Animal Reintroduction

(Conservation Biology)

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Reintroduction

Reintroduction is the deliberate release of species into the wild, from captivity or relocated from other areas where the species survives. It usually involves species that are endangered or extinct in the wild (EW). Because reintroduction may involve returning native species to localities where they had been extirpated, some prefer the term "**re-establishment**".

Survival skills

It may be very hard to reintroduce EW species into the wild, even if their natural habitats were restored. Survival techniques, which are normally passed from parents to offspring during parenting, are lost. The genetics of the species is saved, but the natural memetics of the species is not.

Beginning in the 1980s, biologists have learned that many mammals and birds need to learn a lot to survive in the wild. Thus, reintroduction programmes have to be planned carefully, ensuring that the animals have the necessary survival skills. Biologists must also study the animals after the reintroduction to learn whether the animals are surviving and breeding, what effects the reintroduction has on the ecosystem, and how to improve the process.

Still, a vast number of animals may need to be reintroduced into the wild to be sure that enough of them learn how to survive. For instance, in reintroducing Houbara Bustards into the wild in the United Arab Emirates, more than 5,000 birds per year are used.

Ex-situ conservation

Ex-situ conservation means literally, "off-site conservation". It is the process of protecting an endangered species of plant or animal outside of its natural habitat; for example, by removing part of the population from a threatened habitat and placing it in a new location, which may be a wild area or within the care of humans. While ex-situ conservation comprises some of the oldest and best known conservation methods, it also involves newer, sometimes controversial laboratory methods.

Colony relocation

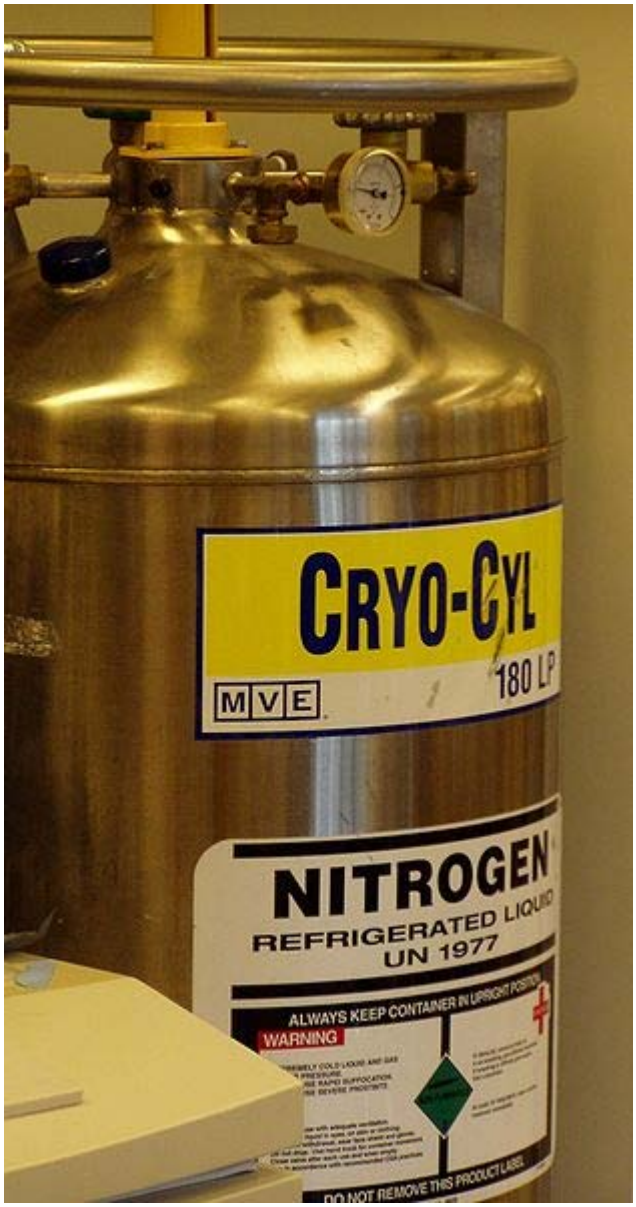
The best method of maximizing a species chance of survival (when ex-situ methods are required) is by relocating part of the population to a less threatened location. It is extremely difficult to mimic the environment of the original colony location given the large number of variables defining the original colony (microclimate, soils, symbiotic species, absence of severe predation, etc.) It is also technically challenging to uproot (in the case of plants) or trap (in the case of animals) the required organisms without undue harm.

An example of colony relocation in the wild is the case of the endangered Santa Cruz Tarweed, a new colony of which was discovered during a mid 1980s survey at the site of a proposed shopping center in as western Contra Costa County. Once the city of Pinole had decided to approve the shopping center, the city relied on a relocation plan developed by Earth Metrics scientists to remove the entire colony to a nearby location immediately east of Interstate Highway 80 within the Caltrans right-of-way

Human care methods

Zoos and botanical gardens are the most conventional methods of ex-situ conservation, all of which house whole, protected specimens for breeding and reintroduction into the wild when necessary and possible. These facilities provide not only housing and care for specimens of endangered species, but also have an educational value. They inform the public of the threatened status of endangered species and of those factors which cause the threat, with the hope of creating public interest in stopping and reversing those factors which jeopardize a species' survival in the first place. They are the most publicly visited ex-situ conservation sites, with the WZCS (World Zoo Conservation Strategy) estimating that the 1100 organized zoos in the world receive more than 600 million visitors annually.

Endangered plants may also be preserved in part through seedbanks or germplasm banks. The term seedbank sometimes refers to a cryogenic laboratory facility in which the seeds of certain species can be preserved for up to a century or more without losing their fertility. It can also be used to refer to a special type of arboretum where seeds are harvested and the crop is rotated. For plants that cannot be preserved in seedbanks, the only other option for preserving germplasm is in-vitro storage, where cuttings of plants are kept under strict conditions in glass tubes and vessels.



A tank of liquid nitrogen, used to supply a cryogenic freezer (for storing laboratory samples at a temperature of about −150 degrees Celsius).

Endangered animal species are preserved using similar techniques. The genetic information needed in the future to reproduce endangered animal species can be preserved in genebanks, which consist of cryogenic facilities used to store living sperm, eggs, or embryos. The Zoological Society of San Diego has established a "Frozen zoo" to store such samples using modern cryopreservation techniques from more than 355 species, including mammals, reptiles, and birds.

A potential technique for aiding in reproduction of endangered species is interspecific pregnancy, implanting embryos of an endangered species into the womb of a female of a related species, carrying it to term. It has been carried out for the Spanish Ibex.

Showy Indian clover, *Trifolium amoenum*, is an example of a species that was thought to be extinct, but was rediscovered in 1993 by Peter Connors in the form of a single plant at a site in western Sonoma County. Connors harvested seeds and grew specimens of this critically endangered species in a controlled environment.

The Wollemi Pine is another example of a plant that is being preserved via ex-situ conservation, as they are being grown in nurseries to be sold to the general public.

Drawbacks

Ex-situ conservation, while helpful in man's efforts to sustain and protect our environment, is rarely enough to save a species from extinction. It is to be used as a last resort, or as a supplement to in-situ conservation because it cannot recreate the habitat as a whole: the entire genetic variation of a species, its symbiotic counterparts, or those elements which, over time, might help a species adapt to its changing surroundings. Instead, ex-situ conservation removes the species from its natural ecological contexts, preserving it under semi-isolated conditions whereby natural evolution and adaptation processes are either temporarily halted or altered by introducing the specimen to an unnatural habitat. In the case of cryogenic storage methods, the preserved specimen's adaptation processes are frozen altogether. The downside to this is that, when re-released, the species may lack the genetic adaptations and mutations which would allow it to thrive in its ever-changing natural habitat.

Furthermore, ex-situ conservation techniques are often costly, with cryogenic storage being economically infeasible in most cases since species stored in this manner cannot provide a profit but instead slowly drain the financial resources of the government or organization determined to operate them. Seedbanks are ineffective for certain plant genera with recalcitrant seeds that do not remain fertile for long periods of time. Diseases and pests foreign to the species, to which the species has no natural defense, may also cripple crops of protected plants in ex-situ plantations and in animals living in ex-situ breeding grounds. These factors, combined with the specific environmental needs of many species, some of which are nearly impossible to recreate by man, make ex-situ conservation impossible for a great number of the world's endangered flora and fauna.

IUCN/SSC Re-introduction Specialist Group

The IUCN/SSC Re-introduction Specialist Group (RSG) is one of the over 100 Specialist groups of the Species Survival Commission (SSC), which is one of the six IUCN Commissions, with its headquarters in Gland, Switzerland. The RSG is one of the few disciplinary Specialist Groups (e.g. Veterinary, Conservation Breeding) as opposed to the majority which are taxon based (e.g. Crocodile, Cat, Orchid).

The role of the RSG is to promote the re-establishment of viable populations in the wild of animals and plants. The need for this role was felt due to the increased demand from

re-introduction practitioners, the global conservation community and increase in re-introduction projects worldwide.

Increasing numbers of animal and plant species are becoming rare, or even extinct in the wild. In an attempt to re-establish populations, species can – in some instances – be re-introduced into an area, either through translocation from existing wild populations, or by re-introducing captive-bred animals or artificially propagated plants.

United Kingdom

Ongoing or successful programs

- Moose to Scotland (ongoing)
- Northern Goshawk – the existing UK population is believed to be derived from a mixture of escaped falconers' birds and deliberate introductions – (successful)
- Large Blue butterfly in the West and The South West – (successful and ongoing)
- Red Kite in the Chiltern Hills, Black Isle, Northamptonshire, Dumfries and Galloway, Yorkshire, Perth and Kinross and Gateshead – (successful)
- Osprey to Rutland Water – (successful)
- White-tailed Eagle to the Hebrides – (successful)
- White-tailed Eagle to the east coast of Scotland – (ongoing)
- Glanville Fritillary butterfly to Somerset – (successful)
- Heath Fritillary butterfly to Essex – (successful)
- Silver-washed Fritillary to Essex - (ongoing, locally successful)
- Great Bustard to Salisbury Plain – (ongoing)
- Black Grouse to Derbyshire – (ongoing)
- Corncrake to Cambridgeshire – (ongoing)
- Wild Boar to several places in Britain – (accidental), (successful)
- Red Squirrel to Anglesey – (successful and ongoing)
- Common Crane to Somerset (ongoing)
- European Beaver to Scotland (ongoing)

Planned or proposed programs

- Wolf in Scotland (proposed)
- Brown Bear in Scotland (proposed)
- White-tailed Eagle to England and Wales (planned - on hold whilst suitable site is found)
- European Lynx in England and Scotland (proposed)
- European Beaver in England and Wales (if the Scottish project is successful).
- Golden Eagle in England
- Moose in Scotland
- White Stork (proposed)

Rejected proposals

- The Wild Beasts Trust
- European Beaver in Scotland (2005)

Other countries

Planned or proposed programs

- Asiatic Lion Reintroduction Project of Asiatic Lion to Kuno Wildlife Sanctuary from their only home presently in the world at Gir Forest National Park. Kuno Wildlife Sanctuary is the chosen site for re-introducing and establishing the world's second completely separate population of the wild free ranging Asiatic Lions in the state of Madhya Pradesh

Ongoing or successful programs

- Alpine Ibex in the French, Italian and Swiss Alps (successful)
- Black-footed Ferret in the Canada, USA and Mexico
- Bornean Orangutan in East Kalimantan, Indonesia
- Brush-tailed Bettong in Australia (ongoing)
- California Condor in California (USA) and Mexico (ongoing)
- Eurasian Brown Bear in the Alps (ongoing)
- European Beaver in several places in Europe (successful)
- European Otter in the Netherlands (ongoing)
- European Lynx in Switzerland (successful), and other parts of Europe (ongoing)
- European Black Vulture in the Massif Central in France
- Griffon Vulture in the Massif Central, France (successful), Central Apennines, Italy, and Northern and Southern Israel (ongoing)
- Lammergeier in the Alps (successful)
- Lesser Kestrel in Spain
- Lesser White-fronted Goose in Sweden and Germany (ongoing)
- Musk ox in Alaska (USA) (successful)
- Northern Bald Ibis in Austria and Italy (ongoing)
- Nubian Ibex in Israel (successful)
- Père David's Deer in China (ongoing)
- Peregrine Falcon in Germany, Poland, Sweden and Norway
- Persian Fallow Deer in Israel (ongoing)
- Przewalski's Horse in Mongolia (ongoing)
- Puerto Rican Parrot in Arecibo (ongoing)
- Red Kite in Ireland
- White-tailed Eagle in Ireland (ongoing)
- Golden Eagle in Ireland (ongoing)
- Wisent in Poland, Belarus (successful) and other parts of Europe (ongoing)
- Wolf in Wyoming (USA) (successful)
- Arabian Oryx in the Sultanate of Oman (successful)
- Goitered Gazelle in Protected Areas of Vashlovani in Georgia (country)(ongoing)

Chapter- 2

Arabian Oryx Reintroduction

Arabian Oryx at Chay Bar Yotvata, Israel

The Arabian Oryx (Oryx leucoryx), also called the White Oryx, was extinct in the wild as of 1972, but was reintroduced to the wild starting in 1982. Initial reintroduction was primarily from two herds: the "World Herd" originally started at the Phoenix Zoo in 1963 from only nine oryx and the Saudi Arabian herd started in 1986 from private collections and some "World Herd" stock by the Saudi National Wildlife Research Center (NWRC). As of 2009 there have been reintroductions in Oman, Saudi Arabia, Israel, the United Arab Emirates, and Jordan, but the IUCN Red List still classifies the species as Endangered, and it is included in CITES Appendix I.

Decline of a species

The Arabian Oryx was known to be in decline since the early 1900s in the Arabian Peninsula. By the 1930 there were two separate populations isolated from each other. In 1960, Lee Talbot reported that Arabian oryx appeared to be extinct in its former range along the southern edge of Ar-Rub' al-Khali. He believed that any oryx still existing would be exterminated within the next few years and recommended that a captive breeding program be started to save the species. Michael Crouch, then Assistant Adviser in the Eastern Aden Protectorate, drew attention to the fact that each spring, small groups of oryx still emerged onto the gravel plains in the northeast corner of the Protectorate, where he thought a capture attempt would be possible.

Operation Oryx

Operation Oryx was a program of the Phoenix Zoo and the Fauna and Flora Preservation Society of London (now Fauna and Flora International), with financial help from the World Wide Fund for Nature. One of the first captive breeding programs at any zoo, this program had the specific goal of saving and then reintroducing Arabian Oryx in the wild.

The initial plan of the Fauna and Flora Preservation Society was to establish a herd in Kenya where another species of oryx already lived and flourished. The Kenyan plan was dropped because of an outbreak of hoof-and-mouth disease, and the oryx destined for Kenya were shipped to the Phoenix Zoo instead.

Although in hindsight we know that there were actually quite a few potential Arabian oryx in private collections. For instance, the Arabian reintroduction was started with 57 Arabian orix from the collection of King Khalid bin Abdul Aziz in Ath-Thumamah, this was not known in 1962, when only 16 oryx were located as possible breeding stock.

There were originally four individuals captured and seven donated for this project. The four were captured in Aden (now Yemen) near the border of Oman by an expedition lead by the late Major Ian Grimwood, then chief game warden of Kenya, with help from Manahil and Mahra tribesmen. One male from this group later died of capture stress. The seven donated oryx were: one from the London Zoo, two from Sheikh Jabul Abdullah al-Sabah, and two pairs from the collection of King Saud bin Abdul Aziz. One of the oryx from Sheikh Jabul Abdullah al-Sabah died before delivery as well, leaving nine oryx to start the "World Herd."

Five Arabian Oryx were delivered to the Phoenix Zoo in 1963 (four in June and one in September). A baby was born to the herd in October 1963 from a conception en route, and another was born in the spring of 1964, bringing the starting population of the Phoenix Zoo herd to seven. The four oryx donated by King Saud arrived at the Phoenix Zoo in July 1964, bringing the population of the "World Herd" to 11.

The breeding program at the Phoenix Zoo was very successful, and the zoo celebrated its 225th Arabian Oryx birth in 2002. From Phoenix, ArizonaPhoenix|, individuals were sent to other zoos and parks (including the San Diego Wild Animal Park) to start their herds. Most of the Arabian Oryx in the wild today have ancestors from the Phoenix Zoo.

Reintroductions

Reintroductions started in 1982 in Oman. As of 2009 there have been reintroductions in Oman, Saudi Arabia, Israel, the United Arab Emirates, and Jordan. At this time, populations in the United Arab Emirates and Jordan are still not considered in the International Union for Conservation of Nature (IUCN) Red List wild oryx count. The population in Oman is still receiving supplementary forage, and the introduction into Jordan was after the last update of the Red List.

Oman

By 1980 the number of Arabian Oryx in captivity had increased to the point that reintroduction to Oman was attempted from the San Diego Wild Animal Park to Jaaluni in the Jiddat-al-Harasis. The oryx were initially kept in large pens outdoors, but were released to the wild on January 31, 1982 in the Omani Central Desert and Coastal Hills.

These oryx became the core of the Oman herd in the wild, though there were several other releases of captive bred animals over the next two decades. The area of their release became the Arabian Oryx Sanctuary.

On June 28, 2007, Oman's Arabian Oryx Sanctuary was the first site to be removed from the UNESCO World Heritage List. UNESCO's cited the Omani government's decision to open 90% of the site to oil prospecting as the main reason for this decision. The Arabian Oryx population on the site has been reduced from 450 Oryx in 1996 to only 65 in 2007, mostly due to poaching and illegal live capture. There are now fewer than four breeding pairs left on the site.

Saudi Arabia

Organized captive breeding of the Arabian oryx in Saudi Arabia began in April 1986, when 57 oryx from the farm of the late King Khalid bin Abdul Aziz in Ath-Thumamah (now the King Khalid Wildlife Research Center or KKWRC) were brought to the National Wildlife Research Center (NWRC) near At-Ta'if.

Between the initial 1986 founding and 1996, 33 additional oryx (including some from the "World Herd") have been introduced to the founder generation of Arabian Oryx at the NWRC. Since 1996, all additions to the population have been through births.

Due to an outbreak of *Mycobacterium bovis* (Bovine Tuberculosis) in the founder generation, a "buffer generation" was introduced in the herd. Since then, calves produced by the founder herd are removed from their dam immediately after birth and hand-reared.

These hand-reared second generation oryx are regularly tested for tuberculosis and a variety of other pathogenic agents, and join the breeding nucleus only when tests are consecutively negative. After breeding, they produce the third generation of oryx, which are tuberculosis free and mother-reared, and of which more than 80% are reintroduced into the wild.

Reintroduction of a wild population began in 1995 in the 'Uruq Bani Ma'arid protected area. The reserve covers about 12,000 km^2 (4,600 sq mi) at the western edge of the Rub'al-Khali or "Empty Quarter". As of 2009, the IUCN Red List estimates the oryx population on this reserve at 160 individuals.

