act fast and massively now. In the 200 years since the Sumatran rhinoceros was first scientifically described (Fisher 1814), the range of the species has contracted from a broad region in Southeast Asia to three areas on the island of Sumatra and one in Kalimantan, Indonesia.

#### **Characteristics of Sumatran Rhino:**

- Males are primarily solitary except for mating pairs activity and mothers with baby under 2 years old
- Life span is short, just 35-40 years, long gestation length of approximately 15-16 months, and age at sexual maturity estimated at 6-7 years for females and 10 years for males
- Home range: Males up to 5,000 ha with often overlapping with female home range and females more small, just about 1,000 -1,500 ha.
- Daily movements between feeding sites and wallows site are probably only a few kilometers per day. Longer treks are made when males and females go to saltlicks (5-10 km) and by males exploring their large ranges.
- Water is never very far away in the habitats occupied by the Sumatran rhino.

### **THE SUMATRAN RHINO STORY**

#### **Sumatran Rhino in Captivity:**

1985-1992 Sumatran rhino capture program. PHKA working together with HPLF (Howletts and Port Lympne Foundation) from England and SRT (Sumatran Rhino Trust) from America were captured 40 rhinos from areas being converted to plantations in Riau and Bengkulu province (18 rhinos), for the captive breeding program. In same period in Malaysia were success captured 22 rhino from Peninsular and Sabah. So the Sumatran rhino were distributed to few places such as Indonesia, England, US and Malaysia. Unfortunately 13 Sumatran rhino was died until 1993 because of various causes, in particular because of problems with food and digestion, poor husbandry and health care, and fatal fighting because of limited space and no reproduction did occur. So, we can say captive breeding program was failed, even though the first rhino expert too confident about captive breeding success.

- Howlett and Port Lympne England Zoo- failed
- US (Bronx zoo, San Diego Zoo, LA zoo and Cincinnati zoo – Breeding 2001, 2004, 2007) – overall failed
- Sungai Dusun and Zoo Malaysia - failed
- Sepilok and Borneo Rhino Alliance Tabin Sabah Malaysia - failed
- Safari park Indonesia - failed
- Ragunan and Surabaya Zoo Indonesia - failed
- Sumatran Rhino Sanctuary Indonesia (breeding 2012) – still survive and running to date.
- On 2016 just Bina, one Sumatran rhino survive in the captivity with 39 Sumatran rhinos was died.

### **SUMATRA RHINO EXTINCT IN MALAYSIA**

Malaysian population 52-75 on 1980, including 20 to 25 individuals in the Endau-Rompin area in Johor and 15 to 30 in Sabah. Population continuing to decreased and separated in few small populations. The tragic death of all six rhinos at Sungai Dusun Rhino Conservation Centre in Selangor

between April and November 2003 put a finish to the captive breeding effort. Sumatran rhino extinct in Peninsular (Taman Negara, Endau Rompin National Park and Royal Belum State Park) on 2007 and close to extinct Sabah, just 3 sumatran rhino (*Dicerorhinus sumatrensis harrissoni*) left in the rhino Sanctuary, they are Tam (2008), Puntung (2011) and Iman (2014) - Tabin Wildlife Reserve. 200 cameras running in Danum Valley on 2012, there is just one rhino lost and captured on 2014. The Sumatran rhino is now considered to be extinct in Malaysia (Hance, 2015), and the current conservation strategy there is to propagate the remaining rhinos in a captive breeding program (Payne, 2012). The Borneo Rhino Alliance (BORA) directs this program, and currently it seems there is no chance to re-introduce any rhinos back into the wild (Ahmad *et al.*, 2013). Main conservation program is patrol, protection and intensive monitoring.

The Sumatran Rhino Population Problem in Indonesia right now is same with Malaysian condition 20 years ago:

- Sumatran rhino population distributed in small population <15/habitat
- Male and female rhino is very difficult to meet because small and distributed.
- High Inbreeding potential
- Just few rhino calves was born

The captive propagation plan largely failed through a fatal combination of diverse factors including dealing with a solitary species which is inherently difficult to breed, inadequate knowledge of rhino breeding biology and dietary requirements, cautious decision-making, poor hygiene in some facilities, weak collaboration, emphasis on capture of "doomed" rhinos rather than fertile rhinos, and a willingness to keep on doing the same thing and waiting in vain for a better result. Three calves were produced by one rhino pair in Cincinnati Zoo in 2001, 2004 and 2007 and 2 calves was produced by one pair in SRS in 2012 and 2016.

