Summary of the RUBICODE Review on:

"Concepts of Dynamic Ecosystems and their Services"

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Ecosystems and the species living within them undergo change continuously. Ecosystems provide many services to humanity, but the degree of provision changes as ecosystems change, particularly under periods of rapid climate or land use change. Successful conservation of ecosystems, their biodiversity and their services requires conservation measures that take account of the dynamic nature of ecosystems as well as their multiple service provision. This report reviews the state of the art with regard to the assessment of ecosystem services in the context of biodiversity conservation.

Ecosystem services were categorised according to the Millennium Ecosystem Assessment into four different classes: provisioning, regulating, cultural and supporting. Six terrestrial (agro-ecosystems, forests, semi-natural grasslands, heaths and shrubs, montane and soils) and three freshwater (wetlands, rivers/floodplains and lakes) ecosystems were assessed. Some services (such as food, fibre, and fuel) are provided by all ecosystems, while others are restricted (for example pollination is only provided by terrestrial ecosystems). Quantification of these ecosystem services is important in understanding their value (both monetary and non-monetary) to humanity.

The concept of "service providing units" (SPU) was explored as a tool to link species populations, functional groups and ecological communities to the quantification of the services provided to humanity. An SPU can be defined simply as the components of biodiversity necessary to deliver a given ecosystem service at the level required by service beneficiaries. This definition makes three assumptions. First, that the [human] need for an ecosystem function has been explicitly identified thereby re-classifying it as a service. Second, that the rate of delivery of the service can vary, but it should meet some base level defined by service beneficiaries (i.e. humans; e.g. financial profits attributable to service provision are above a given threshold). And third, that the components of biodiversity providing the service can be identified and quantified.

The steps that need to be undertaken to identify and quantify an ecosystem service using the SPU concept can be divided into three stages of analysis, which are described in detail in the full review: (i) identify beneficiaries and providers of the ecosystem service; (ii) quantify demand and supply of the service; and (iii) appraise the service value and implications for management and policy. A literature review gathered information on each of these steps for 64 case studies, covering all nine ecosystems, though good examples for montane and lake ecosystems were few. Studies cover a range of scales from local to regional to global, though local examples were more common as it is easier to recognise service provision and usage at this scale.

Ecosystems are in a constant state of flux and ensuring systems have the capacity to cope with likely changes is crucial if desirable ecosystem services are to be maintained. A permanent shift in conditions or an increase of stress (due to anthropogenic pressures such as climate change) can lead to changes in the balance between species, changes in species and/or functional composition and therefore to changes in (the composition of) SPUs, with possibly important consequences for conservation and management. A framework for quantifying and assessing these factors was developed and is discussed in the full review paper.

The review showed that service quantification, particularly in non-monetary terms, is often minimal and that some standardised approach to quantification, and thus to conservation, of ecosystem services is required.