A free ranging herd was established in the newly created Mahazat as-Sayd Protected Area in 1989. This 2,244 km^2 (866 sq mi) fenced reserve is home to reintroduced oryx, gazelle and the Houbara Bustard. As of 2009, the IUCN Red List estimates the oryx population on this reserve at about 800 individuals. There is currently some debate about whether animals in this reserve should be considered "wild."

Israel

In Israel the reintroduction program was established in 1978 when four pairs of Arabian Oryx were purchased. At this time the IUCN Redbook reports wild populations totaling 90-100 animals in 3 locations in Northern Arava and the Negev Desert.

The United Arab Emirates

In the early 1960s, the late Sheikh Zayed bin Sultan Al Nahyan directed the capture of two breeding pairs of the Arabian Oryx for the nucleus of a captive-breeding program in Al Ain. In 2007 the United Arab Emirates started releasing animals into Umm Al Zumul. As of 2009 there have been about 100 animals released.

As part of this initiative, a similar program is being developed to reintroduce this extinct species into its natural habitats in Yemen and Iraq.

Since March 1999, Abu Dhabi has been host to an inter-governmental body known as The Coordinating Committee for the Conservation of the Arabian Oryx, which oversees the coordination of conservation efforts for this species within the Arabian Peninsula.

Jordan

The reintroduction project for Jordan began when the Environment Agency - Abu Dhabi (EAD) and the Al Aqaba Special Economic Zone Authority signed a sponsorship agreement in April 2007. Under this agreement, EAD is sponsoring the $1.1 million three-year project which includes reintroduction of the Arabian Oryx into the Wadi Rum Protected Area, rehabilitating the habitat, and helping local residents to improve their living standards.

Twenty oryx were released into the Wadi Rum Protected Area in 2009.

Current status

By 2009, the Arabian Oryx was protected by law in all areas where it appears.

As of September 2009 the IUCN Red List estimates total world population of wild Arabian Oryx to be about 1100. The Red List classification limits "wild" animals to parts of the populations in Oman, Saudi Arabia, and Israel. In addition, 6,000-7,000 animals are held in captivity worldwide. The wild population trend is listed as "stable/decreasing." If current trends hold, the IUCN estimates that the Arabian oryx will be reclassified from Endangered to Vulnerable in 2011.

Chapter- 3

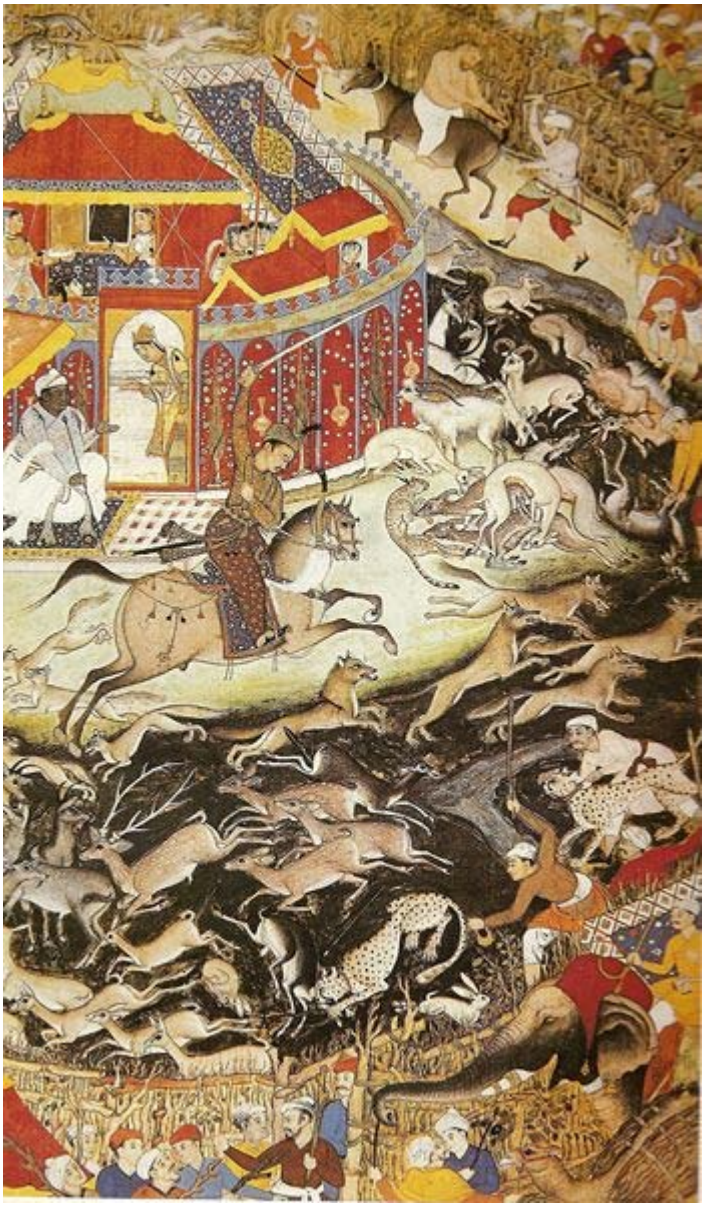
Cheetah Reintroduction in India

Cheetah cubs with dog (India, 1897).

Reintroduction of Cheetah in India involves the artificial reestablishment of a population of cheetahs into areas where they had been previously slaughtered by the British officers and Indian Princeses. Shahgarh landscape in Rajasthan has been chosen as the abode for Cheetah until a sufficient population built up for reintroduction into former habitats in others parts of India like the Banni grasslands and Desert National Park etc.

Background

History



A painting depicting Akbar, Mughal emperor of India hunting with locally trapped Asiatic Cheetahs, c. 1602.

Until the 20th century, the Asiatic Cheetah was quite common and roamed all the way from Arabia to Iran, Afghanistan and India. The Asiatic Cheetah was also known as the '**Hunting leopard**' in India, and were kept by kings and princes to hunt gazelle. The Moghul Emperor Akbar kept them for hunting gazelle and Blackbucks. He was said to have had 1,000 cheetahs at one time for assisting in his royal hunts. Trapping of large numbers of adult Indian cheetahs, who had already learned hunting skills from wild mothers, for assisting in royal hunts is said to be another major cause of the species rapid decline in India as they never bred in captivity with only one record of a litter ever.

Extinction

Hunting of Blackbuck with Asiatic Cheetah; Drawn by James Forbes in South Gujarat, India. Oriental Memoirs, 1812.

By the beginning of the twentieth century, the species was already heading for extinction in many areas. The last physical evidence of the Asiatic Cheetah in India was three shot by the Maharajah of Surguja in 1947 in eastern Madhya Pradesh. He also bears the dark honour of holding the record for shooting the most tigers — a total of 1,360.

In India fifty years ago, prey was abundant, and it fed on the Blackbuck, the Chinkara, and sometimes the Chital and the Nilgai.

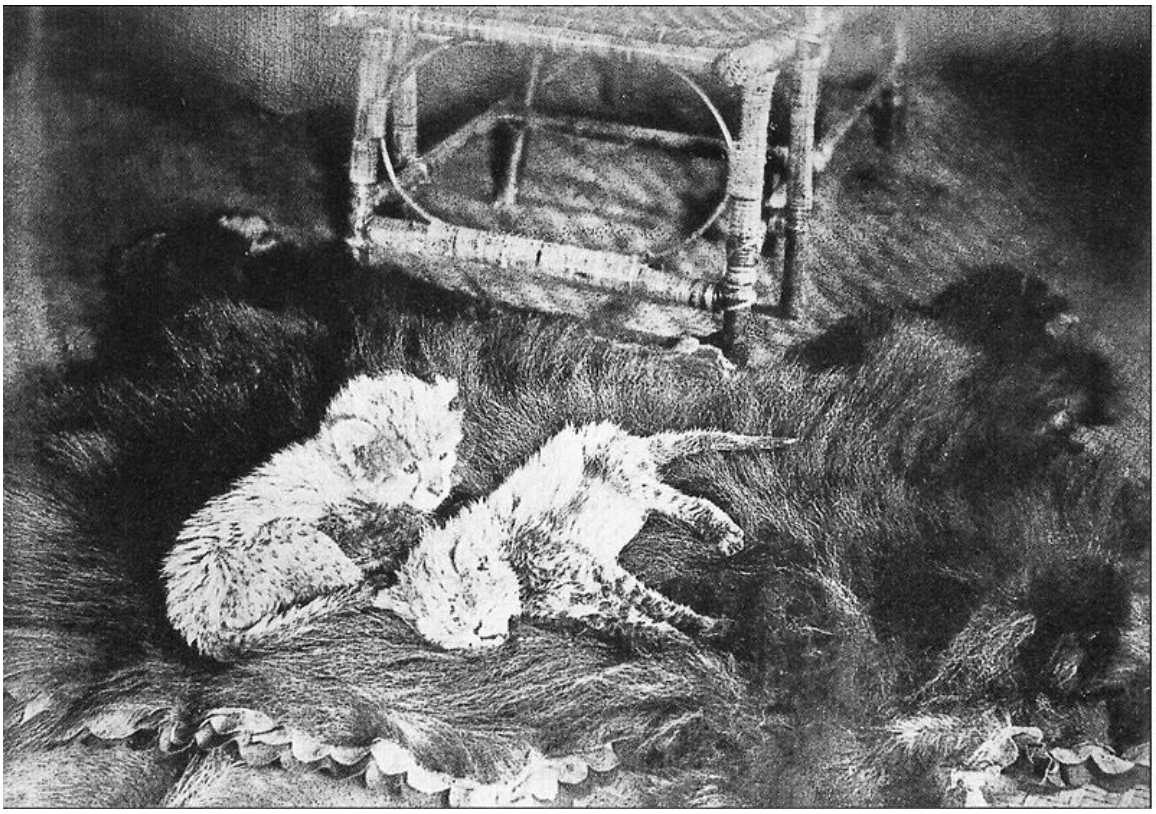
...is in low, isolated, rocky hills, near the plains on which live antelopes, its principal prey. It also kills gazelles, nilgai, and, doubtless, occasionally deer and other animals. Instances also occur of sheep and goats being carried off by it, but it

rarely molests domestic animals, and has not been known to attack men. Its mode of capturing its prey is to stalk up to within a moderate distance of between one to two hundred yards, taking advantage of inequalities of the ground, bushes, or other cover, and then to make a rush. Its speed for a short distance is remarkable far exceeding that of any other beast of prey, even of a greyhound or kangaroo-hound, for no dog can at first overtake an Indian antelope or a gazelle, either of which is quickly run down by *C.*

jubatus, if the start does not exceed about two hundred yards. General McMaster saw a very fine hunting-leopard catch a black buck that had about that start within four hundred yards. It is probable that for a short distance the hunting-leopard is the swiftest of all mammals.

—Blanford writing on the Asiatic Cheetah in India quoted by Lydekker

With the death of the last remaining population of the Asiatic Cheetah in India, the species was declared extinct in India is the only animal in recorded history to become extinct from India due to unnatural causes.



Asiatic Cheetah cubs in India, 1897.

Reintroduction Efforts

Cloning

During the early 2000s, Indian scientists from the Centre for Cellular and Molecular Biology (CCMB), Hyderabad, proposed a plan to clone Asiatic Cheetahs obtained form Iran. India requested Iran to translocate one live pair to India.If not possible, Indian scientists requested Iran to allow them collect some live cells of the Cheetah in Iran itself, which can then be made into living cell lines.

However, Iran refused saying that it would neither send any Cheetahs to India nor would allow Indian scientists to collect their tissue samples. But, the Indian government has again contacted Iran to explore the possibility of the Islamic Republic supplying cheetahs to help to re-establish their presence on the subcontinent decades after they were hunted to extinction. The Iranian embassy in Delhi said its government was in the process of "arranging" talks.

Introduction of African Cheetah

As the world's last Asiatic cheetah population surviving only in Iran is currently critically endangered with an estimated total of below 100, the cheetah experts feel it won't be conducive to disturb it. India is thus exploring an alternate plan of importing the African Cheetah (*Acinonyx jubatus*) from some African countries where they are in greater abundance, with a view to breeding them in captivity, then setting them free in protected, semi-arid habitats in India.

Since India lost the Indian / Asiatic Cheetah, which went extinct about half a century ago, suggestions to reestablish the cheetah in India have been ongoing but this is the first time that a major conservation NGO like Wildlife Trust of India (WTI) has taken it on them and are currently spearheading the Cheetah reintroduction plan in India in collaboration with Wildlife Institute of India (WII). For this purpose a meeting of International cheetah experts was organized in Gajner, near Bikaner in the Indian state of Rajasthan during September 2009. As per the discussions held at the meeting cheetah experts from around the world favored importing African cheetahs from Africa for the proposed reintroduction in India as against getting them from the world's last remnant population of Asiatic Cheetah, also called Iranian cheetah, that only survive in Iran which are currently critically endangered with their entire population estimated to be below 100. International experts including Laurie Marker of Cheetah Conservation Fund (CCF), credited with developing cheetah conservation programmes in a number of countries, including Iran, argues that the world's last Asiatic cheetah population in Iran is abysmally low to spare any individuals for reintroduction efforts in India. Stephen J O'Brien, world's leading conservation geneticist and Chief of the Laboratory of Genomic Diversity at the National Cancer Institute (NCI), USA, has clarified that there is no significant genetic difference between the African and the Iran's Asiatic cheetah, as per genetic research carried out by him African and Indian cheetahs were only separated just some 5,000 years ago which is not enough for a sub-species level differentiation. "African and Asian cheetahs are similar in nature and have same genetic make-up. So India can have the animal from South Africa if it is not getting from Iran (which has already refused to part with its Asian cheetah)," noted the cheetah genetic expert Stephen J O Brien. At the meeting experts also identified South Africa, Botswana, Kenya, Tanzania and UAE as countries from where the cheetah could be imported for India. "About 5 to 10 animals annually have to be brought to India over a period of 5 to 10 years," recommended another working group, which was formed for exploring sourcing and translocation of the cheetah.

Ministry of Environment & Forests, Government of India has approved the recommendation for a detailed survey of potential reintroduction sites in four Indian states of Rajasthan, Gujarat, Madhya Pradesh and Chattisgarh, shortlisted during the consultative meeting. Three more Indian states Karnataka, Andhra Pradesh and Maharashtra are being also considered. This survey, will form the basis for the roadmap of reintroduction of cheetah in India, and will be carried out by Wildlife Institute of India (WII), in collaboration with the Wildlife Trust of India (WTI), the Bombay Natural History Society (BNHS) and the concerned state governments with their respective forest departments.

Current status

The Ministry of forests and environment of India is now hammering out the details of the cheetah conservation plan. As a first step, a two-day seminar of technical experts on cheetahs was held in Gajner from September 9, 2009. Experts on cheetah, including Divyabhanusinh and M K Ranjitsinh presented their papers on how to go about bringing cheetahs to India.

The initial plans were to bring the cheetahs to Gajner Wildlife Sanctuary. "We want to set up a breeding ground for the cheetahs and Gajner seems to fit the bill perfectly. Thereafter, they will be transported to various states," he added.

India is also in talks with the Islamic Republic of Iran over the possibility of sending a pair of Asiatic Cheetah to India. It is said that Iran wanted an Asiatic lion in exchange for a cheetah and that India wasn't ready to export any of its Asiatic lions. The Iranian embassy in Delhi said that its government was in the process of “arranging” talks.

The Union Minister of State for Environment and Forests Jairam Ramesh said that African cheetahs could be brought to India within three years having just returned from a trip to South Africa, one of the potential source-habitats of cheetahs to be moved to India.

The Wildlife Institute of India is spearheading the project, and will unveil a road map and destination for the African cheetahs — possible options are in Rajasthan, Madhya Pradesh and Gujarat — by May-end.

Kuno Palpur and Nauradehi wildlife sanctuaries in Madhya Pradesh and Shahgarh landscape in Jaisalmer in Rajasthan have been selected in by the Wildlife Institute of India as most suitable sites for the reintroduction project.

Chapter- 4

Wolf Reintroduction

A reintroduced gray wolf in Yellowstone National Park.

Wolf reintroduction involves the artificial reestablishment of a population of wolves into areas where they had been previously extirpated. Wolf reintroduction is only considered where large tracts of suitable wilderness still exist and where certain prey species are abundant enough to support a predetermined wolf population.

In the United States

In Arizona

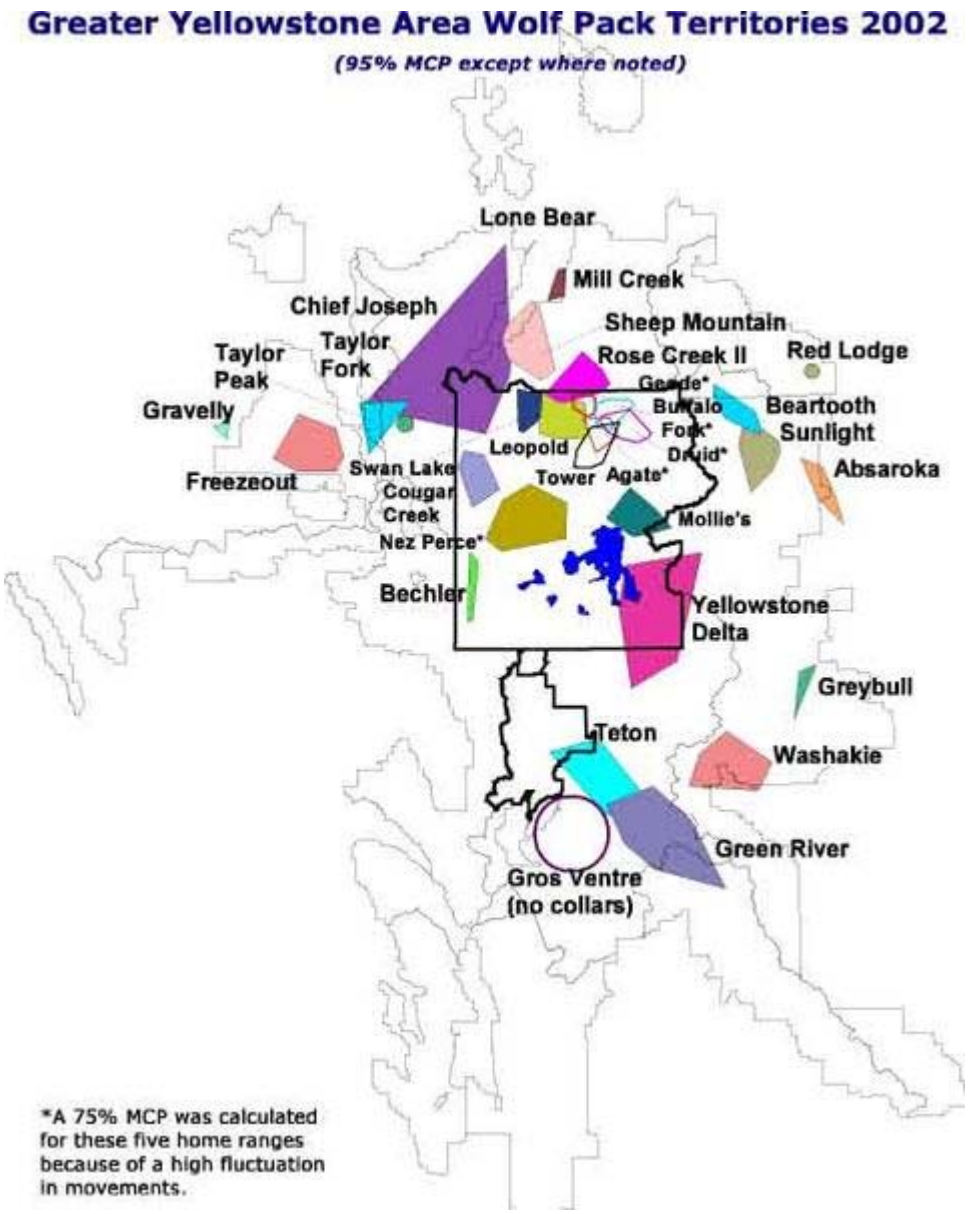
Captive bred Mexican wolf in pen, Sevilleta National Wildlife Refuge.