#### **CURRENT POPULATION - ESTIMATES OF SUMATRAN RHINOS LEFT IN THE WILD**

Strategy and Action Plan for the Conservation of Rhinos in Indonesia (2007-2012) in situ

Conservation: overall failed

- Expand the wild population in Gunung Leuser, Bukit Barisan Selatan and Way Kambas National Parks by at least 30%
- Secure adequate habitat for viable wild populations in Kerinci Seblat National Park (500,000 ha), Bukit Barisan Selatan National Park (100,000 ha), Gunung Leuser National Park (700,000 ha) and in Kalimantan (500,000 ha).
- Translocation of animals from the southern parts of Bukit Barisan Selatan National Park (which has a relatively dense rhino population), to its relatively empty northern sections. The movement of rhinos will occur when security is assured in the northern areas

#### **2012**

- WKNP 35 Sumatran rhinos in 2012 (Talukdar *et al.*, 2012), indicating a strong recovery after being declared extinct in the Park in 1961 but rediscovered in the 1980s (Reilly *et al.*, 1997)
- BBSNP during 2007-2008 estimated there were  $21 \pm 7.1$  rhinoceroses in the Park (Pusparini and Wibisono, 2013). Based on patrol data, the distribution of rhinoceros signs had decreased by 70% during 2007-2012 (Talukdar *et al.*, 2012)
- Leuser Ecosystem 17 individuals were confirmed in a 250 km<sup>2</sup> area in 2012 (Leuser International Foundation, 2012)

#### **2013-2014**

Base on Sumatran rhino crisis summit (2013) and rhino range state meeting (2014), the Sumatran rhinos were protected in the three main Sumatran rhino regions in Sumatera and From the 14 sites that recorded the presence of wild Sumatran rhinos in 1995, only five still have incontrovertible evidence of the species in 2012 and they are now restricted to the island of Sumatra, Indonesia (Bukit Barisan Selatan, Gunung Leuser and Way Kambas National Parks) and Malaysian Borneo (Danum Valley Conservation Area and possibly Tabin Wildlife Reserve). The 1984-2016 strategy of trying to protect them in the wild has not resulted in increasing their numbers in each sites.

The 2016 best population of Sumatran rhino numbers is less than 100, down from an estimated 413 - 563 in 1995 and declining is in very serious trouble. Sumatran rhino numbers have declined more than 70% over the last two decades due to poaching for its horn as well as increasing destruction of its habitat.

Now, the populations are primarily threatened by small population size, habitat encroachment, the potential for catastrophic events, and invasive plant species, as well as poaching.

#### **2015-2016**

Kalimantan 4-15, Way Kambas 31-36, Leuser 26-36, BBS 16-35.

Summary of Sumatra rhino PVA meeting in Bogor 2015:

- Four location distribution Sumatran rhino in Way Kambas, BBS, Leuser, Kutai Barat, each site needed special solution and different challenge.
- Build national level support for Sumatran rhinoceros conservation
- Conservation effort is zero poaching, increasing individual, control of species invasive.
- Action points: build Intensive Protection Zone and Intensive Management Zone in each population and manage individual as metapopulasi
  - o Establish IPZs and ensure that all Sumatran rhinoceros are protected from poaching, deforestation, encroachment and habitat degradation
  - o Manage all Sumatran rhinoceroses from Indonesia and Malaysia as one meta-population and establish Intensive Management Zones (IMZs) at each site in Indonesia
- Conduct critical research and monitoring to measure effectiveness and inform and evaluate conservation management including - Monitor diseases within the surrounding livestock population.
- Engage local communities, government authorities and the private sector in the conservation of Sumatran rhinoceros and their habitats.
- Captive must be support to wild population.

