Ecology and Simpson's Diversity Index

Ecologists are interested in species diversity because it is usually proportional to the stability of an ecosystem: the greater diversity, the greater the stability. The most stable communities have large numbers of species that are fairly evenly distributed in good-sized populations. Pollution often reduces diversity by favoring a few dominant species. Diversity is a factor in successful conservation management.

A diversity index takes into account the number of species present, as well as the abundance of each species. Species diversity should not be confused with species richness. The number of species per sample, e.g. plants in a one m^2 quadrant, can be used as a measure of richness. A consolidated species list may be built up of all the species found in a habitat or ecosystem over a period of time. These are useful for comparing different areas, but just counting species will not allow comparison of diversity.

Environmental scientists use a variety of methods to compare diversity in different ecosystems and to monitor the progress of conservation measures. One of the most popular methods is to use relative abundance of different species to calculate Simpson's Index of Diversity. You can investigate this by using ordinary playing cards as "species" to generate data to calculate Simpson's Index (D) using the following equation:

$$D = \frac{\sum n(n - 1)}{N(N - 1)}$$

where N = the total number of organisms of all species and

n = the total number of organisms of a particular species

from which Simpson's Diversity Index, 1 – D, is found.

Each card of the deck represents the nine possible species.

Species A: all picture cards (jacks, queens, and kings) i.e. Douglas fir	**Species B:** odd numbered clubs i.e. Ponderosa pine	**Species C:** even numbered clubs i.e. red alder
Species D: even numbered diamonds i.e. Douglas squirrel	**Species E:** odd numbered diamonds i.e. chestnut-backed chickadee	**Species F:** odd numbered hearts i.e. mountain beaver
Species G: even numbered hearts i.e. Roosevelt Elk	**Species H:** odd numbered spades i.e. spotted owl	**Species I:** even numbered spades i.e. Olympic black bears

Community 1:
Shuffle the cards. Count out 26 cards to use as your sample. Using the Recording sheet, note how many of each species (A to I) you have in your sample. Tally your results with tally marks. Complete the table to calculate Simpson's Index.

Community 2:
Remove seven jacks, queens, OR kings from the pack of 52 cards to leave five cards for every "species." Repeat the procedure for Community 1. Use a different Recording sheet to calculate Simpson's Index.

Community 3:
Remove the jacks, queens, AND kings, and one of the suits from the pack of 52 cards to leave you with three suits and six "species" with five cards each. Repeat the procedure for Community 1. Use a different Recording sheet to calculate Simpson's Index.

Community 4:
Make up a community of your own. Use all of the "species" but alter the relative cards to get the lowest diversity you can. Repeat the procedure for Community 1. Use a different Recording sheet to calculate Simpson's Index.

Questions to consider:

1. Why is 1-D rather than just D used as a measure of diversity?
2. Two factors affect diversity scores. What are they? What effect do they have?
3. How could you ensure reliability?