Umbrella species

Definition:

A species with large area requirements for which protection of the species offers protection to other species that share the same habitat.

History and uses of the concept

- First Frankel & Soule (1981) used the *umbrella* term in the form of "denser species" that conserve measure directed at the largest species could protect.

- Wilcox (1984) used term "protective umbrella"

- The biological conservation literature from the 1980s includes a number of references to the umbrella species concept, but most of these papers only state the theoretical appeal of that concept without evaluating its validity.

- Since the beginning of the 1990s, attention to the umbrella species approach has grown.

Why used and why important ?

- Not knowing where to place a reserve in a country or region
- It is impossible to assess the sizes and viabilities of many different species' population and then relate them to reserve design.

- So, one species used as shortcut to design or managing the reserve.
- Distributional and species richness are using as indicator

On the basis of purpose, umbrella species are categorized into three categories:

1. Classical umbrella species:

   When population of one species is used as a shortcut to designate viable population of other background species occur.

2. Local umbrella species:

   When area covered by the population of one species is used as a way of delineate the location, size and shape of a reserve that will contain as many other species.

3. Management umbrella species:

   When population of one species used as a shortcut for managing a reserve or ecosystem.

Four major difference betw Umbrella and species indicators

Characters	Umbrella species	Species indicator
Use	Used to conserve or management of other species	utilize for distributional data about many species within a taxon to predict geographic distributions of biodiversity.
Target species	Single species or a group of species	Whole taxonomic group
area	It used at local geographical scale	It used at global to regional scale
Focus area	Focus on target species population sizes	Focus on target species' distribution

Nonetheless, the terms umbrella species and species indicators of biodiversity are often incorrectly interchanged at a regional scale.

Lamberck's insight

- Lambeck (1997) suggested that to employ several umbrella species to define spatial and compositional attributes of a landscape and their appropriate management regimes, because no single umbrella species would be the most sensitive to all of these attributes.
- Lambeck's scheme demands knowledge of the factors limiting species and is therefore labor intensive.
- He suggest that multispecies umbrellas should be chosen on the basis of following ecosystem attributes:
  - Requiring large areas of wet heath land
  - being sensitive to habitat fragmentation, desiccation, and eutrophication
  - being dependent on one of the biotrope attributes

Umbrella species by Taxon

Plants

- Protection of vascular plant diversity as a whole might conserve less well-known taxa such as bryophytes, lichens, or fungi.

- None have tried to use a single plant population or small collection of plant species as classic umbrella species.

- Local umbrella species-groups were chosen either on the basis of being easy to identify (vascular plants and trees are well known) or because they are marker for a habitat type (the lichen occurs in very old tree stands in northern Europe).

Invertebrates

- Butterflies have occupied an important place in investigations of the umbrella species concept—usually as local umbrella species—because they are well known and admired.

- Beetles also feature in local umbrella species studies.

- if invertebrates occupy a unique ecosystem such as a cave or isolated wetland, then sympatric species might benefit as well.

Mammals

- Mammal umbrella studies are split into types of studies
  - Classic umbrella species
  - Local umbrella species

- Giraffe and cheetah still benefited from the establishment of these parks using umbrella species, although this did not hold for all mammalian taxa.

- In North America, large carnivores are advertized as important local umbrella species because their area requirement

- A subsequent study involving grizzly bear, fisher, lynx, and wolverine in the Rocky Mountain region found that predicted suitable habitat, ets.

- Smaller mammals, Siberian flying squirrel presence is found associated with greater amounts of deadwood and higher numbers of polypore species and records.

Birds

- Birds are an attractive umbrella group because they are well known and relatively easy to monitor—amateur bird watchers help collect routine data.

- Background species have either been other bird species or small collections of various vertebrates or invertebrates, with outcome variables such as species richness of birds, or other easy-to-measure taxa.

- Woodpeckers, grouse, raptors, and owls may all be umbrella candidates.

- Mikusinski and collaborators (2001) found that open landscapes were positively associated with the number of woodpecker species.

- Roberge and Angelstam (2006) found that the presence of green, lesser spotted, and middle spotted woodpeckers was associated with an abundance of other bird species in deciduous forests although not in coniferous forests.

- Martikainen and coworkers (1998) discovered the number of saproxylic beetle species was greater in areas inhabited by white-backed woodpeckers than elsewhere.

- Findings suggest that places inhabited by certain bird species may be sites of particularly high species richness for birds as well as other taxa.

- Three ecological reasons may underlie these associations:
  1. Predators may structure ecological communities by facilitating resources essential to other species or by initiating trophic cascades
  2. Species that are top predators or that capture particular prey species may require relatively intact lower trophic levels to survive.
  3. If species are habitat specialists, they may be sympatric with other species that require the same resources.

Choosing an appropriate Umbrella species

- To choose an umbrella species, an "umbrella index" is used, which included three parameters.

  1. The mean proportion of co-occurring species, was quantified on a scale of 0 to 1.
  2. The occurrence rate (essentially rarity), was the proportion of sampling locations in which the species were present.
     - (being present in either a very low or very high proportion of locations received scores close to 0, but being present in exactly half of the locations received a score of 1)
  3. Incorporated life-history characteristics that potentially influence vulnerability to human activities.

- Finally, the three parameters were added together to give each species "umbrella index."

- In both reserve design and management, these criteria pertain to
  - Single umbrella species
  - Multi-taxa focal species

- First, for each sort of umbrella species, its biology must be reasonably well known so we can be sure that its habitat requirements match those of the general area to be conserved.

- It must have a strong probability of persistence to be used for long-term conservation efforts.

- The species must be easily sampled or observed in order to make it cost-effective as an umbrella species.

- It must co-occur with target species of conservation interest, such as habitat specialists or threatened species.

- Umbrella species should be sensitive to human disturbance so that responses to fragmentation, climate change, and pollution will be incorporated into planning and management decisions about background species.

- Classic umbrella species should have large habitat requirements, either because they have large home ranges, often associated with large body size or being migratory, or because they are habitat specialists and these habitats are patchily distributed.

Thanks