

**Video 3**

**What do we offset: How biodiversity is described and measured for the purposes of offsetting**

As we know, the aim of offsets is to deliver biodiversity gains, which should compensate for the losses caused by a development project. To do this, we need accurate picture of what types of biodiversity – such as which species, and which ecosystems - are negatively affected by the development.

Biodiversity is defined technically as all the species on earth, the diversity of their genes, and the ecosystems that they are part of. Because biodiversity is so rich, varied and complex, we can never hope to measure all components of biodiversity that are affected by a given development. Instead, when we measure biodiversity losses and gains, we have to simplify this task and decide on what triggers a need for an offset, as described in Video 2. So, we might use broad surrogates of biodiversity: things we can measure relatively easily that we think indicate other features that are harder to measure. Or, we might only focus on particular elements of biodiversity that we consider most important, such as threatened species.

Once we know what biodiversity elements we will offset, we still need to decide how to measure them. The units in which biodiversity losses and gains are measured may have many different names, but we will refer to them as biodiversity indices. These are the units in which an exchange is made. In like-for-like offsetting, losses can only be counterbalanced by gains of the same amount and of the same type– measured with the same index.

The most common types of biodiversity indices are measures of habitat quality for a particular species, measures of vegetation condition, and measures of species abundance or density.

Species-based indices may measure the abundance of the species, or even just the area or extent over which the species occurs. If the species abundance, or the area over which the species occurs is difficult to estimate reliably, perhaps because the species is rare, cryptic, or its number fluctuate at a site over time, then habitat-based indices might be used.

Sometimes a good habitat model exists for the species – a quantitative description of what habitat attributes are important and in what ways for a species - and that model can be used to estimate the quality or importance of a given area for that species. Often we do not have such a model, and so we may have to develop our own index of habitat quality. It is important to remember that when considering a species, then habitat quality must reflect the habitat preferences or needs of that species. So, sometimes even degraded vegetation can still be very important habitat for a species – some threatened species rely on hollow trees in farmland, for example. Habitat quality is usually estimated per unit area, and so the index used to compare losses and gains is a quality-weighted area measure. For example, ten hectares of habitat quality that is 80% as good as the best habitat for a species would be scored as eight ‘quality hectares’.

For an ecosystem, the simplest index is area or extent. But measuring area alone misses important information about whether the affected ecosystem is in good or poor condition. So, vegetation-based indices are often used to score the condition of natural vegetation relative to an undisturbed or intact example of that ecosystem or vegetation type – called a benchmark or a reference state. These indices are also usually expressed as a weighted area measure, but the difference is that they are measures of the condition of an ecosystem type, and they are not designed as a measure of habitat quality for any particular species.

To be able to use these condition-weighted area indices to compare losses and gains of an ecosystem type, you need two things to be in place: a classification of ecosystem types, and a set of benchmark values for the components of vegetation in each ecosystem type. In this way, the condition of a site relative to a benchmark condition can be calculated, and expected changes in that condition (due to either the impact or the offset) can be estimated. Remember that there might be a difference in the quality of a site as habitat for a particular species and the vegetation condition of the ecosystem at that site.

Sometimes, our measures of species, habitat, or vegetation might be used as surrogates, in the hope that they will also represent other biodiversity features which interact with or rely on the surrogate. The aim of such surrogates is that by measuring several habitat attributes, such as large trees, understorey cover, or leaf litter, the index might also reflect other plants and animals that rely on these habitat features.

The risk of using a surrogate is that it may not represent other important biodiversity components at a site.

Also, when many different habitat attributes are combined into one composite index, it is possible that an increase in one element of the index can substitute for another element, even if both elements are important. Also, in a weighted area index, area and condition or quality can be substituted. For example, a loss of a small area of high quality habitat could be exchanged for a gain of a large area of poor quality habitat. Sometimes this is acceptable, but sometimes it might not be – and we will cover this in the video on exchange rules. So, it is important to check the assumption that a composite index will ensure that losses and gains are achieved for all important elements of biodiversity.

A given impact might affect several different elements of biodiversity. So, often, an offset will require using a suite of indices, each appropriate to an important element of biodiversity, and then calculating the losses and the gains for each element in the appropriate index. This helps to ensure the biodiversity gains delivered from an offset are like-for-like.

So, once we know the species and ecosystems that we need to offset impacts upon, and we have decided on the indices we will use to measure losses and gains for those species and ecosystems, we move on to the next step – estimating the size of an offset gain, so that we can compare it to the size of the loss for each biodiversity feature that is affected. We will cover that topic in the next video.