

Macroecology – getting the big picture

Originally printed at http://www.thetobagonews.com/opinion/Macroecology___getting__the_big_picture-183445711.html

By Jo-Anne Nina Sewlal BSc., MPhil., FLS., AMSB Dept of Life Sciences, University of the West Indies
December 13, 2012

Macroecology is a subfield of ecology and was a term coined by scientists James Brown and Brian Maurer in their 1989 paper published in the world renowned journal "Science".

It is a relatively new branch of ecology gaining acceptance in the scientific community although the concept has been around for over 20 years. In my opinion one of the best definitions of macroecology is that it is "concerned with patterns expressed by ecological systems over extensive spatial (area) and temporal (time) scales and with the processes that determine these patterns."

Therefore as its name suggests macroecology looks at "the big picture" focusing on patterns of distribution in terms of their abundance, body size and range size for a wide variety of species and how they relate to each other.

This article serves to look at some of the intricacies of this developing branch of ecology; such as the challenges of conducting studies in this field and how they are overcome and some of the advantages and shortcomings of this area.

This field of ecology faces four challenges;

- 1) using historical information that is, if it is available for the area;
- 2) acquiring detailed knowledge of the local processes leading to an understanding of the larger-scale patterns observed;
- 3) dependency on high quality large-scale data which is needed for a wide range of regions and lots of species and
- 4) the need for more sophisticated statistical analysis to account for biases in getting data. This leads to some criticisms such as how to get it all done, after all sciences is fuelled by data, so how to get data accurately and for such a wide area, as the areas dealt with are not small one metre plots but span countries and may include regions.

The typical approach to ecology is to look at small areas and at individual ecological processes. This approach is not restricted to ecology but by science in general. The goal is to piece all the fragments together therefore seeing how all the different ecological processes work together in that area.

However this approach has two major shortcomings, the first is how to piece them together when you do not know how they are interrelated in the first place. You may think that process A influences process B but it actually causes process D to occur. Therefore macroecology shows that our environment is very complex and that we have to accept that. Secondly by looking at a fragment of an ecosystem you end up disregarding the very factors that influence the biodiversity found there for example, looking at the number of species of aphid species on a single plant rather than in a selected plot in the forest. Another characteristic of macroecology is its dependency on observational data, which is used to formulate and test hypotheses.

This leads to another one of the criticisms of macroecology is how data is collected, which unlike typical ecological studies requires teams of scientists from different countries.

You may think that this would be a problem with the internet and ability to transfer data over the world in a matter of seconds. But since macroecology depends on observations but how one person interprets observations is different for each individual.

In addition to this the data collection was taken over a period of time, some of which may be a result of unplanned trips, different dates and in general can be quite uncoordinated, thus resulting in biased results if not used with caution. But macroecologists do get some help from nature, when it comes to conducting experiments. They use what is termed "natural experiments" for example, volcanic eruptions, hurricanes and earthquakes.

But natural experiments do have their advantage in that without them testing on such a large area and the effects over time would not be possible.

In this region hurricanes in particular are of interest as they affect entire countries with respect to some West Indian islands or the entire region as the hurricanes move along the archipelago. Also with respect to hurricanes it is easy to see that it affects both the flora and fauna including humans, thus bring into account the human (anthropogenic) effects as well.

Natural experiments are also more realistic than lab or field experiments as they show how all factors influence an ecosystem especially seen after a disturbance.

Although these natural experiments provide the macroecologist with data, the quality of the data comes into question as unlike in a lab or regular field experiment the factor to be tested was not selected by the person doing the experiment and there are very little control measures to exclude influencing factors not under study.

However despite its advantages and flaws we cannot ignore the need for studies in this field as we have realised that many of the environmental problems for example, pollutants originate from one point and either affect a wide area or area other than the source of the pollution.