The five last known wild Mexican grey wolves were captured in 1980 in accordance with an agreement between the United States and Mexico intended to save the critically endangered subspecies. Since then, a comprehensive captive breeding program has brought Mexican wolves back from the brink. Currently, there are 300 captive Mexican wolves taking part in the program.

Eurasian wolf (*Canis lupus lupus*) at

The ultimate goal for these wolves, however, is to reintroduce them to areas of their former range. In March 1998, this reintroduction campaign began with the releasing of three packs into the Apache-Sitgreaves National Forest in Arizona. Today, there may be up to 50 wild Mexican wolves in Arizona and New Mexico. The final goal for Mexican wolf recovery is a wild, self-sustaining population of at least 100 individuals.

In Idaho / Yellowstone National Park



Map showing wolf packs in Yellowstone National Park as of 2002.

Grey wolf packs were reintroduced to Yellowstone National Park and Idaho starting in 1995. These wolves were considered as "experimental, non-essential" populations per article 10(j) of the Endangered Species Act (ESA). Such classification gave government officials greater leeway in dealing with problem wolves, which was considered one of a series of compromises wolf reintroduction proponents made with concerned local ranchers.

A Eurasian wolf (*Canis lupus lupus*), an example of the "northern" wolf clade

Indeed, local industry and environmental groups battled for years over the Yellowstone and Idaho wolf reintroduction effort. The idea of wolf reintroduction was first brought to Congress in 1966 by biologists who were concerned with the critically high elk populations in Yellowstone. Officially, 1926 was the year the last wolves were killed within Yellowstone's boundaries, and over the succeeding decades, populations of elk and other large prey animals had soared, and new growth vegetation suffered as a result. This is due to ecosystem instability when keystone predators are removed. With wolves being at the top of the food pyramid, their absence let the elk population boom out of control. Soon deciduous woody species such as upland aspen and riparian cottonwood crashed as a result of overgrazing. This affected habitat for other species as well. Moreover, coyotes tried to fill in the niche left by wolves, but were unable to control the large ungulate populations. Booming coyote numbers, furthermore, also had a negative effect on other species, particularly the red fox. Ranchers, though, remained steadfastly opposed to reintroducing a species of animal that they considered to be analogous to a plague, citing the hardships that would ensue with the potential loss of stock caused by wolves.

A Czechoslovakian Wolfdog

The government, which was charged with creating, implementing, and enforcing a compromise, struggled for over two decades to find middle ground. A wolf recovery team was appointed in 1974, and the first official recovery plan was released for public comment in 1982. General public apprehension regarding wolf recovery forced the U.S. Fish and Wildlife Service to revise their plan to implement more control for local and state governments, so a second recovery plan was released for public comment in 1985. That same year, a poll conducted at Yellowstone National Park showed that 74% of visitors thought wolves would improve the park, while 60% favored reintroducing them. The preparation of an environmental impact statement, the last critical step before reintroduction could be green-lighted, was halted when Congress insisted that further research be done before an Environmental Impact Statement (EIS) was to be funded.

People look on as the grey wolves are trucked through Roosevelt Arch, Yellowstone National Park, January, 1995.

In 1987, in an effort to shift the burden of financial responsibility from ranchers to the proponents of wolf reintroduction, Defenders of Wildlife set up a "wolf compensation fund" that would use donations to pay ranchers market value for any stock that was lost to wolf depredation. That same year, a final recovery plan was released. Following a long period of research, public education, and public commenting, a draft EIS was released for public review in 1993 and it received over 150,000 comments from interested parties. It was finalized in May 1994, and included a clause that specified that all wolves reintroduced to the recovery zones would be classified under the "experimental, non-essential" provision of the ESA. Though the original plan called for three recovery zones – one in Idaho, another in Montana, and a final one in the Greater Yellowstone Area – the Montana recovery zone was eliminated from the final EIS after it had been proven that a small, but breeding population had already established itself in the northwestern part of the state.

Reintroduced wolves being carried to acclimation pens, Yellowstone National Park, January, 1995.

A pair of lawsuits filed in late 1994 put the whole recovery plan in jeopardy. Interestingly, while one of the lawsuits was filed by the Wyoming Farm Bureau, the other was filed by a coalition of concerned environmental groups. The latter pointed to unofficial wolf sightings as proof that wolves had already migrated down to Yellowstone from the north, which, they argued, made the plan to reintroduce an experimental population in the same area unlawful. According to their argument, if wolves were already present in Yellowstone, they should rightfully be afforded full protection under the ESA, which, they reasoned, was preferable to the limited “experimental” classification that would be given to any reintroduced wolves.

Wolf in acclimation pen, Yellowstone National Park.

Nevertheless, both cases were thrown out on January 3, 1995. Adolescent members from packs of Mackenzie Valley wolves in Alberta, Canada were tranquilized and carted down to the recovery zones later that week, but a last minute court order delayed the planned releases. The stay came from an appellate court in Denver and was instigated by the Wyoming Farm Bureau. After spending an additional 36 hours in transport cages inside the recovery zones, the wolves were finally released following official judicial sanction. Yellowstone's wolves stayed in acclimation pens for two more months before being released into the wild. Idaho's wolves, conversely, were given a hard release. A total of 66 wolves were released to the two areas in this manner in January 1995 and January 1996.

Genetic research has shown that black-furred wolves owe their colouration to a mutation that first arose in domestic dogs.

2005 estimates of wolf populations in the two recovery zones reflect the success the species has had in both areas:

- Greater Yellowstone Area: 325
- Central Idaho: 565

These numbers, added with the estimated number of wolves in northwestern Montana (130), puts the total number of wolves in the Northern Rocky Mountains recovery area at over 1000 individuals. This includes approximately 134 packs (two or more wolves traveling together) and 71 breeding pairs (male and female that successfully rear a litter of at least two until Dec. 31). The recovery goal for the area was 30 breeding pairs total, and this number has been surpassed for some time.

The red wolf is thought by some scientists to be a wolf/coyote hybrid.

Since wolves have been recovered, there have been hundreds of confirmed incidents of livestock depredation, though such predation represents a minute proportion of a wolf's diet on a per wolf basis. While the majority of wolves ignore livestock entirely, a few rogue wolves or wolf packs will become chronic livestock depredators, and will either be relocated or killed depending on the area and number of incidents. Since the year Defenders of Wildlife implemented their compensation fund, they have allocated over $1,000,000 to private owners for proven and probable livestock depredation by wolves. Opponents argue that the Yellowstone reintroductions were unnecessary, as American wolves were never in danger of biological extinction. Opponents have stated that wolves are of little commercial benefit, as cost estimates on wolf recovery are from $200,000 to $1 million per wolf. But the Lamar Valley is one of the best places in the world to observe wolves, and tourism based on wolves is booming. The growing wolf-viewing outfitting trend contrasts with declines for big game hunters. National Park Service Biologist Wayne Brewster informed guides and outfitters living north of Yellowstone National Park, to expect a fifty percent (50%) drop in harvestable game when wolves were reintroduced to Yellowstone National Park. This was confirmed when in 2006, the Yellowstone elk herd had in fact shrunk to 50% since the mid 1990s. Two thirty day

periods of tracking radio collared wolves showed that 77-97% of prey species documented by wolves in the park were elk. Outside the park, numerous hunting outfitters have been run out of business due to elk hunting opportunities being reduced by 90%. Although Defenders of Wildlife have established a $100,000 compensation program to reimburse ranchers in Wyoming, Idaho, Montana, New Mexico and Arizona for losses caused by wolves, reintroduction opponents have argued that the program is nothing more than a publicity tool and is inadequate for addressing the problem of livestock loss to wolves, due to the fact that the programme has apparently unrealistic criteria in confirming wolf kills. This can be problematic, as wolves often leave little physical evidence of kills the size of lambs and small calves.

The reintroduction of wolves has reportedly increased biodiversity within Yellowstone National Park. Along with (and partly because of) an increase in new-growth vegetation, such as aspen and willow trees, which has resulted from the reduction in elk numbers. The aspen and willow were able to recover because not only was the elk population reduced because of predation due to the wolves, but they quit venturing as deep into thickets due to the fear of being attacked by wolves in an area of very low visibility. This process of top predators regulating the lower sections of the trophic pyramid was dubbed, "the ecology of fear" by William J. Ripple and Robert L. Bestcha In addition to the restoration of vegetation several important species such as the beaver (which had also become extinct from the park) and red fox have also recovered, probably due to the wolves keeping coyote populations under control.

The Idaho state government opposed the reintroduction of wolves into the state and many citizens feel as if the wolves were forced onto the state by the federal government. Despite residing within state borders, the US Fish and Wildlife Service has managed the wolf population since the reintroduction. The Idaho wolf population has made a remarkable comeback with an estimated 1,200 wolves in the Greater Yellowstone area, 700 of these residing within Idaho's borders in 2007. However, the wolves have increasingly become nuisances. In order to quell the political battle between the ranchers and conservationists while still ensuring proper management the federal government has agreed to remove the wolf from the Endangered Species list and allow state management of the species if Idaho, Montana and Wyoming all propose management plans that meet the Fish and Wildlife Service's approval. Currently plans proposed by both Idaho and Montana have been approved by the US Fish and Wildlife Service. Wyoming is the only member of the trio who has not authored a plan accepted by the service.

Despite being approved by the US Fish and Wildlife Service Idaho's proposed management plan is still shrouded in controversy. The plan proposed by the newly inaugurated governor of Idaho, Clement "Butch" Otter, calls for the killing of 550 wolves, approximately eighty percent of the current population, and a reduction in the number of breeding pairs from 72 to just 10. Otter's plan is strongly supported by many state residents. According to the US Fish and Wildlife Services guidelines the Idaho wolf population needs to stay above 100 individuals for the species to stay off the endangered species list and remain a viable, self sustaining population. However, there is much

evidence that shows that a much larger wolf population can survive in Idaho without causing any major problems.

Wolf 2M, Co-founder of the Leopold Pack was killed on New Year's Eve 2002 by the Geode Pack near Hellroaring Slopes. 2M was the last of the original 14 wolves reintroduced to Yellowstone in 1995.

In North Carolina / Great Smoky Mountains National Park

Red wolves were once native to the southeast but the last wolf seen in the vicinity of the park was in 1905. The wolves were reintroduced to the Great Smoky Mountains National Park in the early 90s but the program was cancelled in 1998 due to the death of wolf pups from malnutrition and disease; and the wolves roaming beyond the boundaries of the park.

In Northern Europe

In Sweden and Norway, there has been a long and ongoing conflict between some groups whose belief it is that wolves have no place in human inhabited areas and those who wish the wolf to be allowed to expand out into more of the area's vast boreal forests. The former mostly consists of members of the rural working class who fear competition for certain large ungulate species (Roe Deer, moose, etc.), and who consider the wolf to be a foreign element. They argue that modern Scandinavian wolves are actually recent migrants from Russia and not the remnants of old native wolf packs, which, they reason, is why they do not belong in Sweden and Norway.

Scandinavian wolves had been nearly completely eliminated from the range due to extirpation campaigns in the nineteenth and twentieth centuries, and were considered to be gone from the area by the 1960s. In the early 1980s, however, a single breeding pack was discovered in southern Sweden, over 1000 km away from the nearest known population in Russia or Eastern Finland. The pack was small – about ten animals – and it stayed that way for many years until its population began to noticeably increase starting in 1991. Prior to 1991, the small population lacked ideal genetic diversity, and inbreeding had been occurring to a potentially dangerous degree. Furthermore, low birth rates suggest that the wolves were apprehensive to mate with each other, which was most likely due to their close relation. Genetic data suggests that, in 1991, a lone immigrant wolf from Russia migrated to the area and single-handedly restored genetic diversity to the population. A particular study showed that of the 72 wolves born between 1993 and 2001, 68 of them could trace their genetic heritage to this lone migrant wolf. Today, there are over one hundred individuals that range across this southern area of Scandinavia. The population remains genetically isolated, however, which is a cause of concern for some. On the other hand, there is reason to believe that as the number of wolves living in this area increases, the boundaries of the population's range will creep towards the ranges of other, separate populations in Finland, thus promoting dispersal. Direct reintroduction remains an intriguing option to foster genetic diversity in the Scandinavian population in the meantime.

There has been much speculation as to how the original population came to be in the early 80s. Some believe that they might be a native species – remnants of a population that somehow survived persecution. Much genetic research has been performed on this population, however, and this particular theory isn't supported by the findings. Genetic analysis seems to support the idea that the wolves were immigrants that had traveled over 1000 km from Russia to southern Scandinavia along one of several possible dispersal routes. Certain conspiracy theorists believe that they were artificially reintroduced per some secret agenda by the Swedish government.

Since the wolves have reestablished themselves, Norwegian and Swedish farmers have complained of sheep and dog depredation. Indeed, many farmers in Norway were forced to give up their practice once local wolves discovered sheep as potential prey. This exemplifies the general trend that the people who are usually the most skeptical about wolf recovery, though they typically represent the minority, are also the ones most directly affected by it. Most of the proponents of wolf reintroduction in Norway and Sweden can be found in urban populations, which is a pattern that can be seen wherever wolf reintroduction is a hot button issue. . As a result, some are calling for the legalization of hunting wolves in this area. European Union regulation doesn't make this an option in Sweden. However, government action could be taken to cull wolf populations if either of the two countries involved should sanction such action.

In Central and Western Europe

In several areas in Europe, reintroduction of wolves to areas where they have become extinct is being actively considered. Charities in many European countries including Denmark, Germany, Italy and Scotland are also advocating the reintroduction of wolves to specific rural and forested areas. Most plans have been met with a mixture of enthusiasm and unease by different population groups. Opponents fear the loss of livestock that may result from their reintroduction. In several countries, charity based compensation plans (similar to those that operate in the USA) have been proposed.

Chapter- 5

Asiatic Lion Reintroduction Project

The **Asiatic Lion Reintroduction Project** is an effort to save the Asiatic lion from extinction in the wild. The last wild population in the Gir Forest region of the Indian state of Gujarat is threatened by epidemics, natural disasters and anthropogenic factors. The project aims to establish a second independent population of Asiatic Lions at the Kuno Wildlife Sanctuary in the Indian state of Madhya Pradesh.

Wildlife Institute of India researchers confirmed that the Palpur-Kuno Wildlife Sanctuary is the most promising location to re-establish a free ranging population of the Asiatic lions and certified it ready to receive its first batch of translocated lions from Gir Wildlife Sanctuary where they are highly overpopulated. There are large scale deaths in the population annually because of ever increasing competition between the human and animal overcrowding. Asiatic lion prides require large territories but there is limited space at Gir wildlife sanctuary, which is boxed in on all sides by heavy human habitation.

Kuno Wildlife Sanctuary was selected as the reintroduction site for critically endangered Asiatic lion because it is in the former range of the lions before it was hunted into extinction in about 1873. It was selected following stringent international criteria and internationally accepted requirements & guidelines developed by IUCN/SSC Reintroduction Specialist Group and IUCN/SSC Conservation Breeding Specialist Group which are followed before any reintroduction attempt anywhere in the world.

Twenty four villages of the Sahariya tribe, which had lived in the remote core area set aside for the reintroduction of the Asiatic lions in Kuno Wildlife Sanctuary in the Indian state of Madhya Pradesh, were moved out of the Sanctuary to prepare it for receiving a lion population. They were rehabilitated to a new location on the edge of the Kuno sanctuary by incurring an expense equal to millions of dollars under a Central Government of India sponsored scheme. The plan included expenses on infrastructure development, so that they can have access to basic amenities like roads, schools and a hospital. Samrakshan Trust, an NGO, has been working for better rehabilitation of villagers who agreed to move out of the Kuno Wildlife Sanctuary.

The resettled villages were allocated housing and agricultural land at Village Agraa outside the sanctuary. The stated purpose of this move was to create a safe home and an inviolate space for the translocated prides of critically endangered Indian lions. However,

major gaps remained in the implementation of these measures The economic impact of their displacement from Kuno sanctuary has been very adverse for the villagers, according to independent research, making this a controversial case of species preservation via dislocation of human populations living inside Protected Areas.

Establishing the wildlife sanctuary

Asiatic Lion

Asiatic Lioness, named MOTI, at Bristol Zoo, England (1996).

The plan is to reintroduce a pride or two of wild, free-ranging Asiatic Lions from Gir Forest in the neighboring Indian state of Gujarat to start with. Even though recent studies have shown that Kuno Wildlife Sanctuary is ready to receive its first pride of lions from Gir, controversy continues to shroud the project as the state government of Gujarat, from where the Lions are to come from, is reluctant to let go of them as it considers Asiatic Lions a state property and wants to keep its monopoly over the tourism revenue generated by the species which is extinct everywhere else in the world (i.e. over its entire original range in South West Asia (The Middle East and Near East) including adjoining parts of Europe (The Balkans and Greece) where it once was found in good numbers). Hence Gujarat sees the lions as a "tourist attraction" and a source of direct and indirect tourism-related revenue.

Proponents of the plan hope that the central government of India and the state governments of Gujarat and Madhya Pradesh can soon reach some consensus on relocating at least two or three lion prides from Gir Forest to Kuno Wildlife Sanctuary, thus securing the long-term survival of the species and produce, eventually, a more genetically-diverse population.

The Gir Forest in the State of Gujarat, India is the last natural habitat of the approximately 350 wild Asiatic Lions, though plans are afoot to re-introduce some to Palpur-Kuno Wildlife Sanctuary in the neighboring State of Madhya Pradesh in India to ensure their longterm survival against epidemics and natural calamities.

Inbreeding

The wild population of more than 300 Asiatic Lions has been said to be derived from just 13 individuals, and thus was widely thought to be highly inbred. However, this low figure, quoted from 1910, may have been publicised to discourage lion hunting; census data from the time indicates the population was probably closer to 100.

