

IN245 Density and distribution of Sulawesi megafauna, Indonesia

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Megafauna (large animals) are important in forest conservation for two main reasons:

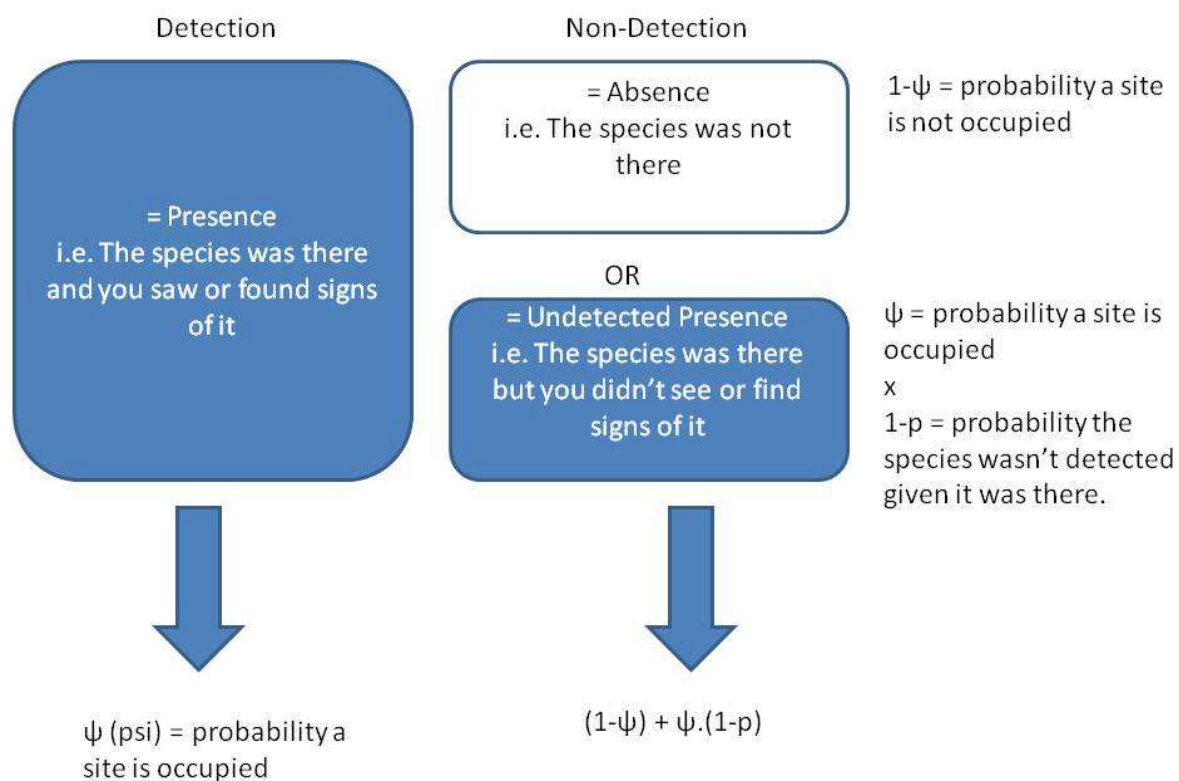
1. They provide candidates for 'flagship' or 'umbrella' species: those which can be used as icons to draw in support for conservation or whose conservation depends on the conservation of a wide area and presumably other species within it.
2. Big animals have big impacts on ecosystems. Large animals affect forest systems in some important ways: they can change vegetation composition and structure through grazing and browsing, affect forest regeneration through digging and seed/seedling predation and they can be seed dispersers for a wide range of species over large geographical areas.

The Lambusango forest has four species of megafauna that science teams there have been studying for seven years. These are:

- a) The Anoa *Bubalus depressicornis* a dwarf forest buffalo, endemic to Sulawesi and its surrounding islands. It is now classified as Endangered (www.iucnredlist.org) with its distribution restricted to mainland Sulawesi and Buton. Fewer than 3000 individuals remain and its rapidly declining, fragmented populations are threatened by forest loss and hunting, the latter being the major threat to the species short term persistence. An assessment of the state of the Anoa population in Lambusango is critical to understanding the importance of the forest to wider conservation efforts as well as indicating the current level of effective forest protection in the area.
- b) The Sulawesi wild pig *Sus celebensis* is a Sulawesi endemic relative of the Eurasian wild boar, and domestic pigs. It is very poorly studied as populations have been assumed to be healthy and has not been a major source of conservation interest. However genetic introgression from domestic pigs and hunting from non-Islamic communities are now perceived to be threats. Pigs are 'ecosystem engineers' playing a vital role in seedling predation and regeneration through their digging. Assessing the state of the population and its distribution can tell us about the nature of pigs' role in the forest and highlight any conservation concern.
- c) The Buton macaque *Macaca (ochreata) brunnescens* is a primate species (or subspecies, depending where you draw the line) endemic to the islands of Buton and Muna. The majority of what is known about the species is based on Operation Wallacea research in the Lambusango area. Surveys of the distribution and status of macaques allow us to monitor this species in forests with different levels of disturbance.
- d) The knobbed hornbill *Aceros cassidix* is another species endemic to the Sulawesi region. It is a large forest hornbill that feeds on a variety of fruit, invertebrates and small vertebrates. They are probably important seed dispersers and can sometimes be found in large groups in fruiting trees. There are good hornbill populations in Lambusango, but they are potentially threatened on the fringes of the forest by deforestation.

Monitoring studies of these species in Lambusango have used two methods: patch occupancy modelling and distance sampling. Patch occupancy modelling is a method that assesses species distributions based on presence/absence (or, more correctly detection/non-detection) data. Ecologists usually assume that surveys of detection/non-detection for a particular species are assessing presence/absence directly, but this isn't necessarily (or even usually) the case. Detection

probability can vary with a whole variety of things such as weather, habitat type, presence of predators, population density so understanding detection probability and how it changes with these other variables is critical to getting an understanding of the underlying patterns of presence/absence, or 'site occupancy'. The figure below gives an idea of the problem and how patch occupancy analysis seeks to address it by separately assessing detection probability



These methods are particularly applicable to rare or difficult to survey species, such as the megafauna in Lambusango. We assess occupancy using systematic surveys of animal tracks and signs (including hornbill calls) on transects around the Lambusango forest. Past reports on large mammals that are on the Opwall website give more details of the methods involved. We also use a technique called distance sampling to assess populations of macaques. This technique is widely used for a range of population studies and there are a lot of resources on it on the web, as well as some of the references in the list below. Both patch occupancy analysis and distance sampling analysis can be carried out with bespoke free software that do all the technical bits. These are PRESENCE and DISTANCE software respectively. Search for them and download them online. We also carry out habitat surveys to assess the quality of the forest using a standardised method. We can then relate data on distribution of species to forest quality at a variety of scales.

The project involves quite a lot of walking over pretty difficult terrain so you need to be reasonably fit to get the most from it. You'll be carrying out walking surveys, walking slowly and carefully through the forest: it is the best way of seeing an amazing amount of forest in places that only a tiny handful of people will ever see with some incredible plants and animals. You will be based for most of the time in the forest node camps, so be prepared to live in a remote setting with basic facilities, sleep in a hammock and wash in the river. The camps are a brilliant experience and one you are bound to enjoy, even if conditions can be tough at times.

References:

Here is a list of some relevant papers. There are, of course many more that will be relevant to your particular study so these are just to get you started. The ones in **bold** are the really key ones that you definitely must read before preparing your proposal.

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