Biodiversity

ACRONYMS AREAS COUNTRIES MARINE TERMS

DEFINITION

'Biological diversity' means the variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species and of ecosystems.

Convention on Biological Diversity 1992[1]

Biodiversity is a compound word derived from 'biological diversity' and therefore is considered to have the same meaning.

NOTES ON DEFINITION

The CBD definition is the internationally accepted definition of biodiversity. The E.O. Wilson version is included below (in further definitions) as the first recorded definition of the term and therefore of historical interest.

Functionally these two definitions are similar. The CBD definition explicitly incorporates the term ecosystem which is used in a comparable context to the word biome within the Wilson definition. Both definitions include genetic, species, habitat and geographic scales thereby encompassing all living things and associated systems.

FURTHER DEFINITIONS

The variety of life at every hierarchical level and spatial scale of biological organisations: genes within populations, populations within species, species within communities, communities within landscapes, landscapes within biomes, and biomes within the biosphere.

E. O. Wilson (1988), Biodiversity[2]

KEY POINTS

- Biodiversity is being lost at an alarming rate which poses a risk to the provision of ecosystem services.
- The Convention of Biological Diversity provides a global legal framework for action on biodiversity It is a key instrument to promote sustainable development and tackle the global loss of biodiversity.
- Biodiversity can be measured through the use of quantitative indicators, although no single unified approach exists.
- Biodiversity also underpins ecosystem function and the provision of ecosystem services.

INTRODUCTION

The term biodiversity encompasses variety of biological life at more than one scale. It is not only the variety of species (both plant and animal) but also the variety of genes within those species and the variety of ecosystems in which the species reside.

HISTORY

In the context of conservation science the term ‘biodiversity’, a contraction of 'biological diversity', is relatively young. ‘Biological diversity’ in its current sense began to be used in the early 1980s, with interest in the concept elevated by publications such as ‘Limits to Growth’ [3], which discussed the implications of unrestricted population and economic growth on the environment . Use of the term has ranged from a focus on species richness (number of different species in a location/sample) [4] to greater emphasis on ecological and genetic diversity [5]. The specific origin of the word ‘biodiversity’ is often attributed to W.G.Rosen in 1985 during planning for the ‘National Forum on Biodiversity’ which took place in America later that year [6]. The proceedings of the forum were published by E. O.Wilson in 1988 in a book entitled ‘Biodiversity’, which is likely to have initiated the widespread use of the word [7].

Initially the term biodiversity was used more in political forums than scientific ones [8], progressing over time to become a term used to symbolise the concept of the "richness of life on earth" [9]. Importantly, biodiversity does not exclusively refer to species richness. It also encompasses diversity at a wider scale meaning that differences in the genetic makeup of populations is important. Endemism has a key role to play in this context because endemic species are restricted to small areas and provide pockets of particularly high genetic diversity.

The concept of biodiversity continues to evolve and more recently it has been included in the idea of ecosystem services in that it is a form of ‘natural capital’ and thus underpins the functioning of ecosystems [10, 11]. Biodiversity itself is not generally considered an ecosystem service but rather supports environmental functions [11].

IMPORTANCE

The increasing use of the term biodiversity is being driven by the fact that, in an ecological context, global biodiversity itself is being lost at an alarming rate [12]. Although it has been shown that the significant global biodiversity loss that has occurred over the timeframe of human existence has not stopped global human population increase [13], there is clear evidence that biodiversity loss can affect the wellbeing of society and have negative economic impacts [14].

Biodiversity underpins ecosystem function and the provision of ecosystem services. Biodiversity loss therefore threatens the provision of goods and services provided by ecosystems. Reduction in biodiversity can affect decomposition rates, vegetation biomass production and, in the marine environment, affect fish stocks [15, 16, 17, 18]. It is predicted that a reduction in marine productivity means

that fisheries will not be able to meet the demands of a growing global population [19]. In addition to the gradual decline in environmental function linked to reductions in biodiversity, it has been suggested that there is a risk that at some point a threshold will be crossed and a catastrophe may occur. Research has highlighted that biodiversity loss could rival the problems of carbon dioxide increases as one of the major drivers of ecosystem change in the 21st century [20]. Whether from environmental collapse or gradual decline in function, our ability to adapt to a changing world may be considerably reduced if the environment on which we rely does not contain sufficient biodiversity to evolve and continue to support our needs [13, 21].

