How mathematics is used to describe or model the crisis

Having seen some of the ways that mathematics has helped to shape the crisis of species loss, it is worth standing back and reflecting on potential difficulties with measuring biodiversity. This is a question that could potentially be a stimulus for work in school.

Students could be challenged to compare the biodiversity of three areas of the school campus or surrounding area (they can choose the size of area to compare and the location, but perhaps need to compare at least *three* sites). As part of their work, they would need to decide how to measure the biodiversity and explain their approach. Students may be able to collect data over time with the aim of making some recommendations for supporting biodiversity in the area.

To engage in this task, students would first need to decide how to define biodiversity (they could choose to look at animal or plant life, or both). Can they come up with a method for giving a *value* to the biodiversity of each of the three areas? (The simplest idea would be to simply count the number of species in a given area; or biodiversity values could be based on an estimate of how many individuals from each species there are in an area, or an estimate of the total weights of each species). Students may want to try out a range of possible ideas. Having made these decisions, they should be in a position to decide what data they need to collect in each area. Once they have some data, they should be able to rank their areas in terms of diversity.

For the purposes of this workshop, imagine you had visited the three sites in the photos on the table. Come up with a value of the biodiversity in these three areas.

TASK – MEASURES OF BIODIVERSITY

If you found *n* species in your sample, to use the measures below you will need to calculate or estimate proportions, p_i, for each species (either by weight or number). You will then be in a position to work out three commonly used measures of biodiversity. For these measures, the higher the number, the more diverse the area:

$$N_2 = 1 \Big/ p_1^2 + p_2^2 + \ldots + p_n^2$$

$$N_1 = 1 \Big/ p_1^{p_1} p_2^{p_2} p_3^{p_3} \ldots p_n^{p_n}$$

$$N_0 = n$$

N_2 is the Simpson index of diversity, N_1 is linked to the Shannon index and N_0 is, of course, a species count.

Compare the results from these measures with yours – did they rank the diversity of the areas in the same way you did?

Given your work, what would you recommend as a measure of biodiversity?