Participatory monitoring and evaluation of biodiversity; a first view from the statistical side

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1. Introduction

1.1 The importance of 'Definition'

In the first sentence of the Introduction to this workshop, it is emphasised in the context of the debate about "what biodiversity is', that perceptions (and hence definitions) of biodiversity depend on who you are, what you value and need from the environment. Agreed. However, in order to move on to look at the practical issues - of how do we better understand the different perspectives, and communicate them between stakeholders - and how useful is this communication to different stakeholders, it is clearly necessary to recognise the importance of stakeholders defining what they mean when they use the term biodiversity.

If different stakeholders at a particular time/location are talking about different types of biodiversity, without defining what they mean, then clearly there is no basis for meaningful communication, comparison of results, sharing of data, or meaningful monitoring of changes. Given that biodiversity is a multifaceted concept, various stakeholders will wish to adopt differing views, or definitions of the term, and some will wish to adopt a more general multi-dimensional perspective of the biodiversity concept. We need to adopt a "wide-church" approach if the differences between the various scientific and participatory views are to be reconciled and the community of biodiversity stakeholders is to be able to share and benefit from the diversity of perspectives. But we all do need to define our terms.

Hence a scientific definition of biodiversity for a particular study may include one or more of: species abundance (i.e. the total number of species present), their distribution (and some measure of the evenness of this distribution), and the proportion of all organisms in the most frequent species, and might use one or more of the commonly used diversity indices, (see Magurran (1988) for the definitions of these).

In contrast a local participatory biodiversity might be defined as the monetary or utility value of those species that make significant contributions to forest timber and NTFP product classes. "Significant contribution" and the various product classes would need to be defined. Such a definition, by the very fact of being defined in terms of locally relevant criteria, does not generalise to larger scales in terms of the species and product classes, but the utility measures adopted might possibly be regarded is generalisable to larger scales as long as there is a standardisation to some common utility "currency". In such a case it would be possible to consider including standardised locally defined utility-based measures of biodiversity with the scientific measures and indices mentioned in the last paragraph to make inter-site comparisons, or to monitor changes in the defined biodiversity measures over time, and possibly as the result of interventions.

1.2 The importance of "Measurement"

However, even if the concept of biodiversity that is to be adopted is well defined for the local environment/population, there is the issue of "measurement" of biodiversity through the collection of appropriate data. "Measurement" includes the processes of assessment, monitoring, and evaluation as defined in the workshop documentation and elsewhere. However, it is also crucial that the measurement process is also subject to a strict definition framework. Without such clear definitions

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of the "measurement instrument", whether they by sampling based, or based upon qualitative participatory judgements, it would be impossible to compare, combine, or even usefully share measurements, since we would not know what had been measured, and if the measurement was in fact a "reasonable" measure of the biodiversity that we have chosen to define.

Even in the relatively straightforward area of quantitative scientific definitions of species biodiversity, the estimation of the biodiversity concept defined from the sampled data is far from straightforward. The bias of the sample-based measurement depends on the size of the sample taken. The minimum size of plant measured is usually determined by practical convenience, but the choice can have major effects of the measure of biodiversity obtained, and in effect becomes part of the definition of what is meant by biodiversity.

In the area of participatory measurement, where main features of the measurement instrument are the qualitative perceptions and value-judgments of the assessors it would seem that the definition of the biodiversity concept merges into the way in which the concept is measured. The following statement in the lead discussion paper for this workshop:

> *"Such (participatory) processes show that the values held by different groups in connection with biodiversity can change as a result of active involvement in such an assessment process."*

We might therefore ask if there exists any well-defined concept of biodiversity in such a participatory process, and if "measurements" of such a concept, if it exists, are stable and meaningful measurements of it. Either way, a clear definition and documentation of the measurement process will aid in understanding the measures that are made and assist in deciding about their use for monitoring and comparison purposes.

2. General Statistical Principles in the design of observational and measurement studies.

These considerations of definition of concepts, and measurements of it are in fact just some of the initial stages in a process which are followed in most scientific research studies which involve an assessment and evaluation of the complexity of the real world as we find it in ecology, the environment and society. These are given in a general and formal way in the list below. It seems fairly clear to this author that such general methodology is not incompatible with the participatory approach to the definition and measurement of biodiversity; rather such an approach CAN be adopted in the participatory context, and can only clarify the subsequent debate.

1. Define the domain of interest or concern. That is, define the population and the population elements.
2. Define the variables or attributes that are of particular interest or concern.
3. Define the observational, (or sampling or measurement unit).
4. Define the sampling frame, or the set of observational units which covers the population of interest.
5. Determine a sampling scheme for selection of units to be observed/measured. Usually the sample should in some way be regarded as representative of the population.
6. Determine how data is to be managed, and stored.
7. Determine how the data is to be used and manipulated to obtain meaningful quantitative or qualitative measures that relate to the interests or concerns.
8. Ensure that the data is sufficient in quantity and quality to justify results desired and conclusions drawn.
9. Make important comparisons over time, or over space.
10. Make sure that 2-7 are such that 8 & 9 can be achieved.

It seems to me that all the general considerations above are relevant to almost all the themes listed for discussion in the workshop in the next three weeks. That is to: biodiversity defined and measured in a

participatory context, including local values sets, using a range of tools for measurement and estimation, and so by leading to a clarification of information and information needs, and enabling the possibility of synergy between the diverse methods of biodiversity definition and assessment.

Hence let me leave off at this early point without elaboration, or examples, etc…and possibly return to the details in the discussion of the particular themes that have been listed for the workshop. Readers are referred to some of the inventory and biodiversity papers in http://cms1.gre.ac.uk/conferences/iufro/proceedings/ for some recent quantitative contributions in the forestry sector.

3. References

Magurran, A.E. 1988. Ecological Diversity and its Measurement. Croom Helm Limited, London