Many studies have reported that the inbred populations could be susceptible to diseases and deformed sperm, which may have led to infertility. In earlier studies Stephen O'Brien, a geneticist, had suggested that "If you do a DNA fingerprint, Asiatic lions actually look like identical twins... because they descend from as few as a dozen individuals that were left at the turn of the 20th century." This makes them especially vulnerable to diseases, and causes 70 to 80% of sperms to be deformed — a ratio that can lead to infertility when lions are further inbred in captivity.

Scientists from India have since reported that the low genetic variability may have been a feature of the original population, and not a result of inbreeding. They also show that the

variability in immunotypes is close to that of the tiger population and that there are no spermatazoal abnormalities in the current population of lions.

Recent information from the Central Zoo Authority of India (CZA) reports that "the Asiatic lions and Indian tigers are not as inbred as previously reported by S.J. O' Brien and do not suffer from inbreeding depression".

Chapter- 6

Borneo Orangutan Survival

Borneo Orangutan Survival

Founders	Willie Smits
Type	Non-profit Foundation organization
Founded	1994
Area served	Borneo
Focus	Environmentalism, Conservation
Motto	A secure future for orangutans, free and safe in their natural habitat, living in harmony with local people

The **Borneo Orangutan Survival (**BOS**) Foundation** is an Indonesian non-profit NGO founded by Dr Willie Smits in 1991 and dedicated to the conservation of the endangered Bornean Orangutan and its habitat through the involvement of local people. It is audited by a multinational auditor company and operates under the formal agreement with the Indonesian Ministry of Forest to conserve and rehabilitate orangutans. BOS manages orangutan rescue, rehabilitation and re-introduction programmes in East and Central Kalimantan. With almost 1000 orangutans in its care and employing between six hundred

and a thousand people at a hundred sites BOS is the biggest primate conservation NGO worldwide.

Nyaru Menteng and Samboja Lestari are the BOS sites that have received most extensive media coverage. Nyaru Menteng, founded and run by Lone Drøscher Nielsen, has been the subject of a number of TV series, including Orangutan Diary and Orangutan Island. Samboja Lestari featured recently in a 2009 TED talk, *"Willie Smits restores a rainforest"* in which Smits describes how he recreated forest to provide habitat for rescued orangutans.

History

In 1989 Dr. Willie Smits, then a forest ecologist, had his first enconter with an orangutan, a sick baby female in a cage, while walking in the market in Balikpapan, East Kalimantan. He was struck by "the saddest eyes" he had ever seen and going back later found her on a rubbish heap and took her home. He nursed her back to health and a few weeks later was given another to care for, this time a sick baby male. The number of orangutans in his care grew, and from these beginnings what was initially the "Balikpapan Orangutan Society" came into being in 1991, with the support of fellow researchers at the Tropenbos Kalimantan Program and the schoolchildren of Balikpapan. As its sphere of acitivity broadened, it was renamed the Borneo Orangutan Survival Foundation in 1994. Since then it has received increasing recognition in Indonesia and globally, with sister organizations in 11 other countries.

Orangutans endangered

The Bornean Orangutan

The Bornean orangutans is endangered according to the IUCN Red List of mammals, and is listed on Appendix I of CITES. The total number of Bornean orangutans is estimated to be less than 14 percent of what it was in the recent past (from around 10,000 years ago until the middle of the twentieth century) and this sharp decline has occurred mostly over the past few decades due to human activities and development. Their habitat is so much reduced that they are now only to be found in pockets of remaining rainforest. The largest remaining population is found in the forest around the Sabangau River, but this environment too is at risk. According to the IUCN, it is expected that in 10 to 30 years orangutans will be extinct if there is no serious effort to overcome the threats that they are facing.

This view is also supported by the United Nations Environment Programme, which states in its report that due to deforestation by illegal logging, fire and the extensive development of oil palm plantations, orangutans are endangered, and if the current trend continues, they will become extinct.

BOS aims

1. Orangutan Reintroduction
2. The rehabilitation and habitat protection of wildlife that is protected under law, especially orangutans

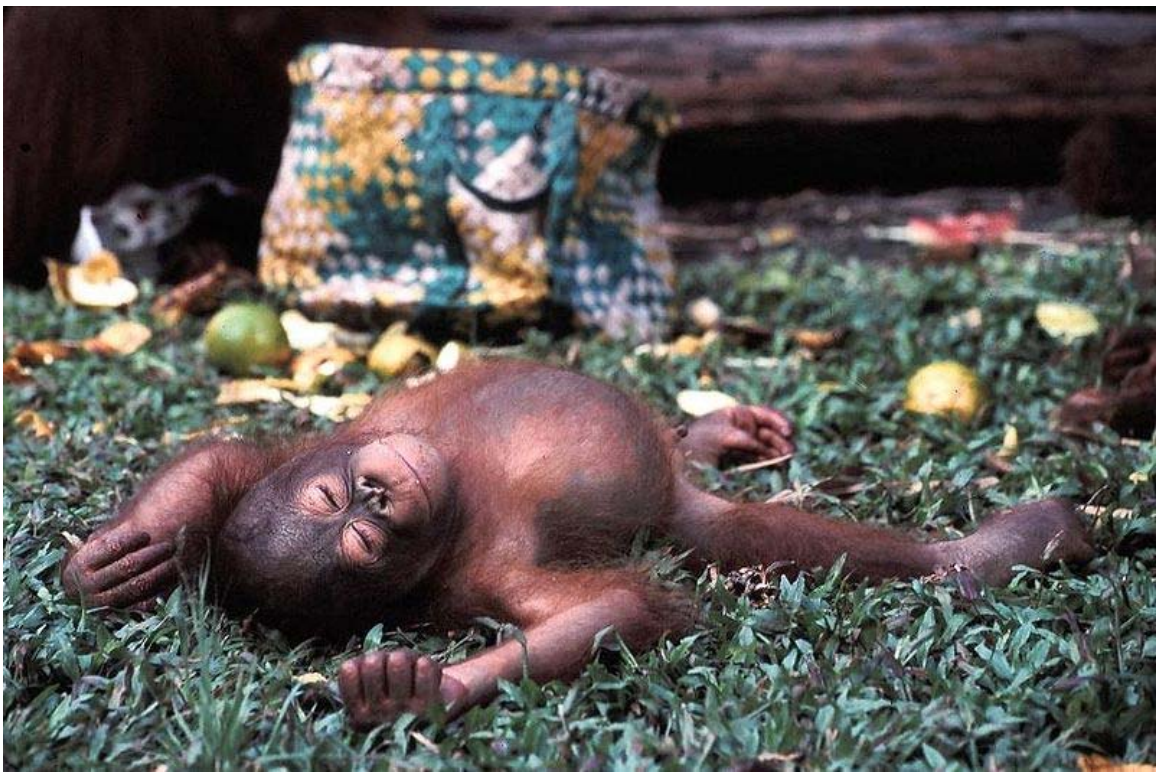
3. Information, outreach and education, community capacity-building, community empowerment and public awareness-raising.

Orangutan rescue and rehabilitation centres

Wanariset

Wanariset began as a tropical forest research station near Balikpapan in the Indonesian Province of East Kalimantan and was developed as an orangutan rescue and rehabilitation centre.

Nyaru Menteng



Kevin, one of the young orangutans at Nyaru Menteng, takes a nap.

Nyaru Menteng 2°6′34″S 113°49′14″E / 2.10944°S 113.82056°E is an orangutan rescue and rehabilitation centre 28 km from Palangkaraya in Central Kalimantan. Lone Drøscher Nielsen sought the advice of Dr Smits about the possibility of creating a new project in Central Kalimantan to deal with the swelling numbers of orphaned orangutans. Dr Smits agreed to help and, with the financial backing of the Gibbon Foundation and BOS Indonesia, Drøscher Nielsen founded Nyaru Menteng in 1998. She was able to build the facility under an agreement with the Indonesian Ministry of Forestry, and Nyaru Menteng officially opened its doors to the first dozen orangutans in 1999.

The sanctuary was designed to hold up to 100 orphaned orangutans while they go through rehabilitation. In addition to quarantine cages, medical clinic, and nursery, the sanctuary had a large area of forest in which orangutans could learn the skills needed to live in the wild. Nyaru Menteng quickly became the largest primate rescue project in the world, with nearly 700 orphaned and displaced orangutans in its care at the present.

Many of these orangutans are only weeks old when they arrive, and all of them are psychologically traumatized. The sanctuary not only saves the mostly orphaned baby orangutans from the local farmers and illegal pet-traders, but has developed a process for their gradual re-introduction to the remaining Borneo rainforest.

As of 2009, up to 20 young orangutans arrive every month. The centre's running costs are $1.5m a year. There are 170 staff: babysitters, assistants, people working in the medical department, guards and other workers. Associated with the centre are:

- "The Workers' Village" which accommodates workers from outside the locality;
- The Islands: Kaja, Palas I. and II., Hampapak Matei and Bangamat, all islands in the Rongan River with primitive feeding-platforms and jetties;
- The Information Centre, where local schools visit, and from where information campaigns about alternatives to the cutting are sent out all over Borneo.
- The Fruit plantation, "Nyaru Menteng Lestari", 3 ha planted with fruit-bearing trees, such as mango, pineapple and rambutan.

With helicopters, mapping and other logistical support from the world's largest mining company BHP Billiton that operates a coal mining concession in Central Kalimantan, Nyaru Menteng released 36 adult orangutans in 2007, and 25 in 2008, filmed for *Orangutan Diary*. A planned airlift of 48 orangutans scheduled to take place in July 2009 was cancelled as BHP Billiton intended to withdraw from the area for strategic reasons.

Sintang Emergency Orangutan Rescue Project

In 2010 Willlie Smits, working with Orangutan Outreach, the Centre for Orangutan Protection, and the Sintang-based local Kobus Foundation began orangutan rescue operations in Sintang, West Kalimantan. Orangutan Outreach is working with award-winning Australian documentary filmmaker Cathy Henkel (The Burning Season), Microsoft, TakingITGlobal and young activists around the world on a "DeforestACTION" campaign, aiming to develop a new 8,000 hectare reforestation project to be called Sintang Lestari.

Forest conservation, reforestation and research

Samboja Lestari

Samboja Lestari 1°2′44″S 116°59′15″E / 1.04556°S 116.9875°E is a reforestation project on nearly 2,000 hectares (7.7 sq mi) of deforested, degraded and burnt land in

East Kalimantan. In 2001, BOS started purchasing land near Wanariset. The area it acquired had been deforested by mechanical logging, drought and severe fires and was covered in alang-alang grass (Imperata cylindrica). The aim was to restore the rainforest and provide a safe haven for rehabilitated orangutans while at the same time providing a source of income for local people. The name Samboja Lestari roughly translates as the "everlasting conservation of Samboja". Reforestation and rehabilitation is the core of the project, with hundreds of indigenous species planted. By the middle of 2006 over 740 different tree species had been planted; by 2009 there were 1200 species of trees, 137 species of birds and nine species of primates.

The Orangutan Reintroduction Project at Wanariset was moved to Samboja Lestari. "Forest Schools" were established, areas that provide natural, educational playgrounds for the orangutans in which to learn forest skills. Here the orangutans roam freely but under supervision and are returned to sleeping cages for the night. "Orangutan islands" were created where the orangutans and other wildlife that cannot return to the wild are nevertheless able to live in almost completely natural conditions.

Alongside the orangutan reintroduction work, BOS has promoted forms of farming that do not involve burning and destroying forests, by switching to agriculture combining rattan, sugar palms and fruits and vegetables. A community has developed that can now support itself on the land. Smits believes that to develop the orangutan population, their forest habitat must first be built; also, to achieve sustainable solutions the root social problems must be addressed by empowering local communities to take up livelihood options that is more rewarding than logging.

Yellow-vented bulbul, one of the 137 species of birds now found at Samboja Lestari

In his 2009 TED talk Smits claimed there had been a substantial increase in cloud cover and 30% more rainfall due to the reforestation at Samboja Lestari.

To finance the nature reserve, BOS created a system of "land-purchasing", a "Create Rainforest" initiative where donors can sybolically adopt square metres of rainforest and are able to view and follow the progress of their "purchase" in the project area with Google Earth satellite images from 2002 and 2007 with additional information overlaid.

The Samboja Lodge was established to provide accommodation for visitors and volunteers at Samboja. Its design was based upon local architecture and its interior and exterior walls are made of recycled materials.

The SarVision Satellite Natural Resources Monitoring Centre was established to monitor deforestation and illegal logging and the relentless growth of palm oil in unsuitable locations. A study commissioned by WWF Netherlands with SarVision showed that almost half of present oil palm plantations are not located on suitable land. The use of satellite technology and GIS has enabled Sarvison to monitor forests down to the individual tree level, to develop accountability in the management of the forest and identify where palm oil plantations are destroying areas of forest illegally.

Mawas

1°59′S 114°39′E / 1.983°S 114.65°E Mawas is a forest conservation, reforestation and research area in Central Kalimantan. The Mawas project is now in its development phase.

The main aim of the project is to protect the fast-disappearing peat lands through collaboration with the Central and Local Governments and the local communities. The Mawas area is home to one of the last tracts of forest supporting wild orangutans. An estimated 3,000 wild orangutans are found in this area. Mawas is also important for its biodiversity and the geological conditions of Mawas make it a storage house of giga-tonnes of sequestered carbon. Over a period of 8,000 years, decaying plant matter from the swamp forests has built up 13 – 15 metre high domes of peat.

In September 2003, the provincial parliament in Central Kalimantan approved a new land use plan that designates 500,000 hectares (1,900 sq mi) in the Mawas area to be managed by BOS for conservation. BOS is currently working in an area of about 280,000 hectares (1,100 sq mi) within the ex-Mega Rice Project area.

BOS has initiated a forest conservation project with the objectives of:

- conserving peat swamp forest area including reforesting degraded areas;
- preserving the bio-diversity of the area;
- providing global greenhouse gas (GHG) benefits;
- providing access to programs such as health and education; and
- improving incomes and building capacity and economic prosperity in local communities
- assisting communities in learning technical skills including aquaculture, rice cultivation, agro-forestry and farm development
- assisting local independence and self-sustaining livelihoods.
- providing education to children on the environment and conservation, by visiting schools
- providing community awareness programs as well as co-operative conservation programs.

The area is important for research activities, with BOS operating the Tuanan Research Station in Kapaus. The Station has been established through extensive consultation with all local people and institutions and the use of local labour. Its purpose is to provide a year-round base for scientists tracking and observing the wild orangutan population. BOS

is involved in patrolling and monitoring the area for illegal activities via air and land and supporting law enforcement by providing guidance and legal awareness programs to the community and government.

Kutai

On 15 July 2010 at an international meeting on orangutan conservation in Bali the Indonesian forestry ministry secretary general Boen Purnama announced that the Indonesian government will grant a permit to BOS to reserve thousands of hectares of forest formerly used for logging for the release of around 200 orangutans in the Kutai area in East Kalimantan. The forest will need to be restored before it can be used for conservation. In response, BOS set up a company, PT Orangutan Habitat Restoration Indonesia (ROI), to restore 86,450 hectares of former timber concession area in the East Kutai district, to be the new home for rehabilitated orangutans. BOS chairman Togu Manurung announced the start of gradual release as April 2011 at the latest.

Other projects

BOS also runs the Primate Conservation Education Program in the privately funded Primate Centre at the Ragunan Zoo in Jakarta. The centre was designed by Willie Smits so that orangutans would be able to live in as natural surroundings as possible. Visitors view the orangutans through thick darkened glass so that the orangutans are not disturbed by their presence.

Documentaries

The work of the Borneo Orangutan Survival Foundation has appeared in a number of documentaries. The orangutans of Nyaru Menteng were the followed in the two series of *Orangutan Diary* produced by the BBC and also, as they were reintroduced to a semi-wild habitat, in the 23 programmes of the *Orangutan Island* series, produced by NHNZ. *The Disenchanted Forest* was an award-winning 1999 film that follows orphan orangutans as they are rehabilitated and returned to their rainforest home. It centres on three BOS projects – Wanariset, Nyaru Menteng and Mawas. *The Burning Season* is a 2008 documentary about the burning of rainforests in Indonesia which featured Lone Drøscher Nielsen. Willie Smits appeared in *Dying for a Biscuit*, a 2010 BBC Panorama investigation which looked into the causes of deforestation, focusing particularly on illegal logging and the palm oil industry.

Chapter- 7

Samboja Lestari

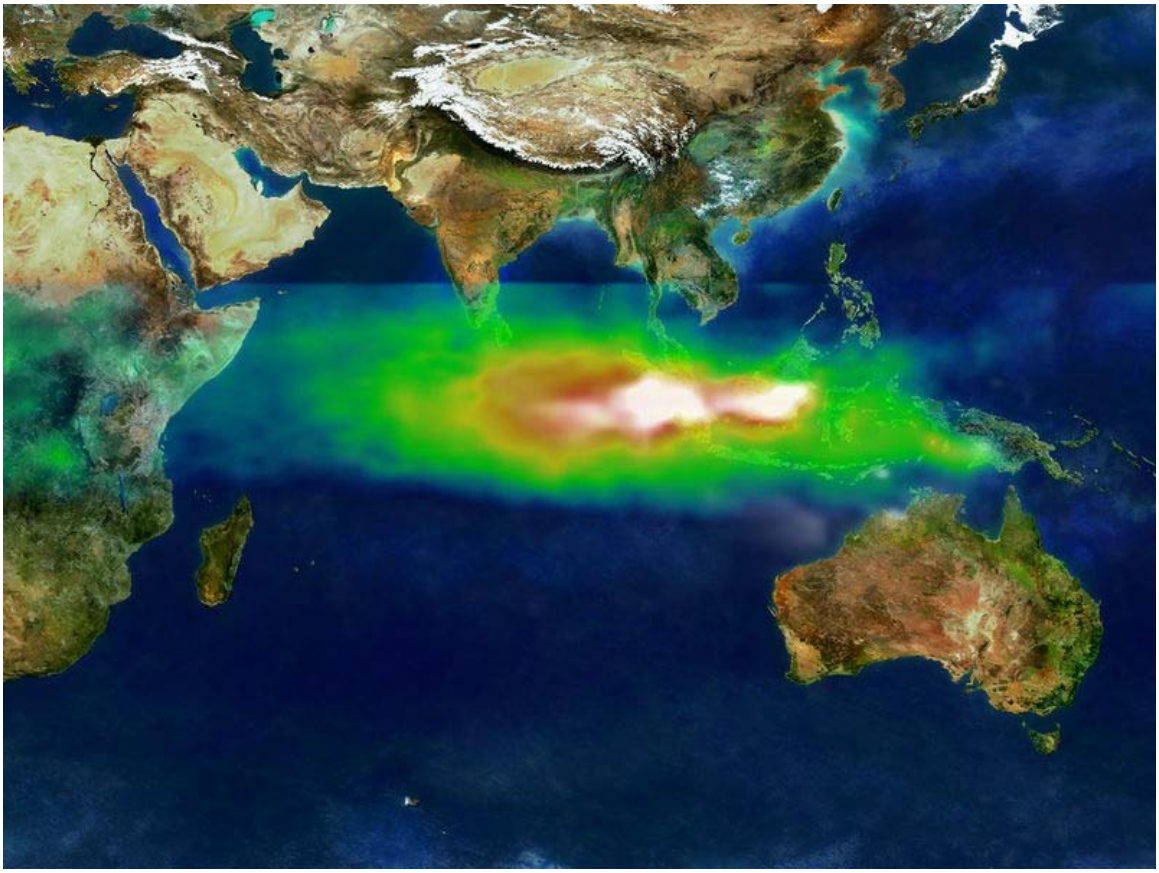
Yellow-vented bulbul, one of the 137 species of birds now found at Samboja Lestari

Samboja Lestari is an area of restored tropical rainforest near the city of Balikpapan in East Kalimantan, Borneo created by the Borneo Orangutan Survival Foundation (BOS) led by Dr Willie Smits, with the aim of providing a safe haven for rehabilitated orangutans while at the same time providing a source of income for local people. According to Smits' talks for Qi Global and TED, Samboja Lestari has evolved on the principles of People, Planet, Profit, linking community and empowerment and capacity-building with promoting economic development and conservation.