MULTILATERAL ENVIRONMENTAL AGREEMENTS

In response to the current rate of biodiversity loss, and on the grounds that biodiversity is a common concern for humankind, the Convention on Biological Diversity (CBD) was opened for signature in 1992. As of June 2013 it has been ratified by 193 parties (governments). The CBD provides a global legal framework for action on biodiversity [22] and is considered a key instrument for sustainable development. Its three main goals are:

1. The conservation of biological diversity;
2. The sustainable use of the components of biological diversity;
3. The fair and equitable sharing of the benefits arising from the use of genetic resources.

The CBD's governing body is the Conference of the Parties (COP). It holds periodic meetings to review progress on the Convention targets, and advance its implementation [23]. To support implementation of the CBD, the United Nations General Assembly declared 2011-2020 the United Nations Decade on Biodiversity and adopted the Strategic Plan for Biodiversity 2011-2020. The Strategy is a ten-year framework for action adopted by signatory countries in 2010 in Nagoya, Japan. It builds on the vision that "by 2050, biodiversity is valued, conserved, restored and wisely used, maintaining ecosystem services, sustaining a healthy planet and delivering benefits essential for all people" [24]. The Strategy calls for all countries and stakeholders to effectively implement the three objectives of the CBD by establishing national and regional targets, feeding into the five strategic goals and 20 global targets (collectively known as the Aichi Biodiversity Targets) outlined by the Strategy. The primary framework for action set forth by the CBD is the ecosystem approach, an integrated strategy for the management of biodiversity resources.

Biodiversity is also at the centre of a number of other Conventions e.g. the Convention on Migratory Species (CMS), the International Treaty on Plant Genetic Resources for Food and Agriculture (Plant Treaty), The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). It is also the subject of a number of associated Protocols such as the Specially Protected Areas Protocol and the Cartagena Protocol.

A new platform, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), was established by the international community in 2012 and is open to all United Nations member countries. It is an independent intergovernmental body committed to providing scientifically-sound assessments on the state of the planet's biodiversity in order to support informed decision-making on biodiversity and ecosystem services conservation and use around the world [25].

MEASURING AND MONITORING BIODIVERSITY

Over the last 30 years, many different definitions of biodiversity have been used. As early as 1992, the year the Convention on Biological Diversity was opened for signature at the Rio Earth Summit, it was noted that the definitions of biodiversity are *''as diverse as the biological resource''* [26]. While the CBD

definition is commonly accepted, the variety of definitions of biodiversity is particularly relevant when it comes to the scientific measurement of biodiversity. For the purposes of detailed analysis, and the creation of indicators to measure or monitor trends, exactly how biodiversity is defined will influence what is measured [7, 27, 28]. Biodiversity indicators aim at using quantitative data to measure aspects of biodiversity, ecosystem condition, services, and drivers of change. This advances understanding of how biodiversity is changing over time and space, why it is changing, and what the consequences of the changes are for ecosystems, their services, and human well-being. The huge variety of elements included in the definition of biodiversity results in a varied set of methodologies to measure the natural environment [29]. There is no unified metric for quantitative measurement. The variety of metrics employed include [30]:

- species richness (number of species);
- population number (number of genetically distinct populations of a particular species defined by analysis of a specific element of its genetic makeup) [31];
- genetic diversity (The variation in the amount of genetic information within and among individuals of a population, a species, an assemblage, or a community [32];
- species evenness (measurement of how evenly individuals are distributed among species) [29]; and
- phenotypic (organism characteristics) variance, (the measurement of the different between the phenotypes within a sample) [30].

BIODIVERSITY MEASUREMENT AND POLICY

The detail of how to measure biodiversity is an area of discussion particularly relevant at the science/policy interface [33]. The CBD-mandated Biodiversity Indicators Partnership (BIP) promotes the development of indicators in support of the CBD and related Conventions, national and regional governments and a range of other sectors. Indicators initiated under the partnership are linked to the goals of the Strategic Plan for Biodiversity 2011-2020 [24] and include habitat extent, protected areas and species extinction.

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Coral reefs are among the most biodiverse ecosystems.

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Category:

Internationally recognised definitions

Key terms: In depth

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