#### **Interesting fact about condition of Sumatran rhino to date:**

1. Summary of TFCA rhino expert Meeting in Jakarta August 2016 (just ~72 Sumatran rhino left in *in-situ* habitat)
2. Camera/video trap in BBSNP during 3 years project just capture 6 photos of Sumatran rhino (~2/3 different individual rhino (unpublished WWF Indonesia). Population 17- 24 Rhinos (Footprint, Occupancy & CT), Footprint 30-40 rhinos (RPU) – confuse with Tapir footprint? Nobody know what the real number of sumatran rhino in the field.
3. Camera/video traps in WKNP and RPU activities ~ 25 rhinos (TERMA). Footprint 31-36 rhinos (RPU)
4. Leuser ~ 12 rhino from (2-15) 6 different area (KEL)
5. Sumatran Rhino Population in the area which have intensive protection and monitoring (RPU 1995-now) continuing to decreased or stagnant (TNBBS and TNWK) - no overall indication of recovery of the wild populations
6. Rhino zero poaching (TNBBS and TNWK) - no recorded poaching events – real or nor? Protection and habitat restoration are no longer sufficient to ensure the Sumatran rhino's survival.
7. Camera trap and Fecal DNA – low result
8. No info about rhino death in BBS 2001, TNWK (1 or 2) on 2006
9. Just 3-10 Sumatran (Kalimantan) rhino survival, capture and translocation protocol to rescue the sumatran wild rhinos (Najaq) from remote hill forests in Kutai Barat. The capture of isolated Sumatran rhinos is indeed inherently risky, but leaving isolated animals in a place where they cannot find a breed and snare on the leg has far greater risks. Although Najaq's death is tragic, we have learning much from this experiences to continue its rescue efforts

#### **Problem has been occurring such as:**

- The rhino population densities in 1990s were probably already too low for them to recover without intensive management intervention.
- With the deaths of the many captive sumatran rhinos, the breeding project became unpopular and the focusing on saving rhinos in the wild rather than bringing them into sanctuary.

- No evaluation and comprehensive scientific assessment from Sumatran rhino monitoring and protection project by expert.
- No info about reproductive status individual of rhino in Leuser, BBS and WK.
- No info about Genetic Plasticity and Heterositas Genetic status of population in Leuser, BBS and WK. The small size of Sumatran rhino populations make them vulnerable to inbreeding.
- Sumatran rhino population drastic decline about 90% during period 1984-2015. Distribution habitat of Sumatran rhino in 5 sites (1984) and now just in 3 sites left (Leuser, BBSNP and WKNP). The wild populations in Sumatera mostly have stagnated, declined or gone extinct.
- Very small individual into population just 2-10 rhino, separated without access for transferred new blood (genetic exchange) between sub population
- The essence of the problem now is only one breeding female's success in captive (Ratu). A conservation program now needs to put in place measures that significantly boost rhino birth rate in captive conditions.
- Strategy and Action Plan for the Conservation of Rhinos in Indonesia 2007-2017 was failed – need Emergency Plan

Even though the Sumatran rhino decreased in Indonesia but if we compare with other country in the south East Asia, Indonesia still is the best to save Sumatran rhino.

## **SUMATRAN RHINO CONSERVATION IN WKNP - CENTER OF EXCELLENT**

### **Rhino Protection Unit**

Protection Securing the rhinoceros and their habitat through operating Rhino Protection Units (RPU) and intelligence and law enforcement unit (ILEU). the activity of the rpu are Intensive patrolling of areas to detect and destroy traps, interdict intruders and arrest suspected poachers, take actions against unauthorized utilization of natural resources in addition of rhino protection, conduct intensive and extensive surveys and monitoring of the rhino population, and Provide intelligence to assist in the apprehension of poachers.

### **Sumatran Rhino Sanctuary**

The Sumatran Rhino Sanctuary (SRS) is a unique breeding center for Sumatran Rhinoceros in the native habitat of the species. The sanctuary was built within the Way Kambas National Park in an effort to provide a natural environment to keep and propagate Sumatran rhinos. The captive conditions in the SRS are different from those in zoos, as the SRS provides 10-20 ha of secondary forest habitat for each rhino within the 100 ha complex, with minimized human interference. The SRS has separate enclosures for each rhino, because in the wild Sumatran rhinos are solitary animals that live alone most of the time. The female and male Sumatran rhinos are kept separate until a willingness to mate is shown in their behavior in correlation with their sexual cycle. The mature secondary tropical rain forest of Way Kambas National Park provides natural habitat for the Sumatran rhino.

The aim of Sumatran Rhino Sanctuary is produce many offspring as safely possible, safely mean save/secure genetic and environments.

