Summary of the RUBICODE Review on:

"Biodiversity Conservation: Going Beyond the Protection of Species Richness"

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Land use, land management and changing climate conditions are likely to impact adversely on biodiversity in numerous ecosystems worldwide. In order to detect and monitor such impacts, indicators are needed that reliably reflect these changes. Biodiversity indicators need to be easy to interpret and communicate to decision makers. But they must also have a strong relationship with the biology, structure and function of biological communities.

Within the RUBICODE project, a review compiled about 630 scientific references to compare the development and application of indicators for different purposes in different terrestrial and aquatic ecosystems. The analysis revealed widespread use of plant and animal "richness" (the number of species present) as indicators of biodiversity. A remarkable gap, however, was found for the functional and genetic components of biodiversity. Functional diversity refers to the role a species or community plays in an ecosystem. Soil microbes, for instance, help to decompose and recycle organic material, while algae and bacteria are crucial for the process of self-purification in rivers. Thus, functional diversity is strongly related to ecosystem processes, which finally make the ecosystem services people obtain from the ecosystems.

As a consequence, new biodiversity indicators are needed to account for functions: the process-related component of biodiversity. A potential way to fill this gap is to measure the ecological characteristics of plants and animals. These characteristics ('traits') are attributable to specific ecosystem functions (in a way that individual species names are not) and therefore provide a promising means to indicate the status of functional biodiversity. The ecological characteristics are applicable at various geographical scales, making them useful as indicators at the scale of entire nations and bioregions. At present, such large-scale indication is still approached by rather indirect measures of biodiversity, such as ecosystem area and fragmentation.

The review on indicators showed that much more effort must focus on the development of process-based bioindicators. In order to sustain ecosystem services, such as food and fuel provision, water purification, or nutrient cycling, we also need to know more about the thresholds of biodiversity at which a service is no longer provided or runs the risk of failure.

Finally, little is known about genetic biodiversity indicators across ecosystems. Filling this gap will be crucial to identifying and monitoring genetic resources and, ultimately, to ensuring their sustainable use. The sustainable use of ecosystem services, in general, is likely to be promoted by greater use of ecosystem valuation, where economic (monetary) indicators are linked to ecosystem functioning. Economic indicators, however, are still scarce in the field of indication.

Full report: "Assessing and monitoring ecosystems – indicators, concepts and their linkage to biodiversity and ecosystem services".