

Survey Techniques

We are all familiar with the notion that global biodiversity is at increasing risk of extinction due to a variety of reasons. These reasons include, but are not limited to; habitat destruction and degradation, environmental pollution, over-harvesting of wildlife for human consumption, wildlife diseases and climate change. But how do we know that biodiversity is threatened on a global scale? In order to understand fully what is happening to global biodiversity, we must find sensible ways of monitoring it. How we go about this enormous task depends very much firstly on at what level we are trying to assess biodiversity. It is impossible to look at all biological diversity at the same time so we must break it down into more manageable sections in some way.

Study Site

The survey techniques that we use will depend on the size of the area that we are interested in studying. For example, satellite images can be taken of large areas of forest to calculate the proportion of forested, degraded or deforested areas, whereas a microscope might be necessary to study the diversity of the invertebrate community living on a single tree within that same forest. So the first thing that we have to do is identify our study area. This may be a large protected area of forest, coral reef or other ecosystem, or it may be something as small as a garden pond.

The next decision to make is are we interested in all biological diversity in that area, or are we actually only interested in a small number of key species? Normally researchers are only interested in a small proportion of the overall diversity present, because even within a small area it can be very difficult to survey and identify everything present. This is why at large study sites it is common to have different researchers working in the same location all carrying out different survey techniques in order to monitor the particular species or communities that they are interested in. We can then combine this information to get a clearer picture of the biodiversity contained within the study area. Obviously the smaller your study area is the easier it is to build an accurate picture of the biodiversity present, but you will still likely need to use a variety of different survey methods.

The importance of replication

Whenever we survey a site, it is highly unlikely that we will encounter every individual of the species or group of species that you are trying to study. Therefore, any data we collect is only a small sample of the actual population of each species of interest. The smaller our sample size is, the greater the chance that we will see strange results just by chance that do not give a very good representation of the population as a whole. For example, species will often not be spread evenly through your study site, but instead will be clumped into areas of suitable habitat. Therefore, taking only a single sample may give you a very biased result (Figure 1). That is why when we survey populations we try to take as many repeat samples as possible in order to get an accurate estimate and to reduce the bias that can result from low sample size. By taking multiple samples it also allows us to measure the reliability of our average estimate. If every time we take a sample there is very little difference in the number between those samples then we can say that the variability in our data is low and we can be confident in our estimate. However, if every time we sample the population we get a very different result the variability in our data is high and we will have less confidence in our estimate. When this is the case we will likely need to sample to population more often to get a reliable estimate.

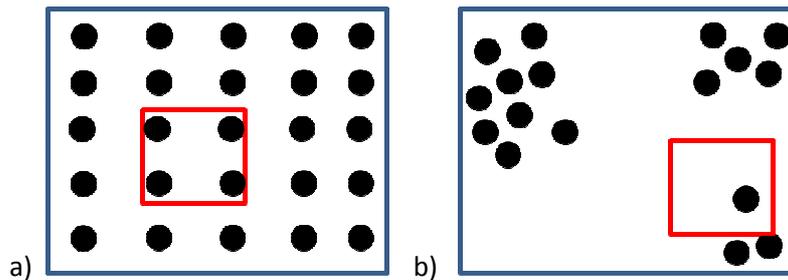


Figure 1. This example displays the danger of using a single sample to describe the state of a population when the species of interest is not evenly distributed within the study area. Where a species is evenly distributed within an area, as in example (a) a single sample will actually give you a good indication of the overall population size and density, however, when a species is not evenly distributed within an area (which is more likely) a single sample is insufficient and will likely result in a very biased estimate of total population size as in example (b).

What survey design to use?

The methods that we use will depend on what we want to know. For example we may simply be interested in the number of different species present in a given area. Alternatively, we might want to know the population size for a particular species within that area. Therefore, the survey method that we use must be appropriate to the question that we want to answer and it must also take into account the biology and ecology of the species we are trying to survey.

As conservationists we have a wide variety of survey techniques available to us. Below are some examples of common techniques used (there are many more). How we actually carry out these techniques will depend on the species we are trying to survey:

- *Capture-Mark-Recapture* – suitable for estimating the population size of locally abundant species or intensively studied populations
- *Transect sampling* - suitable for estimating species diversity and relative abundance
- *Distance sampling* – suitable for estimating population size when capturing and marking individuals is no practical. Can be done for multiple species simultaneously.
- *Passive trapping* – suitable for assessing local species diversity and estimating local abundance of species that are easily trapped
- *Camera trapping* - suitable for assessing local species diversity and estimating local abundance of elusive animals such as large mammals. Can be used for population estimates for species that have highly individual markings that can help identify different individuals
- *Direct counts e.g. Helicopter surveys* – suitable for obtaining accurate population data for large animals in open areas such as large mammals in Africa

Unless you are working within a very small study site, it is normally impractical to survey and identify 100% of species within any given area. Therefore, we may sometimes monitor 'indicator' species that we know to be good predictors of what is happening within the ecosystem in general. A good indicator species is one that is vulnerable to disturbance of the ecosystem but that is also easy to survey.

What is survey data used for?

Survey data is used by all sorts of people, but generally it is used by people that want to know how best to manage a particular area and to conserve the biodiversity present. Perhaps the most well known way that biodiversity survey data is used is for the classification of species under the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species. This system categorises species into levels of conservation concern based on all of the data that is available.

- Extinct (EX)
- Extinct in the Wild (EW)
- Critically Endangered (CR)
- Endangered (EN)
- Vulnerable (VU)
- Near Threatened (NT)
- Least Concern (LC)

Although many species have been assessed under the IUCN Red List, there are still a very large number of species that have not yet been formally classified due to a lack of data. These species currently fall into another category called "Data Deficient (DD)" and yet many other species have not even been assessed at all (they fall into a Not Evaluated category). Survey data is constantly needed in order to categorise additional species and to update the conservation concern of those species that have previously been categorised.

Therefore, one very important use of survey data is to identify which species are of the highest conservation concern. The IUCN red list provides a mechanism for doing this on a global scale, but many other databases exist that assess the conservation status of species on a national or local level. It is the collection of this important data that allows us to piece together the puzzle of what is actually happening to wildlife populations around the globe.