#### **Program Management:**

- 1996 SRS starting to build
- 1997 big fire in WKNP
- 1998 establish with one manager
- 2000 SRS foundation
- 2008 Yayasan Badak Indonesia (YABI) with two manager (Animal and facility)
- 12 June 2012 Andatu was Born
- 12 May 2016 Delilah was Born
- 2014 back with one manager

**Key:** Principle of Sumatran rhino Breeding Success are combining natural breeding and technology of reproductive.

Breeding Sumatran rhinoceroses has proven challenging because the animals can become very aggressive (fighting) when they are paired and the female is not receptive to the male. We need to make sure; when female have peak of estrous cycle if we need to run breeding program. Actually, not so difficult to breeding this endangered animal, two important activities are daily behavior monitoring and Ultrasound examination (Follicle development, Ovulation, Early pregnancy, Embryo development and Pathology condition). After we know the estrous cycle and then introduce them, if good response each other pair male and female in one place. During the female cycle just 4 days female receptive to the male and just about 12 hours good time to breeding success. The other important this is the rhinos must be health with good nutrition.

### Miscarriage – Loss Pregnancy

There was no vaginal discharge, no change in her behavior, nothing that gave us a hint she had lost the embryo. She is very healthy. The embryos can be absorbed fairly quickly early on. We did track the uterine horns from cervix to both ovaries and not see any fluid in there. Ratu was lost pregnancy, that is sometimes happens and is not related to how the rhinos are being cared for or managed. Nobody is to feel responsible for the loss. It is simply the way nature works sometimes.

### Breeding Success Story

- The last record of a Sumatran rhino calf produced by a pair of captive animals dates back to 1889, in Calcutta, India [Rookmaaker, 1998].
- Captive Breeding Success in America. Ipuh and Emi successes produce three calves on 2001, 004 and 2007.
- Captive Breeding Success in Indonesia. The Sumatran rhino global propagation and management board (GMPB) consisting of representatives of rhino range states, rhino breeding facilities and donors, has been meeting since 2005. One of GMPB successful is brought Andalas into captivity in Way Kambas and breeding program has succeeded with two captive births but all of them related. The only unrelated male is held separately in Sabah. The pace is too slow to save the species. Fresh ideas and perspectives are needed to help decide what to do next.
- Rare Sumatran Rhino Birth in Way Kambas National Park Lampung, Indonesia on June 23, 2012 early Saturday morning. The birth is the first in 124 years in a breeding center in Asia and is a significant advance in Indonesia's conservation efforts for one of Earth's most threatened species. One rhino calf is very important because he has one percent of the world's sumatran rhino population.

Sumatran rhino prediction age in Indonesia and Malaysia captivity (estimation of Sumatran rhino productive age is under 30) – life span about 35-40 years old.

No	SRS	BORA	Sex	Age	Productivity
1	Bina		Female	32	1 calf, prolonged cycle
2	Ratu		Female	16	4-5 calf
3	Rosa		Female	15	4-5 calf, cyst and myoma?
4	Andalas		Male	15	
5	Harapan		Male	11	
6	Andatu		Male	4	
7	Delilah		Female	1	
8		Tam	Male	25	Low spermatozoa
9		Puntung	Female		Cyst
10		Iman	Female		Myoma

Based on table, Sumatran rhinos at the SRS looks related especially male (low genetic variation) and Sabah female is not potential to produce calve because have pathology status of reproductive tract. If do not have new blood to put into both sites, the rhino will be extinction.

In the other site, in situ Sumatran rhino conservation, high risk also occurred such as: allee effect, high in-breeding index, low heterositas genetic population, pathology case on reproductive organ, potential for recessive lethal gen or abnormal, population stagnant or decline and bring species to exstint.

If the Sumatran rhino population just fewer than 100, what can we do? What needs to be done? What the best strategy for conserving the Sumatran rhinoceros? Good question but difficult to answer or the answer should be obvious. Without specific actions to bring Sumatran rhinoceroses together to boost production it is likely that the species will go extinct even if protection of suitable habitat increases. Need extreme or revolution action for Sumatran rhino conservation now!!! If Not, Sumatran rhino will be Gone.....!!!!

Saving Sumatran rhinos in the wild? or Saving Sumatran rhino in the captivity?

