**Title:** M04D03-C: Determining the biodiversity index of dung beetles found at different altitudes in the cloud forest of Cusuco National Park (CNP) in Honduras.
**Keywords:** Biological indicators; biodiversity; climate change; data handling; deforestation; ecosystems;  environmental monitoring; field techniques; human impact; rainforest; sampling; transects; species richness, species evenness, abundance
**Skills:** Simpson's index for diversity, discussion and experimental design.

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In tropical rainforests dung beetles are a conservation priority. As they move dung for feeding, nest building and the provision of nutrients to their larvae, the forest collaterally benefits as a result of soil fertilisation and aeration, nutrient recycling, seed dispersal, pollination, reduction in seed predation and the biological control of the eggs and larvae of mammalian parasites. As forest degradation continues apace, the survival of dung beetles, along with the important ecosystem services they fulfil, is threatened.

The effects of forest disturbance are often first observed by changes in the biodiversity of certain species, known as biological indicators, of which dung beetles are a key example. The diversity of biological indicators can be determined by calculating the Simpson's Diversity Index. The calculation takes into account the number of species present as well as the relative abundance of each species; this is a measure of the evenness of the distribution of the species of interest. Diversity increases as species richness and evenness increase. A community dominated by one or two species is considered to be less diverse than one in which several different species have a similar abundance.
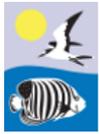


*Phanaeus endymion*

This study involved an assessment of the species richness of dung beetles in Cusuco National Park (CNP), Honduras, where there are at least 34 different dung beetle species. Seven areas were sampled across a range of altitudes (600-2200m) throughout the park and there are 127 sample points which have been continuously recorded for over many years.

The table below contains data related to the abundance and species richness of dung beetles found at three different research camps, situated at similar altitudes, within CNP:

| Species name | Buenos Aires | Base Camp | Guanales |
|---|---|---|---|
| *Ateuchus chrysopyge* | 0 | 1 | 75 |

| | | | |
|---|---|---|---|
| *Ateuchus guatemalensis* | 0 | 0 | 165 |
| *Canthidium ardens* | 0 | 1 | 0 |
| *Canthidium hespenheidei* | 0 | 0 | 2 |
| *Canthon vazquezae* | 1 | 0 | 0 |
| *Copris nubilosus* | 0 | 11 | 3 |
| *Dichotomius satanas* | 5 | 10 | 11 |
| *Eurysternus magnus* | 14 | 0 | 3 |
| *Onthophagus aff. anthracinus* | 2 | 0 | 0 |
| *Onthophagus cyanellus* | 3 | 0 | 0 |
| **Other information** | | | |
| **Altitude (m)** | 1199 | 1201 | 1203 |
| **Species richness** | 5 | 4 | 6 |
| **Total abundance** | 23 | 23 | 258 |

**Tasks and questions:**

1. Using the formula provided, calculate the Simpson's Index of Biodiversity for each location. Present this in a suitable table of results. NB. D values range between 0 and 1; 1 represents infinite diversity and 0 no diversity.

$$D = 1 - \left( \frac{\Sigma n(n-1)}{N(N-1)} \right)$$

  n = the total number of organisms of a particular species
  N = the total number of individuals of all species
  Σ = sum of

2. Define 'species richness', 'species evenness' and 'abundance'.
3. Which site shows the least diversity. Suggest why?
4. If you wished to monitor biodiversity over the next 10 years, describe briefly how you might do this.