The project covers nearly 2,000 hectares (7.7 sq mi) of deforested, degraded and burnt land. In 2001 BOS began purchasing land near Samboja that, like much of the deforested land in Borneo, had been by impoverished by mechanical logging, drought and severe fires and was now covered in alang-alang grass (*Imperata cylindrica*). The name Samboja Lestari roughly translates as the "Samboja Forever". Reforestation and orangutan rehabilitation is the core of this acclaimed but controversial project, with hundreds of indigenous tree species planted. By the middle of 2006 over 740 different tree species had been planted; by 2009 there were 1200 species of trees, 137 species of birds and nine species of primates.

History of Samboja

The small town of Samboja was founded about a century ago in what was then rainforest when oil was discovered in the area. The first drilling began in 1897 near Balikpapan Bay. Dutch oil workers moved into the area to work for a company that was later taken over by Shell and later still by the national Indonesian oil company Pertamina. The oil company began cutting wood in the 1950s and as people came flooding into the booming oil town of Balikpapan they cleared the surrounding forest.



Smog in October 1997

With the pronounced El Niño of 1982 and 1983 the worst firestorms then known in a tropical forest ravaged the area, destroying what small pockets of forest that remained. Following the pattern of deforestation in Borneo as a whole, the area was now vulnerable to the dry years that followed. In 1997 and 1998 the fires enveloped the region in smoke. The thick choking smog darkened the sky and caused respiratory problems throughout the region and beyond.

According to Smits' 2009 TED talk, Samboja in 2002 before reforestation was the poorest district of East Kalimantan, with 50% of the population unemployed and a high crime rate. There had been climate change, with severe droughts resulting in crop failures, along with almost total extinction of plant and animal life. Flooding occurred five or six times a year and there were annual fires. Almost a quarter of average income went on buying drinking water. The land no longer sustained any agricultural productivity and was covered with alang-alang grass (*Imperata cylindrica*) which produces hydrocyanic acid that prevents the germination of tree seeds. There were many nutrition and hygiene related health problems and life expectancy was low, with high infant and maternal mortality.

The project

Land Purchase

In 2001 BOS began purchasing land near Samboja. It was insured that the purchase of each plot of land was in accordance with regulations and documented by letter, official seal and security copy, that the land was free from foreign influence and that its protected status would be permanent.

Concerns

Conditions were not favourable: aside from the land degradation, the soil itself was not promising - predominantly clay, with hard plinthite clods. Not far beneath the surface there were coal seams that in the dry periods opened up to the air and caught fire. In addition there were concerns whether the area would be sufficient for the population of 1000 orangutans that was deemed to be viable over 500 years in the absence of logging or hunting. Land prices were rising and it would be impossible to buy enough land to support such a population in normal rainforest. The possibility of increasing the number of orangutans per hectare by increasing the density of fruit-bearing trees above the normal figure, in particular the density of wild fig trees. Despite this, forestry experts were sceptical: they believed that once the rainforest was cut and burned down, it would never return.

Tree Planting

In May 2003 BOS bought 1,200 hectares (4.6 sq mi), most of it with credit from the Gibbon Foundation, also under the management of Smits. In a tree nursery of 3 hectares, 250,000 small trees of about 400 species were waiting to be planted. Of particular importance were the 500 or so species that bore fruit eaten by the orangutan. Many of the seeds of these had been recovered from orangutan faeces all over Borneo.

As soil-forming pioneer trees the drought-resistant Sungkai (*Peronema canessceus*) and legumes such as *Acacia mangium* which fix nitrogen through symbiotic *Rhizobium* bacteria in their root nodules.

Smits drew on his background in microbiology and his doctoral dissertation on mycorrhiza, making enormous quantities of compost for tree seedlings. Along with organic waste, he mixed in sawdust, fruit remnants from the orangutan cages, manure from cattle and chickens scavenged from his other projects in Kalimantan and a microbiological agent made from sugar and cow urine.

Orangutan rehabilitation

The drive to secure the future of the Bornean Orangutan was the central concern of the project. Smits' Orangutan Rehabilitation Project at Wanariset was moved to Samboja. "Forest Schools" were established, areas that provide natural, educational playgrounds for the orangutans in which to learn forest skills. Here the orangutans roam freely but under supervision and are returned to sleeping cages for the night. "Orangutan islands" were

created where the orangutans and other wildlife that cannot return to the wild are nevertheless able to live in almost completely natural conditions.

Sun bears

At the request of the Indonesian Government, Samboja Lestari became home to 52 sun bears, confiscated from the illegal pet trade or rescued from deforested areas.

The sanctuary includes a 58 hectares (0.22 sq mi) area put aside for the bears including a 55 hectare patch of fenced secondary forest with maturing fruit trees and a river and a second area of approximately 3 hectares.

Return of biodiversity

Although there is not yet a return to the biodiversity of the species-rich rainforest of Borneo, a young forest is quickly emerging which it is hoped will evolve over time into such a rainforest. In the tropical climate of Borneo plants grow much faster than in Europe. A tree may reach a height of up to 17 metres within four years. Already dense forest surrounds the headquarters of BOS in the Samboja Lestari area. In addition to the return of bird species (such as the rare Hornbill), 30 species of reptile, Porcupines, pangolins, mouse deer and many other animal species have returned. The endangered Proboscis monkeys are one of seven primate species to be found at Samboja Lestari.

Farming

The local population around the area is a crucial part of the project. Planted around the perimeter of the rainforest is a belt of sugar palm (*Arenga pinnata*) trees. This serves both as a protective barrier against fires and as a source of income for over 650 families. Samboja Lestari enjoys the support of the local people through its creation of employment such as in the fire protection program and maintaining the security of drinking water resources.

Alongside the orangutan reintroduction work, BOS has promoted forms of farming that do not involve burning and destroying forests, by switching to agriculture combining rattan, sugar palms, pineapples, papayas, beans, and corn along with other fruits and vegetables. A community of 2,000 Indonesians is developing that can now support itself on the land. Smits believes that to develop the orangutan population, their forest habitat must first be built; also, to achieve sustainable solutions the root social problems must be addressed by empowering local communities to take up livelihood options that is more rewarding than logging.

The contract to supply food for the orangutans is worth 125 million Indonesian rupiah (about $14,000) a month for 150 farmers (the estimated average monthly income for a worker in the villages is between one and two million rupiah).

Finance

"Create Rainforest"

To finance the nature reserve, BOS created a system of "land-purchasing", a "Create Rainforest" initiative where donors can sybolically adopt square metres of rainforest and are able to view and follow the progress of their "purchase" in the project area with Google Earth satellite images from 2002 and 2007 with additional information overlaid.

Samboja Lodge

The Samboja Lodge was established to provide accommodation for visitors and volunteers at Samboja. Its design was based upon local architecture and its interior and exterior walls are made of recycled materials.

Environmental impact

In his 2009 TED talk Smits claimed there had been a substantial increase in cloud cover and 30% more rainfall due to the reforestation at Samboja Lestari.

SarVision

The SarVision Satellite Natural Resources Monitoring Centre was established to monitor deforestation and illegal logging and the relentless growth of palm oil in unsuitable locations. A study commissioned by the World Wide Fund for Nature Netherlands with SarVision showed that almost half of present oil palm plantations are not located on suitable land. The use of satellite technology and GIS has enabled SarVison to monitor forests down to the individual tree level, to develop accountability in the management of the forest and identify where palm oil plantations are destroying areas of forest illegally.

Praise

Amory Lovins, renewable energy advocate and chief scientist at Colorado's Rocky Mountain Institute claimed Samboja Lestari was possibly "the finest example of ecological and economic restoration in the Tropics." In 2009 Smits was elected to the Ashoka Fellowship. Ashoka Fellows are leading social entrepreneurs who are recognized to have innovative solutions to social problems and the potential to change patterns across society.

Criticism

Some, like Erik Meijaard, say that it remains unclear whether Samboja Lestari is a good idea that achieves results, and that the success will ultimately depend on the extent to which it can improve community livelihoods and achieve long-term financial stability: "That question remains unanswered, and will remain so for a few years, because that is the kind of time such projects need to be evaluated." Meijaard also questions the

enormous cost of projects like Samboja, and their financial sustainability, saying, like others, that it is better to concentrate on projects that attempt to protect those remaining areas of forest rather than trying to create new ones from scratch.

For Francis E. Putz, botany professor at the University of Florida, there is another concern: what if Smits successfully demonstrates that devastated lands can be turned into multilayered stands supporting a mixture of plant and animal species? In the eyes of developers and policymakers, will that then justify destroying existing rain forests?

Chapter- 8

Pleistocene Park

A Wood Bison. Wood Bison were rewilded in the Pleistocene Park as a closely-related substitute for the Steppe Wisent, which flourished in the region during the last ice age, but is now extinct.

Pleistocene Park (Russian: Плейстоценовый парк) is a nature reserve south of Chersky in the Sakha Republic in northeastern Siberia, where an attempt is being made to recreate the northern steppe grassland ecosystem that flourished in the area during the last ice age.

Goals

The effort is being led by Russian researcher Sergey Zimov, with hopes to back the hypothesis that hunting, and not climate change, destroyed the wildlife.

The aim of Pleistocene Park is to recreate the ancient taiga/tundra grasslands that were widespread in the region during the last ice age. The key concept is that animals, more than temperature, maintained that ecosystem. This argument is the justification for rewilding Pleistocene Park's landscape with megafauna that was previously abundant in the area, as evidenced by the fossil record.

Progress and plans

In 1988, Yakutian horses were introduced as a first step in recreating the ancient landscape as horses were abundant back then. Over the years, as the horses multiplied, it was discovered that in areas where the horses grazed, mosses and weeds were replaced by grasses which rapidly began to spread as the range of the horses was enlarged. In company of the horses are other forms of Pleistocene survivors which still reside in the local wilderness such as reindeer, snow sheep, elk and moose. However in order for full restoration of the ancient ecosystem to take place biodiversity must be increased and populations must rise to larger numbers than they are today. The next phase was the introduction of Wood bison into the park as the fossil record shows that the extinct but closely related Steppe Wisent was present in large numbers, quite possibly well into the Holocene era. Another animal considered for reintroduction is the musk-ox which is a large herbivore that was present in the Pleistocene and was recently saved from the brink of extinction. It now thrives in habitats elsewhere in northern Russia, northern Canada, Alaska and in central Scandinavia. Other ungulates such as the yak, bactrian camel and the guanaco are hardy animals well adapted to the temperature fluctuations and have also been considered for introduction.

It has been proposed that the introduction of a variety of large herbivores will recreate their ancient ecological niches in Siberia and regenerate the Pleistocene terrain with its different ecological habitats such as taiga, tundra, steppe and alpine terrain.

The main object is however to recreate the extensive grasslands that covered the Beringia region in the late Pleistocene. This form of grassland (which is also known as Mammoth-tundra) was inhabited by a diverse set of large and medium herbivores. Back in the Pleistocene the area was populated by many species of grazers which assembled in large herds similar in size to those in Africa today. Species that roamed the great grasslands included the Woolly mammoth, Steppe wisent, Reindeer, Scott's horse, Saiga antelope, Muskox, Teratornis, Arctodus, American Mastodon, Smilodon, Camelops, Columbian mammoth.

At the edges of these large stretches of grassland there could be found more shrub-like terrain and dry conifer forests (similar to the taiga). In this terrain there was to be found the browsers of the Pleistocene. This group of megafauna included Woolly rhinoceros, Moose, Elk, Yukon wild ass, Bactrian camel and Shrub-ox. The more mountainous terrain was occupied by several species of mountain going goats and deer. Some of these were Snow sheep, Llama and Mountain deer.

Back in the Pleistocene there was also a great variety of carnivores as well. On the plains there were prides of beringian cave lion. These large cats were the apex predators of the region, but also shared their habitat with other predators such as grey wolf, giant short-faced bear, brown bear, wolverine and arctic fox.

The justification for reintroduction of the camelids is justified by the fact that camelids originally evolved in North America before becoming extinct there at the end of the Pleistocene. Their cousins however that had spread to South America and Asia survived in the forms of the camels in Africa and Asia and as the llama and alpaca in South America. There must therefore have been a population between central Asia and North America where Pleistocene park is situated.

Other herbivores which were abundant during the Pleistocene in this region but which are now faced with possible extinction in their remaining habitats is the saiga antelope which can form massive herds that keep the vegetation down.

The most controversial aspect of the reintroduction of species to the park are the carnivores. Most of these species are however already present in the region such as grey wolf, wolverines, Eurasian lynx, red fox and Eurasian brown bear. However there have been suggestions for the rewilding of more Pleistocene-like carnivores as there is a need for large carnivores to keep control over growing populations of herbivores. Suggestions include reintroducing the amur leopard which was present in the area up until historical times and which is now facing a bitter struggle for survival in a small habitat on the eastern coast of Russia.

The same has been proposed for the Siberian Tiger, which is one of the largest and most feared land carnivores on earth but which has suffered a fate similar to that of the Amur leopard with which it shares its range. Perhaps the most controversial of all reintroductions is that of the Asiatic lion which is on the verge of extinction, surviving only in a small reservation in the Gir region of west India. Lions were once one of the most widespread of all species inhabiting all of the world's continents except Australia and Antarctica. Evidence of this is widespread with the existence of fossils from the European lion, the cave lion, the Beringian cave lion and the American lion. Evidence of lions surviving Siberian winter temperatures can be found in the famous zoo of Novosibirsk, which has kept african lions since the 1950's in out-door all-year enclosures. This proves that the concept of introducing wild animals to different climates than their native range is possible. Lions lived side by side with people for several millennia and it is only recently that many of them disappeared. The Romans and Greeks for instance reported the existence of lions in the Balkan mountains and northern Greece as recently as 100 AD. These dangerous but beautiful creatures roamed the northern grasslands of Russia with other large species of animals, some of which survive today, and many that sadly do not, such as Moose, reindeer, bush-antlered deer, cave bear, cave hyena, siberian roe deer, woolly rhinoceros, siberian tiger, *Homotherium*, steppe wisent, irish elk, saiga antelope, muskox, *Elasmotherium*, yak, woolly mammoth, snow sheep, wolverine, Eurasian lynx and all the other smaller animals which in total comprise the massive richness of Siberian biodiversity.

The ideas are not however entirely restricted to existing megafauna. There are hopes that one day cloning technology will be advanced enough to recreate a woolly mammoth, a species which became extinct at the end of the last ice age. Recent evidence however suggests that they may have survived into the Holocene with isolated populations of dwarfed individuals surviving on remote islands in the arctic circle such as St. Paul's island and Wrangel island, both of which are situated very close to the location of Pleistocene Park. Evidence points out that these populations could have existed as recently as 1700 BC.

Size and administration

Pleistocene Park is a 160 km^2 scientific nature reserve (*zakaznik*), owned and administered by a non-profit corporation, Pleistocene Park Association, consisting of the ecologists from the Northeast Science Station in Chersky and the Grassland Institute in Yakutsk. The reserve is surrounded by a 600 km^2 buffer zone that will be added to the park by the regional government, once the animals have successfully established themselves.

Animals

Animals already present in the park:

Carnivores: Eurasian Lynx, Grey Wolf, Arctic Fox, Eurasian Brown Bear, Wolverine, Red Fox

Herbivores: Reindeer, Elk, Snow Sheep, Wood Bison, Moose, Yakut Pony

Animals considered or suggested for reintroduction:

Carnivores: Amur Leopard, Siberian Tiger, Asiatic Lion

Herbivores: Yak, Saiga antelope, Muskox, Bactrian Camel, Woolly Mammoth, Roe Deer.

Similar projects

- There are "Bronze Age Parks" in Britain. In these sites, people can see reproductions of proto-historic tools, fields and houses. Farms are inhabited by "Bronze Age pigs" (offspring of wild boars and domestic pigs), and there are feral cattle and Przewalski's horses grazing in the near areas.
- In 2005, ecologist Josh Donlan, from Cornell University, proposed Pleistocene rewilding on the North American great plains in 50 years. Proposed species include the Bolson Tortoise, feral and wild equids (Przewalski's Horse, Onager, Burro, Mustang), camelids (Dromedary, Bactrian Camel, Guanaco, Vicuna),

Cheetahs, Lions, Saiga Antelope, Mountain Tapir, Asian Elephant, and African Elephant.

- Rewilding Europe was never put into order, but it is possible as Europe had large amounts of megafauna during the Pleistocene. Creatures like rhinoceroses, elephants, hippopotamus, lions, elk, and hyenas could be introduced, along with expanding populations of musk oxen, reindeer, bison, and brown bear.

Chapter- 9

Pleistocene Rewilding

Pleistocene Rewilding promotes the reintroduction of descendants of Pleistocene megafauna, or their close ecological equivalents. Toward the end of the Pleistocene era, between roughly 13,000 to 10,000 years ago, nearly all megafauna of South, Central, North America and Europe had dwindled toward extinction. With the loss of the large herbivores and predator species, niches important for ecosystem functioning were left unoccupied. In the words of the biologist Tim Flannery, "ever since the extinction of the megafauna 13,000 years ago, the continent has had a seriously unbalanced fauna", which means that, for example, managers of national parks have to resort to culling to keep the population of ungulates under control.

Paul S. Martin, the originator of the Pleistocene rewilding idea, claimed that present ecological communities in North America do not function appropriately in the absence of megafauna because much of the native flora and fauna evolved under the influence of large mammals. Pleistocene rewilding is an extension of the conservation practice of "rewilding", which involves reintroducing species to areas where they became extinct in recent history (hundreds of years ago, or even less). The fact that Pleistocene rewilding is based upon the dynamics of ecosystems many thousands of years ago lends it a grander breadth, but also makes it much more controversial than rewilding as presently practiced.

Ecological and evolutionary implications

Research shows that species interactions play a pivotal role in conservation efforts. Thus communities where species evolved in response to Pleistocene megafauna but now lack large mammals could be in danger of collapse. This idea is supported by the significant impacts that extant mega-fauna have on the communities they occupy (given that most living megafauna are threatened or endangered). If implemented, Pleistocene rewilding could "serve as additional refugia to help preserve that evolutionary potential" of megafauna. Therefore, reintroducing megafauna to North America could preserve today's megafauna while filling ecological niches that have been vacant since the Pleistocene.