## **GOOD EXPERIENCES TO SAVE ENDANGERED ANIMALS**

The inspiration and lessons learned in bringing back species on the edge such Californian condor, black footed ferret, crested Ibis, red wolf, Indian rhino and white rhino, and to stop us from making the same mistakes that were made that led to the extinction of the Yangtze river dolphin, the Javan rhino in Vietnam, and the northern white rhino.

### **Solution needed**

1. Review the situation and our existing strategies. Identify key issues on which action has to be taken.
2. Global strategy to manage the global population (both wild and captive) as a single metapopulation across national and international borders. The best example of success of a single metapopulation strategy is that of the greater one-horned rhinoceros *Rhinoceros unicornis* in Nepal and India (Talukdar, 2006; Martin et al., 2013).
3. The second agreed action is the continued deployment of Rhino Protection Units at sites with remaining breeding populations.
4. The third proposed action is the creation of intensive management zones, with increased protection and monitoring in areas where the Sumatran rhinoceros breeds naturally.
5. The fourth action of the conservation strategy is captive breeding. The development of advanced reproductive technology for captive breeding.
6. Strong governmental commitment and support to save Sumatran Rhino.

### **Action:**

1. **Review** Strategy and Action Plan for the Conservation of Rhinos in Indonesia (2007- 2012) and **change** with Emergency plan for Sumatran rhino (need a comprehensive budget).
2. **Rhino Protection Unit.** Strict anti poaching operations, protection rhino population and habitat, intensive monitoring, apply ILEU each sites is important for Sumatran rhino conservation, BUT Sumatran rhino conservation program with small population must be use scientific assessment for:
  - Make sure real viable rhino population viable. Find rhino and translocation of isolated wild rhino with population < 5 into existing semi *in-situ* captive breeding. Act now to add animals to the population.
  - Securing priority areas (Leuser, BBS and WK).
  - Reproductive status including pathological status of reproductive organ
  - Index in-breeding and genetic variation(heterocyst) into population - create a real genetic reservoir to support the wild population
  - IPZ, IMZ, Sanctuary - Advance Reproductive Technology
  - Diseases surveillance surrounding 3 different sites
  - Act now to truly manage captive Sumatran rhino population as one global population, with exchange of animals and gametes.
3. **Sumatran Rhino Sanctuary in Lampung**
  - a. Way Kambas is the most undisturbed and secure Sumatran rhino habitats in Indonesia. Way Kambas also have good access and adequate ecological factors for the development of a natural breeding center for Sumatran rhino. In addition, Way Kambas has potential to support

endangered animal conservation as part of the sustainable development of Lampung province.

- b. SRS must be developed as a breeding centre for Sumatran rhino – framework SRS – change brands image SRS not only Sanctuary but real breeding centre. Semi in-situ BREEDING CENTRE – Natural breeding combine with reproductive technology. Framework SRS – change brands image SRS not Sanctuary anymore but real breeding centre: Human resource – upgrading staff, Equipment & Laboratory.
- c. Reproductive technology: hormone modification for female, ultrasounds, EEJ (Artificial insemination has resulted in the births of five white rhinoceros calves in European zoos and three greater one-horned rhinoceros calves (Terri Roth, pers. comm.), AI, Embryo transfer, etc.
- d. SRS must be Insurance (Future security) for Sumatran rhino and need more analyses to support this program.
- e. SRS in-situ and ex-situ closely link to add SRS potency for viable. Actually *in-situ* population has decreased.
- f. Future SRS need government support.
- g. Few options to obtain male sperm quality is:
- h. Continue Natural Breeding
- i. Sperm collection with Electro Ejaculator (EEJ) from Andalas and Andatu and Tam
- j. Collaboration with Sabah (Tam's Sperm for SRS's female rhino), IVF to Bina or Rosa
- k. Government policy and Mou need to be clarified
- l. Genetic issue need to be finished – the need of a join analysis for assessment
- m. Loan New Male from wild (doom rhino): Survey and identification dome rhino in Sumatera, Government policy, Capture – translocation, Adaptation at the SRS, Breeding program, Evaluation and KSDAE Policy: release rhino to the wild or just stay at the SRS (need release program issue).

#### **4. Sumatran Rhino Sanctuary in Kutai Barat Kalimantan Timur**

- a. Find and capture all Sumatran rhino in Kalimantan and bring to sanctuary to captive breeding program
- b. Government policy and Mou need to be clarified

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