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Indicator Species



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An indicator species is an organism whose presence, absence or abundance reflects a specific environmental condition. Indicator species can signal a change in the biological condition of a particular ecosystem, and thus may be used as a proxy to diagnose the health of an ecosystem. For example, plants or lichens sensitive to heavy metals or acids in precipitation may be indicators of air pollution. Indicator species can also reflect a unique set of environmental qualities or characteristics found in a specific place, such as a unique microclimate. However, care must be exercised in using indicator species. Judging an ecosystem based on the response of a single indicator species might be like taking a pulse on a patient and immediately prescribing a treatment without a) further examination, b) other indicators such as blood pressure, or c) knowledge of the patient's past medical history.

Indicator species are an appealing research and monitoring tool. A conservation practitioner can use an indicator species as a surrogate for overall biodiversity, monitoring the outcomes of management practices by measuring the rise or fall of the population of the indicator species. One example of the use of indicator species is the spotted owl as an indicator of old growth habitat. However, this owl was at the heart of the timber industry v. environmentalist controversy over old growth forests in Oregon and Washington, USA. At the time it was believed that spotted owl habitat was limited to the big, tall trees and standing dead wood found only in very old and mature forests (though now it is clear that spotted owl

habitat is much more widely distributed). River otters have been used as indicators of healthy, clean river systems. In the humid mountain forests of Mexico, many peaks harbor a distinct species of arboreal lizard. The health of these unique tree-dwelling lizard populations is used as an indicator of the health and biodiversity of the natural communities in the region. Similarly, maidenhair ferns are known to grow in rich northern hardwoods throughout New England, but a subspecies of maidenhairs that are found only in sites with serpentine mineral soil is an indicator of a specific substrate.

Indicator species are a useful management tool, and can help us delineate an ecoregion, indicate the status of an environmental condition, find a disease outbreak, or monitor pollution or climate change. In one sense, they can be used as an “early warning system” by biologists and conservation managers. Indicator species must also be accompanied by a thorough study of what is being indicated, what is really correlated, and how this one species fits into the rest of ecosystem.

While the concept has excited international initiatives to identify indicator species, in practice, identifying potential indicator species is hard work. The organism’s presence, absence or abundance must be linked to an environmental condition in a scientifically-sound manner to justify its use as a conservation practitioner’s proxy. As the old adage goes, “correlation does not equal causation.” A case in point: it was widely believed (and highly publicized) that a worldwide decline in frogs was an indication of global climate change. The decline, however, seems to be the result of many factors that vary locally. Thus, it remains unclear what environmental or other changes are indicated by declines in frog populations.

References

Miller, Brian et al. (1998). Using Focal Species in the Design of Nature Reserve Networks. The Wildlands Project. Wild Earth Winter 1998/1999.

David B. Lindenmayer, Chris R. Margules, Daniel B. Botkin (2000). "Indicators of Biodiversity for Ecologically Sustainable Forest Management." *Conservation Biology* 14 (4), 941–950

McCallum, M. L. (2007). Amphibian Decline or Extinction? Current Declines Dwarf Background Extinction Rate. *Journal of Herpetology*. 41(3):483–491.

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