Organisms are shaped contemporaneously by ecological processes and over long periods of time by evolution, processes that have led to the diversification of life. But is the diversity of life all biodiversity is? We argue that biodiversity is the conclusion drawn both from the variety of life forms and from the variety of processes that have shaped them. One cannot talk about biodiversity in a scientifically meaningful way without going beyond taxonomic considerations.

Emphasizing taxonomic descriptions and ignoring process descriptions draws attention to genes and organisms rather than to the dynamic interactions between them. When environmental changes reduce the number of species, it is not just the list of present organisms that changes. Possibly unique interactions may also be lost forever, and with their loss, we may lose the potential for generation of a new diversity of life.

Even some of our most prominent institutions dedicated to the preservation of biodiversity miss this salient point. For example, the Convention on Biological Diversity (www.biodiv.org/doc/legal/cbd-en.pdf) states that “‘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 part; this includes diversity within species, between species and of ecosystems.”

Thus, the definition given in the convention does not explicitly state that the processes of ecological interaction and evolution are critical elements of existing biodiversity and the earth’s ability to generate biodiversity. The “biodiversity hotspots” thesis, including its revisions (Myers 1988, 1990, 2003, Myers et al. 2000), also strongly emphasizes a species-oriented biodiversity concept, even though criteria other than endemism, such as species richness and the presence of taxonomically unusual or rare species, are not ruled out by the theory itself (Myers 2003).

Ecological processes and interactions are both the structuring links in all food webs and a major factor in the creation of diversity. Examples include competition, predation, parasitism, and mutualism. Such processes can lead to modification of traits, segregation of niches, “thrust and parry” arms races, and mutually beneficial relations in symbions. Over an evolutionary time scale, small steps of adaptation lead to changes in individual traits and, later, to new traits and the utilization of previously untapped resources and habitats. In concert, these factors represent a diversification process working on all levels, from DNA molecules to kingdoms, and in all organisms, from viruses to large carnivores. As the process of evolution produces and maintains (parts of) biological variation over time, it should be considered an essential part of the biological diversity.

Human influences
Humans change the ecosystems of the world in many ways, through, for example, inappropriate resource use, pollution, and introduction of nonnative genotypes and organisms. Anthropogenic changes are behind one of the largest mass extinctions in the history of life (Avise 2003). It is important to recognize, then, that this loss includes not only biodiversity at the levels of genes to ecosystems but also the diversity of interactions and processes within and between organisms. Conservation strategies should therefore aim to preserve the processes of ecology and evolution, not only the products (such as, e.g., species in zoos or DNA in gene banks). Without their natural interactive ecosystem to live in, neither organisms nor genes will preserve biological diversity.

One might wonder why the Convention on Biodiversity and the hotspots thesis pay little explicit attention to ecological processes. This apparent oversight might be due in part to the abstract, immeasurable quality of a process description. A conservation strategy will always need a measure with which to assign priorities. We understand the risk of further complicating the already difficult concept of biodiversity. The inclusion of ecological processes is likely to make the measurement of biodiversity harder and more ambiguous, and from a political point of view that might represent a challenge for nature conservation. But simplifications have their costs, which we pay now or later. By overlooking the processes that in nature are linked with the diversity of life, we could over- or underestimate our impact on biodiversity, and thus be in danger of making fatal mistakes in our conservation efforts. To give one example of the measurement problem, Price (2002) found that some stressful environments with low species richness have high beta (turnover) diversity. In other words, the same environment can be both a “hotspot” and a “coldspot” of biodiversity, depending on the method of assessment. This is not a paradox; it is merely a result of failing to give due weight to the processes involved in biodiversity.