

Biodiversity conservation - from a crisis-discipline to proactive meta-population management

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WITH THE ONSET OF THE INDUSTRIALIZATION 250 years ago, the World's natural resources have been exploited at an alarming rate. Some fossil commodities, such as coal and crude oil, are diminishing rapidly, and sustainable use is impossible, because the formation of new oil and coal deposits require millions of years. In contrast, biodiversity generally has a rapid "recycling" time. Given the right conditions most animal and plant species can sustain significant levels of continuous harvest, provided that off-take does not exceed the rate of reproduction. Unfortunately, biodiversity is in rapid decline across the World. The extinction of species has reached a rate that is 1000-10.000 times higher than the "normal" rate (IUCN, 2007), and exceeds the cataclysmic Cretaceous–Paleogene extinction event that triggered the end of the dinosaur era (Keller, 2012; Renne et al., 2013; Schulte et al., 2010).

In contrast to the Cretaceous–Paleogene extinction, the modern time rapid extinction of species is caused by a combination of all-too-familiar threats such as climate change, habitat loss, over-exploitation, invasive species and diseases. Whereas this often results in "direct" extinctions the collateral damage caused by anthropogenic activities can also have serious negative impact on species, for example, as a result of wild populations becoming small and fragmented. When this happens a new threat emerges. The added vulnerability of small populations to random stochastic processes (e.g. environmental variation, catastrophes, random variation in survival and reproduction, skewed sex ratio, genetic drift, inbreeding etc) that can feed back into each other, will cause a species to be caught in a so-called "extinction vortex" described by Gilpin and Soulé (1986). Once caught in this downward spiral, it is extremely difficult to reverse the extinction, even if the original primary threats (e.g. poaching, habitat

destruction, diseases) are removed. Biodiversity conservation therefore needs to consider all threats to species survival, both long-term and immediate, and both deterministic and stochastic, because more species will require intensive management at the level of populations and individuals to avoid extinction in the future. In practice, this means that species conservation must evolve from being largely a "crisis discipline" that focuses mainly on the results of failure - extinction - to a proactive discipline that incorporates the major biological attributes of success (Redford et al., 2011). For many species it is not solely about preventing individuals from going extinct, but to manage the *risk* of extinction across a meta-population. This requires a high degree of "integrated conservation" that includes scenarios with hardly any human intervention in wild populations as well as intensively managed populations in human care (Gusset and Dick, 2013; Byers et al., 2013). For example, small, fenced reserves can play critical conservation roles for species on the edge of extinction, however, such setups necessitate periodic translocation of animals to mimic natural dispersal and maintain gene flow (and Gusset, 2013; Gusset et al., 2009).

In the past decade, Indonesia, along with all other countries in Southeast Asia, has enjoyed a tremendous economic growth. Much of this have been sustained through agricultural expansion at the expense of ecosystem integrity with severe habitat fragmentation across the landscape. This new ecological state of affairs requires a new conservation approach that embraces the ecological and social reality of the 21st century. The role of national authorities responsible for natural resources management must develop far more proactive conservation management than merely removing primary extinction causes. Managing the



Figure 1. A very rare picture of two Critically Endangered Javan leopards, *Panthera pardus melas*, photographed in Baluran National Park, East Java, in October, 2013. The total remaining wild population is estimated at below 200 individuals in small fragmented habitats. ©Indra Warman.

extinction risk is critical, and authorities must consider genetic flow, exchange and enrichment when and where necessary. Failing to do so will result in local extinction that in turn can lead to regional extinction --- that is, the extinction vortex has begun (Beaune et al. 2013; Canale et al., 2012; Gibson et al. 2013).

Vast undisturbed ecosystems (e.g. Northwest territories in Canada, Serengeti in Tanzania and Kenya, Siberia) require relatively little extinction risk management. In contrast, countries with heavily fragmented landscapes (e.g. United Kingdom, Denmark, Germany) require constant meta-population management of rare and endangered species. In Southeast Asia, Thailand, Cambodia, Vietnam and Malaysia have long joined the group of nations with heavily fragmented landscapes, and Indonesia is rapidly approaching this ecological condition too. Particularly Java, Sulawesi and Sumatra need effective meta-population management for many charismatic species such as Sumatran tiger (*Panthera tigris sumatrae*), Javan warty hog (*Sus verrucosus*), Javan and Sumatran rhino (*Rhinoceros sondaicus* and *Dicerorhinus sumatrensis*), Javan leopard (*Panthera pardus melas*) (Fig.1), Banteng (*Bos javanicus*),

Babirusa (*Babyrousa sp.*), anoa (*Bubalus quarlesi*) and a long list of critically endangered birds and amphibians. Conserving a species is no longer as confined to simply removing human influences. In many countries many species have become reliant on the direct and indirect ways and magnitudes in which humans manage the world, including changed land use patterns, alteration of landscapes (e.g. dams), creation of new physical structures, availability of alternate foods, presence of new competitors and mutualists, and even changed flows of energy and nutrients (Berger, 2004; Gusset et al, 2009; Laurance et al., 2004; Redford et al 2012; Redford et al. 2011; Watson et al. 2005).

Southeast Asia suffered a critical extinction crisis in the recent decades and biodiversity conservation needs a boost in meta-population management across the region. With numerous species listed as “critically endangered” on the IUCN-redlist, however, with a well-established natural resources management infrastructure, Indonesia is in a favourable position to provide a much needed lead in transforming biodiversity conservation practice from a crisis discipline into a proactive integrated and success discipline in Southeast Asia.

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