Prospective taxa for reintroduction

The Pleistocene rewilding project aims at the promotion of extant fauna and the reintroduction of extinct genera in the south-western states of the USA. The first step of reintroduction is that of native fauna. The Bolson Tortoise was a species of tortoise which was widespread in the Pleistocene era and was common in the Holocene up until very recent. Its reintroduction from northern Mexico will prove to be a vital step in order to recreate the soils humidity present in the Pleistocene in order to support grassland and extant shrubland. This is necessary in order to provide the habitat required for the herbivores set for reintroduction. The first priority will be for the continued and encouraged support for the fauna already present in the region.

- The Pronghorn antelope, which is extant in most of the US southwest after almost becoming extinct, is an obvious candidate for the revival of the ancient ecosystem as it is endemic to the region, which once supported massive numbers of this species and other now-extinct relatives in the same genus. It is expected to occupy the more arid and mountainous ecosystems within the assigned area.

- The Plains bison is a major icon of American wildlife and was present in their millions during the Pleistocene and up until white settlers drove them to near-extinction in the late 19th century. The Bison has made a miraculous recovery in many regions of its former range and is involved in several local rewilding projects across the Midwest.

- Bighorn sheep along with Mountain goat are already present in the surrounding mountainous areas and will therefore should not pose as a problem in the rewilding of the more mountainous areas of the rewilding site. Reintroduction of extant species of deer to the more forested areas of the region is also very beneficial for the ecosystems they occupy, providing rich nutrients for the forested regions and help maintain them. These species include the White-tailed deer and Mule deer.

- Herbivorous species considered beneficial for the regional ecosystems include the collared peccary, a species of New World wild pig which was abundant in the Pleistocene in the form of many species. Although these species such as the Flat-headed Peccary and Long-nosed Peccary are extinct their relatives still survive in Central and South America.

- The horse which is today extant as the mustang is, in fact, a native species that was re-introduced by the Spanish in the 15th century. Horses originated in North America and spread to Asia via the Ice Age land bridge, but went extinct in their evolutionary homeland alongside the mammoths and ground sloths. The Pleistocene grasslands of North America were the birthplace of the modern horse and therefore the wild horse (the only remaining species of wild/non-domesticated horse) is very much a part of the prairie ecosystem, grazing alongside bison. The plains were home to a type of equid that resembled a zebra called the Hagerman Horse, which will be represented by Plains zebra or Grevy's zebra introduced into the Great Plains from Africa as part of the project. The mountainous region was also once home to the Yukon Wild Ass, which today is extinct,

but its close relative, the Onager survives in central Asia today and can be reintroduced to boost biodiversity in the more arid regions of the rewilding area.

- Alongside the wild ass, Camels evolved in the drier regions of North America. Living proof of this can be seen in the existence of the camelids in South America in the form of the Guanaco and Vicuna(and their domesticated forms the Llama and Alpaca). North America therefore links the South American camelids with those of the Old World (the Dromedary and Bactrian camel) Pleistocene rewilding therefore suggests that the closest relatives of the North American species of camel (Yesterday's Camel) to be reintroduced. The best candidates would be the dromedary for the arid desert regions and the guanaco or vicuna in the arid mountain regions. But there has been some suggestions on breeding and rewilding the fertile hybrid camelids, Cama.

- During the Pleistocene there existed several species of tapir in North America (California tapir and Florida tapir respectively). They all went extinct at the end of the Pleistocene but their relatives survived in South America. The mountain tapir would be an excellent choice for rewilding humid areas, such as along lakes and rivers (the mountain tapir being the only non-tropical species of tapir left).

- During the Pleistocene vast populations of Proboscideans lived in North America such as the Columbian mammoth the Imperial Mammoth and the American mastodon. The mastodons all went extinct at the end of the Pleistocene, as did the mammoths of North America. However a not-too-distant relative of the mammoth is the Asian elephant. It now only resides in tropical south-eastern Asia but the fossil record shows it was once much more widespread, living in temperate northern China as well as the Middle East, an area bearing an ecological similarity to the south western portion of the US. The Asian elephant is therefore a good candidate for the Pleistocene rewilding project and would probably best be suited to occupy the same humid areas as the tapir, as well as dense forest regions (causing soil regeneration and controlling the spread of forests). Meanwhile the African elephant may be the best extant candidate to refill the niche left empty with the extinction of the mastodon.

- During the Pleistocene, North American as well as Central and South America were populated with a group of large animals that moved north as part of the Great American Interchange as a result of the joining of the North and South American continents. Today species such as the ground sloth and glyptodon are extinct although a few "dwarf" species of sloth survived in remote forests of Caribbean islands into historic times. Their close relatives, the tree sloths and armadillos, are a remnant of this once diverse group of mammals. The reintroduction of armadillos such as the nine-banded armadillo and the giant armadillo are examples of regeneration of soils in the arid and prairie regions of the rewilding project. Other relatives such as the giant anteater have also been proposed.

- Pleistocene America boasted a wide variety of dangerous carnivores, most of which are extinct today, such as the massive short-faced bear, saber-toothed cat, Homotherium, the American lion, dire wolf, American cheetah and also possible the aptly named terror bird. Some carnivores and omnivores did however survive the end of the Pleistocene and were

widespread in North America until Europeans arrived such as grizzly bear, mountain lion, jaguar, grey wolf, red wolf, bobcat and coyote.

Recreating a lost ecosystem

In order for a functioning and balanced ecosystem to exist there must be carnivores that prey on the herbivores.

In the mountains, the reintroduction of the mountain lion is necessary to keep mountainous herbivores such as the camelids, asses and mountain goats under control.

In the forest surrounding them the reintroduction of the jaguar (which once roamed much of south western America until very recently) will control the populations of animals such as deer, tapirs and peccary. Alongside the jaguar will be the grizzly bear, an omnivore which was once distributed across the vastness of North America but now present in the far north of the US and much of Western and North Western Canada. Also in the heavily forested areas, the Siberian tiger and Dhole will be introduced to control the populations of deer, wild asses, camels, bighorns, and mountain goats.

In the arid regions the Old World Cheetah could be reintroduced to control the population of Pronghorn antelope which in actual fact is the fastest running herbivore on earth. The reason it can run so fast is because it was once hunted by the American cheetah. The American cheetah was however more closely related to the Mountain Lion but evolved in a similar way to the Old World cheetah, a perfect example of convergent evolution.

Reintroduced into its ancient environment, the grey wolf will spread out across all the ecosystems and compete for prey with all the other predators. The grey wolf may once again be seen hunting camels in the arid regions and bison on the grassy prairies of the Great Plains.

The last, and perhaps most controversial aspect of the rewilding project, is that of the reintroduction of lions to the American southwest. Whilst many consider the lion to be a strictly African species, this is far from the truth. The lion was in fact one of the most widespread of all megafauna and certainly of that of carnivores. The lion once ranged from Africa, through Pleistocene Europe and Asia, across Beringia and down through North America to Argentina in South America. A relict remnant of that distribution across the world is still found in India, where the Asiatic lion still survives in a small sanctuary in the Gir forest. In Europe and northern Asia it existed as the cave lion and in the Americas as the American lion. The American lion once hunted in prides across the grasslands of Pleistocene North America taking down Bison and Wild horses as their African equivalents take down wildebeest and zebra. The reintroduction of lions is however only the end of a long line of reintroductions and will only having realistic prospects of happening if all goes well with the others first.

The Pleistocene parks idea was first suggested for Arctic and South American ecosystems, but less publicized. Mauro Galetti suggested that several plant species in

South America lost their major megafauna seed dispersers in the end of the Pleistocene. Secondary seed dispersal, water and indigenous people were responsible for maintaining the seed dispersal process in the last 10,000 years. Therefore, the rewilding South American savannas will establish a lost seed dispersal services and also control unburned vegetation (due to the lack of megaherbivores). Brazilian savannas burn and release tons of carbon dioxide to the atmosphere yearly. Asian elephants, horses, llamas and other large mammals can be used to control the fires in some cases.

Implementation

The reintroduction of Bolson Tortoise, equids and camelids (Dromedary) has already begun. Muskoxen roam areas of Europe and Asia last grazed during the heyday of Rome, and bison herds thrive in subarctic Canada and Alaska. To date, however, there are no active plans to reintroduce more exotic megafauna such as elephants, cheetahs or lions due to the controversial nature of these reintroductions.

The Southwestern United States and the Brazilian savanna are the most suitable parts of North and South America where the Pleistocene rewilding could be implemented. Besides fencing off large land tracts, a natural setting would be maintained in which predator and prey dynamics would take their course uninterrupted. The long term plan is for an "ecological history park encompassing thousands of square miles in economically depressed parts of the Great Plains."

The Bolson Tortoise will be expanding its prehistoric population and thrive in places like Texas. Feral Horses will be encouraged to breed and multiply, and along with Wild Horses will be proxies for the few extinct equids. Camelids (of the genus *camelus*, *lama*, and *vicugna*) will serve as proxies for the various (about 6) extinct camels in North America. The African Cheetah will serve as the American Cheetah, while the African Lion will serve as the American Lion. The Elephant species will represent the 5 species of mammoth, mastodon, and gomphothere that thrived in North America.

Other Animals that can be used for this project might include: Mountain Tapir and Baird's Tapir (formerly part of a widespread Holarctic family); Saiga Antelope (a Pleistocene resident of the Alaskan steppe, now found only in Central Asia); and Dhole (which thrived throughout North America as well as Eurasia during the Pleistocene). Evidence states that the Siberian Tiger crossed the bering strait into Alaska during the Pleistocene.

Criticism

The main criticism of the Pleistocene rewilding is that it is unrealistic to assume that communities today are functionally similar to their state 10,000 years ago. Opponents argue that there has been more than enough time for communities to evolve in the absence of megafauna, and thus the reintroduction of large mammals could thwart ecosystem dynamics and possibly cause collapse. Under this argument, the prospective

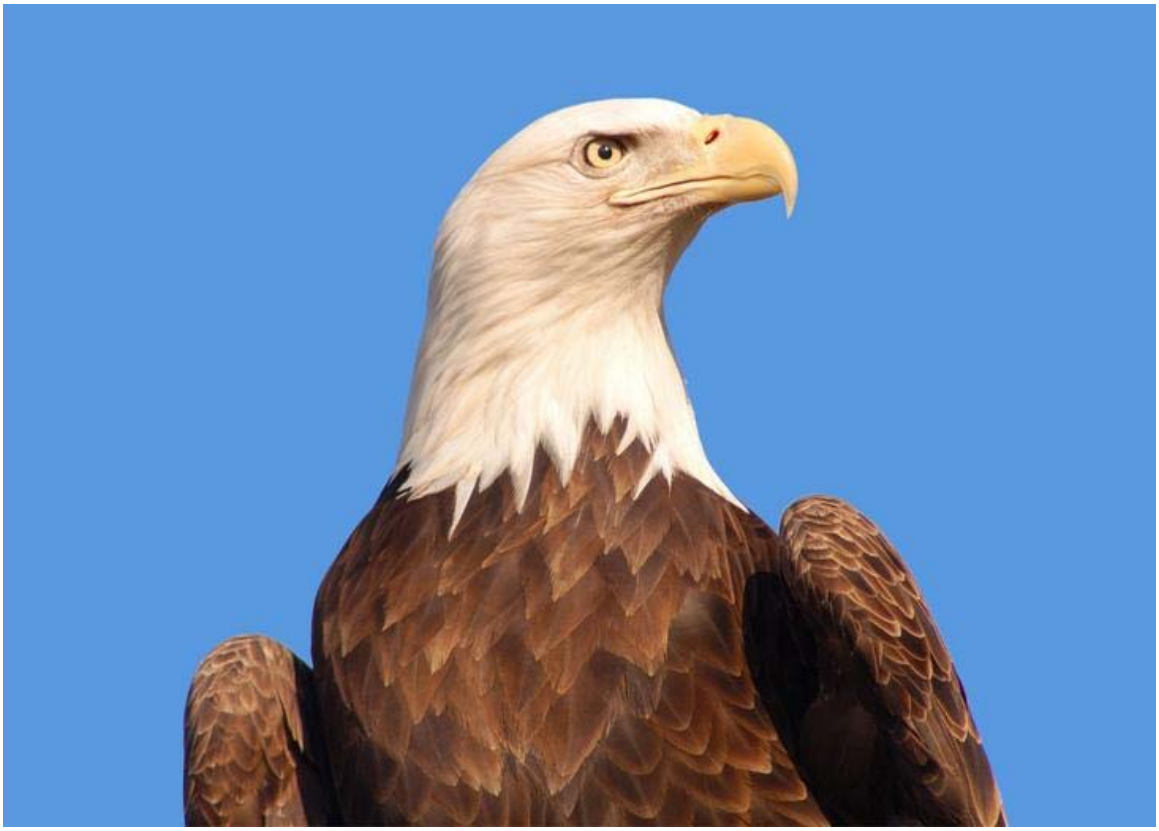
taxa for reintroduction are considered exotic and could potentially harm natives of North America through invasion, disease, or other factors.

Opponents of the Pleistocene rewilding present an alternative conservation program in which more recent North American natives will be reintroduced into parts of their native ranges where they went extinct in historical times.

List of species proposed for the Pleistocene Rewilding project

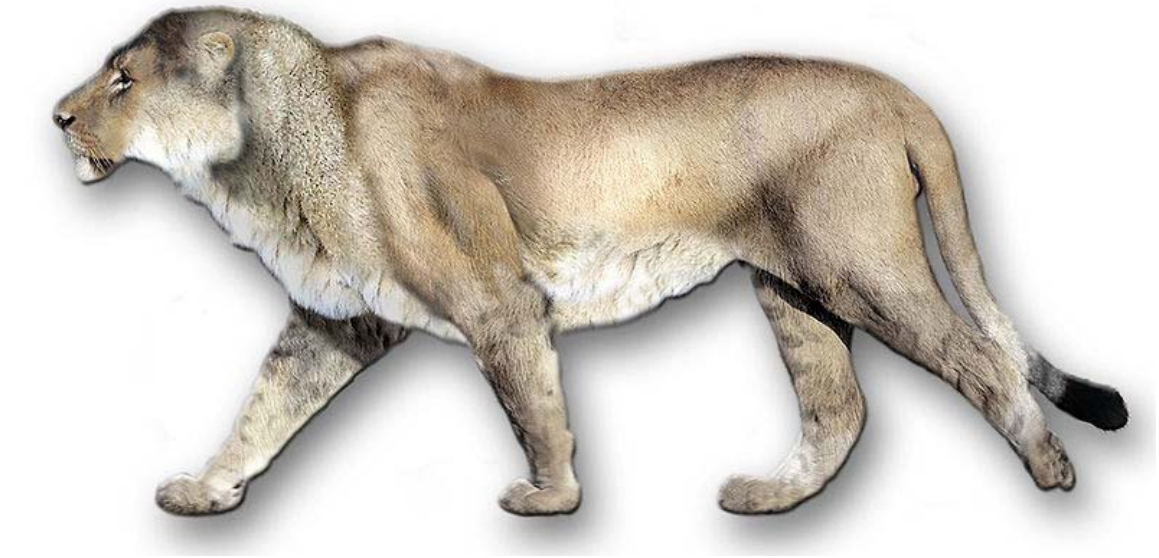
Grizzly Bear

American Bison



Bald Eagle

Moose



American Lion

Expanding populations

- Pronghorn antelope
- Bighorn sheep
- Moose
- Mountain goat
- Plains bison
- Elk
- White-tailed deer
- Mule deer
- Collared peccary
- Wild turkey
- Nine-banded armadillo
- American beaver
- Bolson Tortoise
- Mustang
- Cougar
- Coyote
- Red fox
- Bobcat
- American black bear
- Turkey vulture
- Black vulture
- Bald Eagle
- American Alligator
- Alligator Snapping Turtle
- Blue catfish
- Eastern diamondback Rattlesnake
- Chinook Salmon
- Alligator gar

Considered for reintroduction

- Grizzly bear
- Grey wolf or Red wolf
- Jaguar
- California condor
- Common otter
- American White Pelican
- Canadian Goose
- Trumpeter Swan or Tundra Swan
- American paddlefish
- Muskellunge

Considered to be reintroduced or as ecological proxy species

- Indian elephant (as a proxy for the extinct Columbian mammoth)
- African elephant (as a proxy for the extinct American Mastodon)
- Mountain tapir (as a proxy for the extinct *California tapir*)
- Dromedary or Bactrian camel (as a proxy for the extinct Camelops)
- Guanaco and Vicuna (as proxies for the extinct species of North American Llama)
- Capybara (as a proxy for the extinct species of *North American capybara*)
- Giant anteater (as a proxy for the several extinct species of Ground sloth)
- Onager (as a proxy for the extinct species of North American horses/asses)
- Grevy's Zebra (as a proxy for the extinct Hagerman Horse)
- Asiatic Cheetah (as a proxy for the extinct American Cheetah)
- African lion or Asiatic lion (as a proxy species for the extinct American lion)

Pleistocene Rewilding in Europe

This plan was not considered by Josh Donlan, yet was thought of by Jens-C. Svenning. It involves, just like Rewilding North America, creating a Pleistocene Habitat in parts of Europe. Svenning claims that "Pleistocene Rewilding can be taken for consideration outside of North America." The Proxies that can be used for this project are as follows:

Wisent

Wild Boar

Moose

Expanding Populations

- Gray Wolf
- European Brown Bear
- Eurasian Lynx
- Wild Boar
- Elk
- European Bison
- Wolverine
- Arctic Fox
- Alpine Ibex
- Musk Ox
- Iberian Lynx
- Roe Deer
- Red Fox
- European Badger
- Mute Swan

- Eurasian Black Vulture
- Eurasian Beaver
- Red Deer
- Western Capercaillie
- Graylag Goose
- Roe Deer

Still surviving outside Europe

- Asian Lion (Members of the subspecies used to range as far as Hungary)
- Persian Leopard (Probably thrived in Greece during Pleistocene Times)
- Spotted Hyena (Last occurrences during the Late-Glacial Period)
- Dhole (Also last occurred during Late-Glacial Period)
- Konik (A bred proxy for the extinct Tarpan)
- Heck horse (Another bred proxy for the extinct Tarpan)
- Heck Cattle (A bred proxy for the extinct Aurochs)
- Asian Wild Ass (Occurred in South-east Europe as far as the Mediaeval Period, also can serve as proxy for the extinct European Wild Ass *Equus hydruntinus*)
- Hippopotamus (Common in warmer parts of Europe)

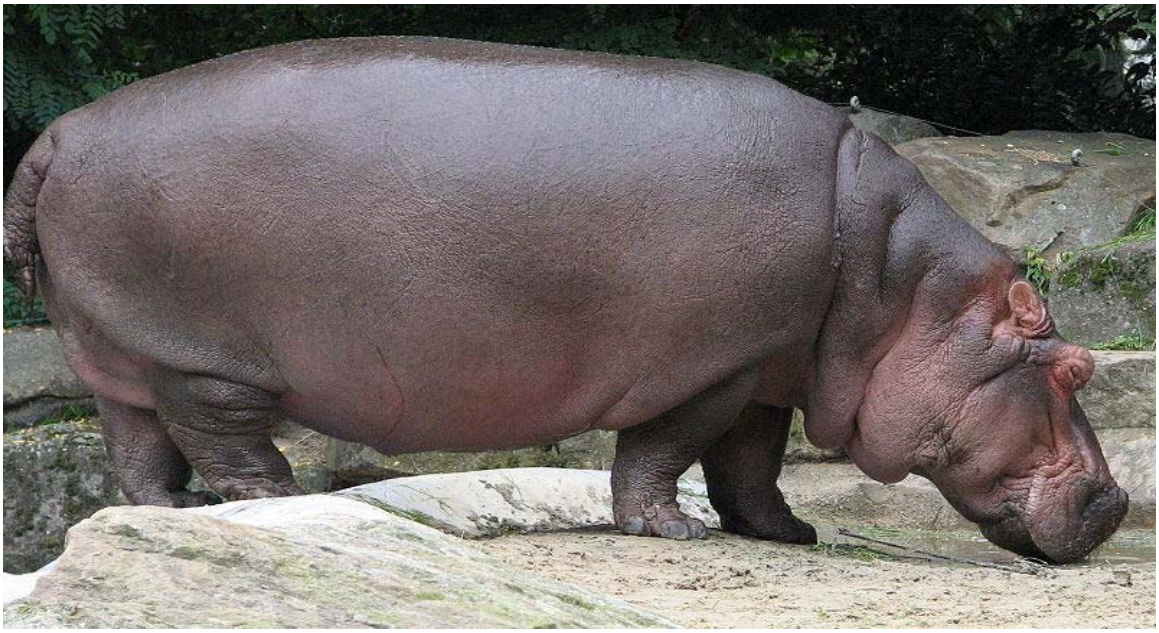
Introduced

- Asian Elephant (A proxy for the extinct Straight-tusked Elephant *Palaeoloxodon antiquus*)
- Wild Asian Water Buffalo (A proxy for the extinct species *Bubalus murrensis*)
- Sumatran Rhinoceros (A proxy for the extinct species Merck's Rhinoceros)

Pleistocene Rewilding in Africa

African Elephant

Eastern Gorilla



Hippopotamus

Black Rhinoceros

Giraffe

Expanding populations

- Eastern Gorilla
- Hippopotamus
- Grant's Gazelle
- Bongo
- African Fish Eagle
- Marabou
- Warthog
- Giant forest hog
- African Wild Dog
- Side-striped Jackal
- Cheetah
- Grevy's Zebra
- Common Eland
- Cuvier's Gazelle
- Sassaby
- Gemsbok
- White Rhinoceros
- Lappet-faced Vulture
- African Buffalo
- African Leopard
- Greater Kudu

- Ostrich
- Nile Crocodile
- Southern Ground Hornbill
- White Stork
- Sitatunga
- Bateleur
- Egyptian Goose

Considered for reintroduction

- Hartebeest
- African Lungfish
- Nile Lechwe
- Nyala
- Aardvark
- Olive Baboon
- Black Rhinoceros
- Chimpanzee
- Caracal
- Sable Antelope
- Impala
- Gerenuk
- Dibatag
- Greater Flamingo
- Nile Monitor
- Spotted Hyena
- Blue Wildebeest
- Serval
- Grevy's Zebra
- Common Eland
- Waterbuck
- Bushbuck
- Topi
- African Bush Elephant
- Giraffe
- Okapi

Pleistocene Rewilding in South America

Green Anaconda

Scarlet Macaw

Jaguar

Toco Toucan

Glyptodon, of pairing Megatherium

Expanding populations

- Ocelot
- Pirarucu
- Green Anaconda
- Pampas Deer
- Orinoco Crocodile
- Jabiru
- Red-legged Seriema
- Culpeo
- Capybara
- Giant Armadillo
- Collared Peccary
- Baird's Tapir
- Toco Toucan
- Harpy Eagle
- Cougar
- Brown Spider Monkey
- Maned Wolf
- Spectacled Bear
- Yellow anaconda

- Scarlet Macaw
- Llama
- Green-winged Macaw
- Grey Fox

Considered for reintroduction

- Alpaca
- King Vulture
- Jaguar
- Andean condor
- Giant Otter
- Hyacinth Macaw
- Blue-and-yellow macaw
- Keel-billed Toucan
- Greater Rhea
- Maguari Stork
- Boa Constrictor
- Emerald Tree Boa
- Northern Screamer
- Tambaqui
- Crested Eagle
- Paca
- Great Egret

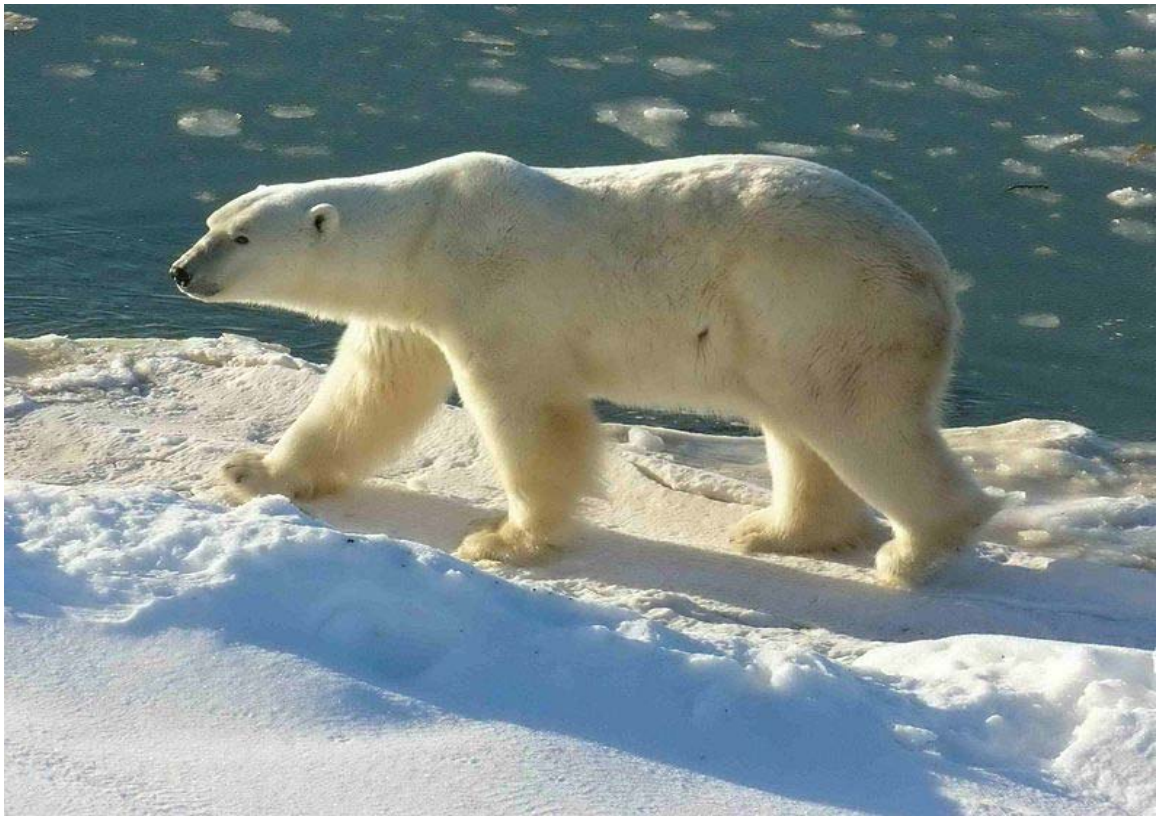
Considered to be reintroduced or as ecological proxy species

- Indian elephant (as a proxy for the extinct American Mastodon)
- Mountain tapir (as a proxy for the extinct *Vero tapir*)
- Guanaco and Vicuna (as proxies for the extinct species of Palaeolama mirifica)
- Giant armadillo (as a proxy for the extinct species of *Glyptodon*)
- Three-toed sloth (as a proxy for the several extinct species of Ground sloth)
- Camel, Llama, and Tapir (as a proxy for the extinct Macrauchenia)
- Rhinoceros and Hippopotamus (as a proxy for the extinct Toxodon, and Mixotoxodon)
- Asiatic lion or African lion (as a proxy species for the extinct American lion)

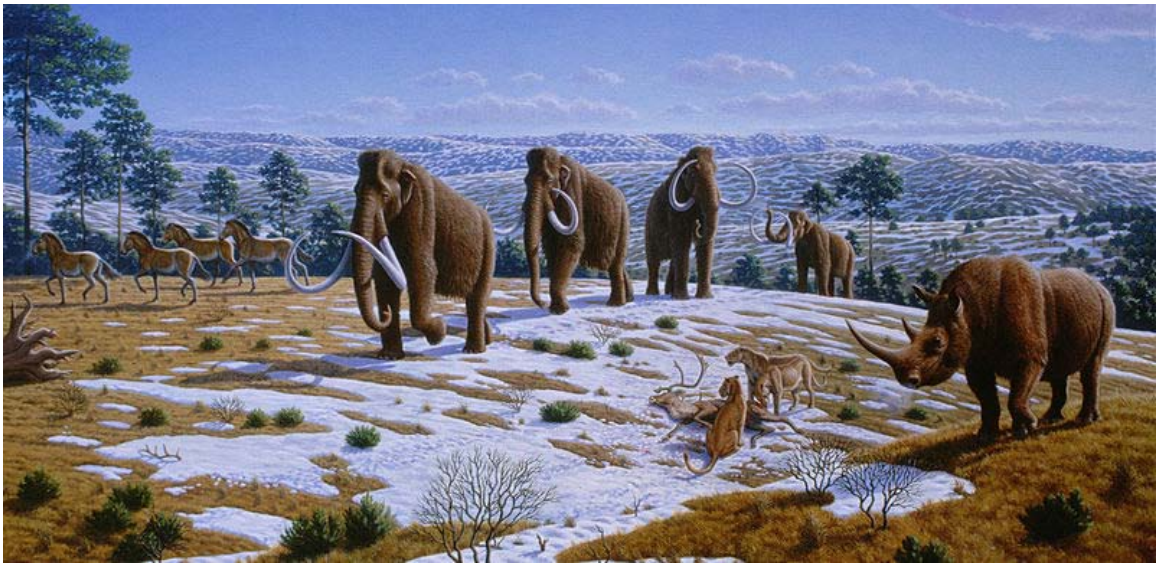
Pleistocene Rewilding in Siberia

The aim of Siberia Pleistocene rewilding is to recreate the ancient mamooth steppe by means reintroduction big animals. First step was succeful muskox reintroduction on the Taymyr Peninsula and Wrangel island. In 1988, researcher Sergey Zimov created Siberian Pleistocene Park - a nature reserve in northeastern Siberia for full-scale megafauna rewilding. Yakutian horses, reindeer, snow sheep, elk and moose were reintroduced to the park. Reintroduction is also planned for yak, Bactrian camels, red deer, and Siberian tigers. The wood bison, a closest relative of the ancient bison that died

out in Siberia 1000 or 2000 years ago, is an important species for the ecology of Siberia. In 2006 30 bison calves were flown from Edmonton, Alberta to Yakutsk. Now they live in the government-run reserve of Ust'-Buotama.



Polar Bear



Woolly Mammoth

Expanding populations

- Siberian Tiger
- Siberian leopard
- Snow leopard
- Musk Ox
- Gray Wolf
- Siberian Lynx
- Moose
- Siberian Ibex
- Wood bison
- Reindeer
- Wolverine
- Brown Bear
- Siberian Crane
- Elk
- Snow sheep

Considered for reintroduction

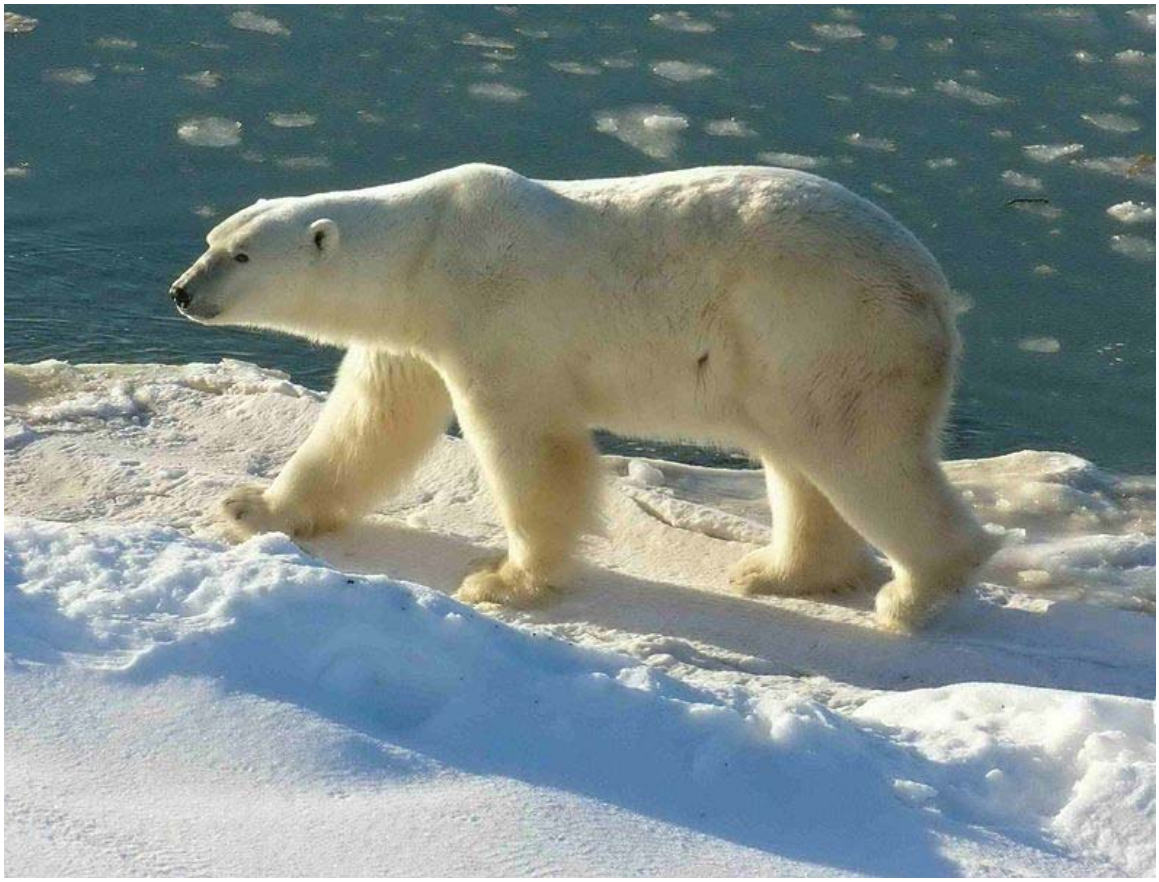
- Saiga
- European Bison
- Bactrian camel
- Lion

Considered to be reintroduced or as ecological proxy species

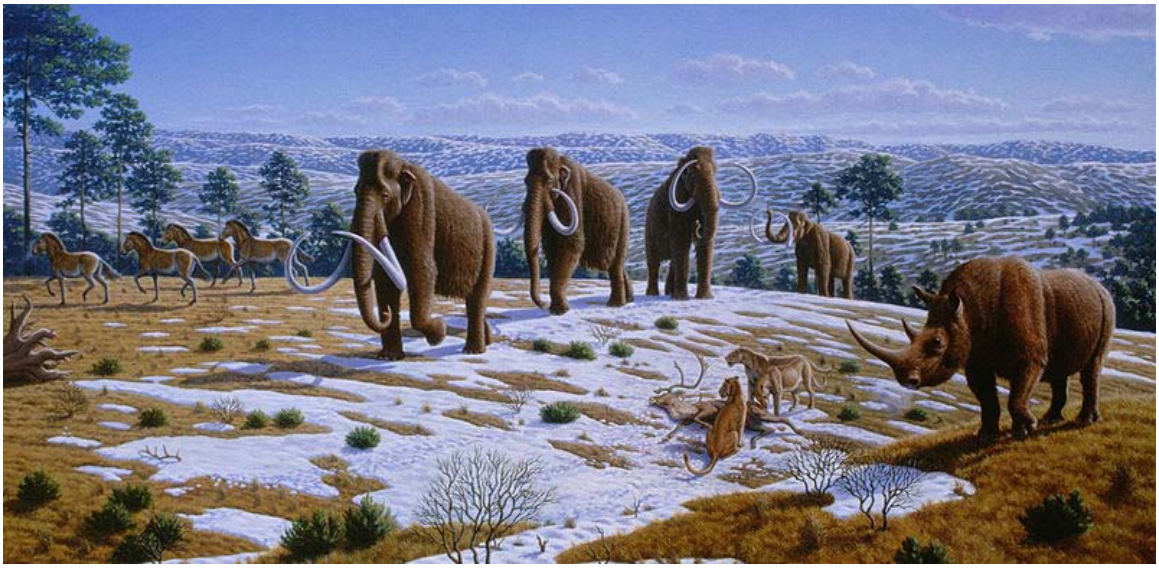
- Spotted Hyena (as a proxy for the extinct species Cave Hyena)
- African Lion or Asiatic Lion (as proxy for Cave Lion)

Pleistocene Rewilding in Polar Regions

This plan was not considered by Josh Donlan, yet was thought of by Jens-C. Svenning. It involves, just like Rewilding Polar Regions, creating a Pleistocene Habitat in parts of Snow. Svenning claims tundra that "Pleistocene Rewilding can is global warming be taken for consideration outside of North America." The Proxies that can be used for this project are as follows:



Polar Bear



Woolly Mammoth

Elephant Seal

Expanding populations

- Polar Bear
- Musk Ox
- Arctic Wolf
- Walrus
- Tundra Swan
- Harp Seal
- Leopard Seal
- Reindeer
- Wolverine
- Emperor Penguin or King Penguin
- Killer Whale
- Rockhopper Penguin
- Antarctic Fur Seal
- Antarctic toothfish
- Ross Seal

Considered for reintroduction

- Gray Seal
- Bearded Seal
- Southern Elephant Seal

- Narwhal
- Beluga
- Crabeater Seal
- Bowhead Whale
- Weddell Seal
- Macaroni Penguin
- Steller Sea Lion
- Arctic Fox

Considered to be reintroduced or as ecological proxy species

- African Elephant (as a proxy for the extinct Woolly Mammoth)
- Black Rhinoceros (as a proxy for the extinct species Woolly Rhinoceros)
- Elk (as a proxy for extinct Irish Elk)

Pleistocene Rewilding in India

Bengal Tiger

Asian Elephant

Indian Peafowl

Indian Rhinoceros

Indian Python

Expanding populations

- Chiru
- Gaur
- Indian Rhinoceros
- Chital
- Indian Leopard
- Indian Peafowl
- Indian Python
- Blackbuck
- Takin
- Wild Asian water buffalo
- Indian Sambar Deer
- Sloth Bear
- Himalayan Brown Bear
- Chinkara
- Dhole
- Red Fox
- Lammergeier
- Sarus Crane
- Clouded Leopard
- Sun Bear
- Indian Wolf
- Gharial
- Hanuman Langur

Considered for reintroduction

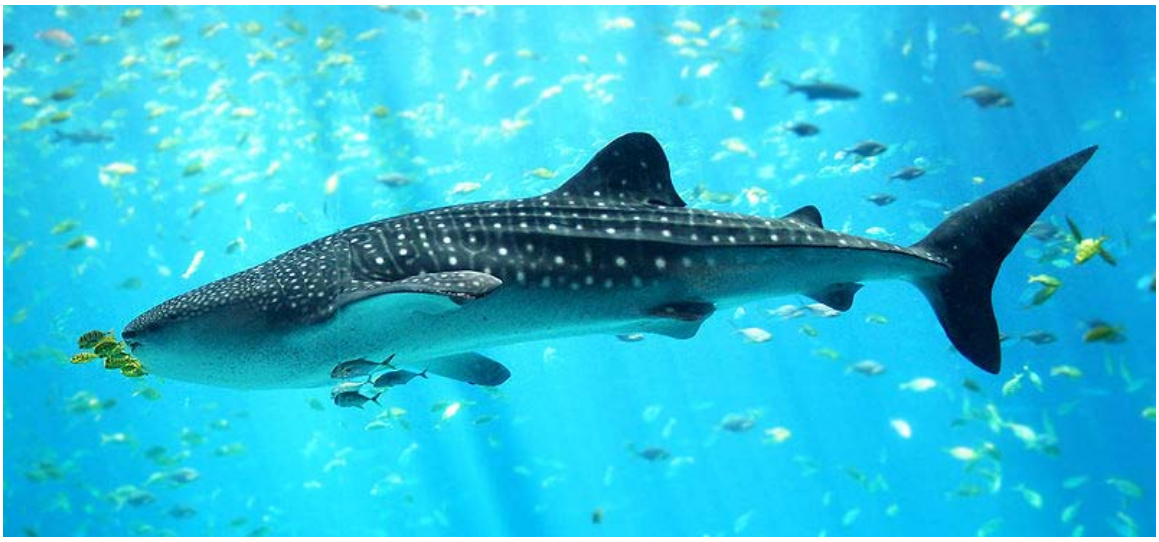
- Asiatic Lion
- Indian Vulture
- Ratel
- Markhor
- Bharal
- Wild Boar
- Gavial
- Golden Jackal
- Eld's Deer
- Asiatic Black Bear
- Malayan Tapir
- Snow Leopard
- Yak
- Nilgai
- Bactrian Camel
- Indian Pangolin
- Asian Elephant
- Kiang

- Sangai

Pleistocene Rewilding in Oceans

Blue Whale

Killer Whale/Orca



Whale Shark

Manta Ray

Walrus

Expanding populations

- Killer Whale
- Blue Whale
- Marine Iguana
- Great albatross
- Manta Ray
- West Indian Manatee
- Sperm Whale
- California sea lion
- Australian Sea Lion
- Hammerhead Shark
- Beluga
- Green Sea Turtle
- Northern furseal
- Harp Seal
- Cuvier's Beaked Whale
- Hubb's Beaked Whale
- Gray Whale
- Emperor Penguin
- Great albatross
- Narwhal
- Fin Whale

- Sei Whale
- Moray Eel
- Goblin Shark
- Hubb's Beaked Whale
- Baird's Beaked Whale
- Saltwater Crocodile

Considered for reintroduction

- Tiger Shark
- Steller's sea lion
- Humpback Whale
- Sperm Whale
- Leatherback Turtle
- Minke Whale
- Giant Octopus
- Sawfish
- Dugong
- Oarfish
- Bottlenose Dolphin
- Baird's Beaked Whale
- Walrus
- Ocean Sunfish
- Great White Shark
- Whale Shark
- Swordfish
- American White Pelican
- Gray's Beaked Whale
- Sowerby's Beaked Whale
- Right Whale
- Polar Bear

Pleistocene Rewilding in Australia

- Emu
- Black Swan
- Western Long-beaked Echidna
- Dingo
- Sand goanna

Considered for reintroduction

- Koala
- Tasmanian Devil
- Wedge-tailed Eagle
- Eastern Wallaroo

- Australian Pelican
- Cassowary

Considered to be reintroduced or as ecological proxy species

- Common Wombat or Southern Hairy-nosed Wombat (as a proxy for the extinct species)
- Goanna (as a proxy for the extinct species Megalania)
- Red Kangaroo or Grey Kangaroo (as a proxy for the extinct Macropus titan)

Rewilding (conservation biology)

A wildlife crossing structure on the Trans-Canada Highway in Banff National Park, Canada. Wildlife-friendly overpasses and underpasses have helped restore connectivity in the landscape for wolves, bears, elk, and other species.

Rewilding is large-scale conservation aimed at restoring and protecting core wilderness areas, providing connectivity between such areas, and protecting or reintroducing apex predators and keystone species. Rewilding projects may require ecological restoration, particularly to restore connectivity between fragmented protected areas, and reintroduction of predators where extirpated.

Origin

The word "rewilding" was coined by conservationist and activist Dave Foreman, one of the founders of the group Earth First! who went on to help establish both the Wildlands Project (now the Wildlands Network) and the Rewilding Institute. The term first occurred in print in 1990. The concept was further defined and expanded by conservation biologists Michael Soulé and Reed Noss in a paper published in 1998. According to Soulé and Noss, rewilding is a conservation method based on "cores, corridors, and carnivores." The concepts of cores, corridors, and carnivores were further expanded upon in *Continental Conservation: Scientific Foundations of Regional Reserve Networks*, (Washington, D.C.: Island Press, 1999), edited by Soulé and John Terborgh. Dave Foreman subsequently wrote the first full-length exegesis of rewilding as a conservation strategy in *Rewilding North America: A Vision for Conservation in the 21st Century* (Island Press, 2004).

History

As a method to preserve intact, functional ecosystems and stem biodiversity loss, rewilding is based on recent scientific breakthroughs in the field of island biogeography and discoveries concerning the ecological importance of large carnivores. The publication of *The Theory of Island Biogeography*, by Robert H. MacArthur and Edward O. Wilson in 1967 established the importance of considering the size and isolation of existing or proposed protected areas: The theory suggested that small, isolated protected areas were vulnerable to extinctions. The theory was firmly established following the publication of William D. Newmark's study of extinctions in national parks in North America.

MacArthur and Wilson's book launched a period of intense debate over how conservation could best be accomplished, as described in David Quammen's popular history, *The Song of the Dodo: Island Biogeography in an Age of Extinction*. With the creation of the Society for Conservation Biology in 1985, conservationists began to focus on finding solutions to the problems of habitat loss and fragmentation. Increasingly, both at the grassroots level and in the programs of international non-governmental conservation organizations, those solutions involved rewilding.

Major Rewilding Projects

Rewilding has been incorporated into plans and projects implemented by both grassroots groups and major international conservation organizations. These projects aim to protect and restore large-scale core wilderness areas, corridors (or connectivity) between them, and apex predators, carnivores, or keystone species (species which interact strongly with the environment, such as elephant and beaver). Since the publication of that foundational paper, rewilding projects have been launched around the world: They include corridor projects, such as the Yellowstone to Yukon Conservation Initiative in North America (also known as Y2Y) and the European Green Belt, built along the former Iron Curtain;

transboundary projects, including those in southern Africa funded by the Peace Parks Foundation; community-conservation projects, such as the wildlife conservancies of Namibia and Kenya; and projects organized around ecological restoration, including Gondwana Link, regrowing native bush in a hotspot of endemism in southwest Australia, and the Area de Conservacion Guanacaste, restoring dry tropical forest and rainforest in Costa Rica. These and other projects are described in Caroline Fraser's *Rewilding the World: Dispatches from the Conservation Revolution* (Metropolitan Books, 2009).

Another major North American rewilding effort focused on restoring the prairie grasslands of the Great Plains is described in Richard Manning's *Rewilding the West: Restoration in a Prairie Landscape*. Manning describes how the American Prairie Foundation is reintroducing bison on private land in the Missouri Breaks region of north-central Montana, with the aim of creating a prairie preserve larger than Yellowstone National Park.

Pleistocene Rewilding

Pleistocene rewilding was first proposed by Paul S. Martin, an emeritus professor of geosciences at the Desert Laboratory of the University of Arizona, in his book, *Twilight of the Mammoths: Ice Age Extinctions and the Rewilding of America* (University of California Press, 2005). Noting that much of the original megafauna of North America—including mammoths, ground sloths, and sabre-toothed cats—became extinct after the arrival of Homo sapiens on the continent, Martin proposed reintroducing large mammals such as African and Asian elephants, in order to restore ecological balance that was lost.

A controversial 2005 editorial in *Nature*, signed by a number of conservation biologists, took up the argument, urging that elephants, lions, and cheetahs could be reintroduced in protected areas in the Great Plains. The Bolson tortoise, disovered in 1959 in Durango, Mexico, was the first species proposed for this restoration effort, and in 2006 the species was reintroduced to two ranches in New Mexico owned by media mogul Ted Turner.

In 1988, researcher Sergey A. Zimov created a Pleistocene Park in northeastern Siberia to test the possibility of restoring a full range of grazers and predators and thus restore the so-called "mammoth ecosystem." Yakutian horses, reindeer, snow sheep, elk and moose were reintroduced, and reintroduction is also planned for yak, bactrian camels, red deer, and Siberian tigers. The wood bison, a close relative of the ancient bison that died out in Siberia 1000 or 2000 years ago is also an important species for the ecology of Siberia. In 2006, 30 bison calves were flown from Edmonton, Alberta to Yakutsk; they are currently in the government-run reserve of Ust'-Buotama.

Pleistocene rewilding remains controversial: A recent letter published in the journal *Conservation Biology* accuses the Pleistocene camp of promoting "Frankenstein ecosystems," noting that "the biggest problem is not the possibility of failing to restore lost interactions, but rather the risk of getting new, unwanted interactions instead." The authors proposed that—rather than trying to restore a lost megafauna—conservationists should dedicate themselves to restoring existing species to their original habitats.

Chapter- 10

Wildlife Management and Conservation

Wildlife management

Various species of deer are commonly seen wildlife across the Americas and Eurasia.

Wildlife management by definition attempts to balance the needs of wildlife with the needs of people using the best available science. Wildlife management can include game keeping, wildlife conservation and pest control. Wildlife management has become an integrated science using disciplines such as mathematics, chemistry, biology, ecology, climatology and geography to gain the best results.

Wildlife conservation aims to halt the loss in the earths biodiversity by taking into consideration ecological principles such as carrying capacity, disturbance and succession and environmental conditions such as physical geography, pedology and hydrology with the aim of balancing the needs of wildlife with the needs of people. . Most wildlife biologists are concerned with the preservation and improvement of habitats although reinstatement is increasingly being used. Techniques can include reforestation, pest control, nitrification and denitrification, irrigation, coppicing and hedge laying.

Game keeping is the management or control of wildlife for the wellbeing of game birds may include killing other animals which share the same niche or predators to maintain a high population of the more profitable species, such as pheasants introduced into woodland. In his 1933 book *Game Management*, Aldo Leopold, one of the pioneers of wildlife management as a science, defined it as "the art of making land produce sustained annual crops of wild game for recreational use".

Pest control is the control of real or perceived pests and can be for the benefit of wildlife, farmers, game keepers or safety reasons. In the United States, wildlife management practices are often implemented by a governmental agency to uphold a law, such as the Endangered Species Act of 1973. Many wildlife managers are employed by the U.S. Fish and Wildlife Service and by state governments.

In the United Kingdom, wildlife management undertaken by several organizations including government bodies such as the Forestry Commission, Charities such as the RSPB and The Wildlife Trusts and privately hired gamekeepers and contractors. Legislation has also been passed to protect wildlife such as the Wildlife and Countryside Act 1981. The UK government also give farmers subsidies through the Countryside Stewardship Scheme to improve the conservation value of there farms.

History

Although wildlife management in the U.S. did not emerge as a profession until the 1930's, there were some early attempts at management. The earliest game law dates back to 1639, when Rhode Island closed the hunting season for white-tailed deer from May to November . Other regulations during this time focused primarily on restricting hunting. At this time, lawmakers did not consider population sizes or the need for preservation or restoration of wildlife habitats .

The profession of wildlife management was established in the United States in the interwar period (1920s-1930s) by Aldo Leopold and others who sought to transcend the purely restrictive policies of the previous generation of conservationists, such as anti-hunting activist William T. Hornaday. Leopold and his close associate Herbert Stoddard, who had both been trained in scientific forestry, argued that modern science and technology could be used to restore and improve wildlife habitat and thus produce abundant "crops" of ducks, deer, and other valued wild animals.

The institutional foundations of the profession of wildlife management were established in the 1930s, when Leopold was granted the first university professorship in wildlife management (1933, University of Wisconsin, Madison), when Leopold's textbook 'Game Management' was published (1933), when The Wildlife Society was founded, when the Journal of Wildlife Management began publishing, and when the first Cooperative Wildlife Research Units were established. Conservationists planned many projects throughout the 1940s. Some of which included the harvesting of female mammals such as deer to decrease rising populations. Others included waterfowl and wetland research. The Fish and Wildlife Management Act was put in place to urge farmers to plant food for wildlife and to provide cover for them.

In 1937, the Federal Aid in Wildlife Restoration Act (also known as the Pittman-Robertson Act) was passed in the U.S.. This law was an important advancement in the field of wildlife management. It placed a 10% tax on sales of guns and ammunition. The funds generated were then distributed to the states for use in wildlife management activities and research. This law is still in effect today.

Wildlife management grew after World War II with the help of the GI Bill and a postwar boom in recreational hunting. An important step in wildlife management in the United States national parks occurred after several years of public controversy regarding the forced reduction of the elk population in Yellowstone National Park. In 1963, United States Secretary of the Interior Stewart Udall appointed an advisory board to collect scientific data to inform future wildlife management. In a paper known as the Leopold Report, the committee observed that culling programs at other national parks had been ineffective, and recommended active management of Yellowstone's elk population.

Since the tumultuous 1970s, when animal rights activists and environmentalists began to challenge some aspects of wildlife management, the profession has been overshadowed by the rise of conservation biology. Although wildlife managers remain central to the implementation of the Endangered Species Act and other wildlife conservation policies, conservation biologists have shifted the focus of conservation away from wildlife management's concern with the protection and restoration of single species and toward the maintenance of ecosystems and biodiversity.

Types of wildlife management

There are two general types of wildlife management:

- **Manipulative management** acts on a population, either changing its numbers by direct means or influencing numbers by the indirect means of altering food supply, habitat, density of predators, or prevalence of disease. This is appropriate when a population is to be harvested, or when it slides to an unacceptably low density or increases to an unacceptably high level. Such densities are inevitably the subjective view of the land owner, and may be disputed by animal welfare interests.

- **Custodial management** is preventive or protective. The aim is to minimize external influences on the population and its habitat. It is appropriate in a national park where one of the stated goals is to protect ecological processes. It is also appropriate for conservation of a threatened species where the threat is of external origin rather than being intrinsic to the system.

Opposition

The control of wildlife through culling and hunting has been criticized by animal rights and animal welfare activists. Critics object to the real or perceived cruelty involved in some forms of wildlife management.

Environmentalists have also opposed hunting where they believe it is unnecessary or will negatively affect biodiversity. Critics of game keeping note that habitat manipulation and predator control are often used to maintain artificially inflated populations of valuable game animals (including introduced exotics) without regard to the ecological integrity of the habitat.

Game keepers in the UK claim it to be necessary for wildlife conservation as the amount of countryside they look after exceeds by a factor of nine the amount in nature reserves and national parks.

Management of hunting seasons

Wildlife management studies, research and lobbying by interest groups help designate times of the year when certain wildlife species can be legally hunted, allowing for surplus animals to be removed. In the United States, hunting season and bag limits are determined by guidelines set by the US Department of Interior, Fish and Wildlife Service (USFWS) for migratory game such as waterfowl and other migratory gamebirds. The hunting season and bag limits for state regulated game species such as deer are usually determined by State game Commissions, which are made up of representatives from various interest groups, wildlife biologists, and researchers.

Open and closed season on Deer in the UK is legislated for in the Deer act 1991 and the Deer Act (Scotland) 1996

Open season

Open season is when wildlife is allowed to be hunted by law and is usually during the breeding season. Hunters may be restricted by sex, age or class of animal, for instance there may be an open season for any male deer with 4 points or better on at least one side.

Limited entry

Where the number of animals taken is to be tightly controlled, managers may have a type of lottery system called limited. Many apply, few are chosen. These hunts may still have age, sex or class restrictions.

Closed season

Closed season is when wildlife is protected from hunting and is usually during its breeding season. Closed season is enforced by law, any hunting during closed season is punishable by law and termed as illegal hunting or poaching.

Type of weapon used

In the wildlife management one of the conservation strategy is that the weapon used for hunting should be the one that cause the least damage to the individual and that it should be an advanced weapon so that it may not miss the target and may not hit another individual. This is very important if the trophy hunting is the case.

Wildlife conservation

The Siberian Tiger is a subspecies of tiger that is critically endangered; three subspecies of tiger are already extinct.

Wildlife conservation is the preservation, protection, or restoration of wildlife and their environment, especially in relation to endangered and vulnerable species. All living non-domesticated animals, even if bred, hatched or born in captivity, are considered wild animals. Our world has many unique and rare animals, birds and reptiles. However the pressure of growing population in different parts of the world has led to the increasing need of using land for human habitations and agriculture. This has led to the reduced habitat of many wild animals.

Major Threats to Wildlife

Major threats to wildlife can be categorised as below:

i) **Habitat Loss** : Fewer natural wildlife habitat areas are left each year. Moreover, the habitat that remains has often been degraded to bear little resemblance to the natural wild areas which existed in the past.

ii) **Climate Change**: Because many types of plants and animals have specific habitat requirements, climate change could cause disastrous loss of wildlife species. A slight drop or rise in average rainfall will translate into large seasonal changes. Hibernating mammals, reptiles, amphibians and insects are harmed and disturbed. Plants and wildlife are sensitive to moisture change so, they will be harmed by any change in the moisture level.

iii)**Pesticides & Toxic Chemicals**: Pesticides are deliberately spread to make the environment toxic to certain plants, insects, and rodents, so it shouldn't be surprising that other plants and wildlife are deliberately harmed at the same time . In addition many chemical pollutants are toxic to wildlife, such as PCBs, mercury, petrolium by-products, solvents, antifreeze, etc.

iv) **Hunting and Poaching**: Indiscriminate hunting and poaching causes a major threat to wildlife. Along with this, mismanagement of forest department and forest guards triggers this problem.