The delay between a driver affecting a system and its consequences for biodiversity change can be highly variable. In the case of species extinctions this process has been well studied, and habitat loss appears to be one direct driver for which lag times will be long . In studies of African tropical forest bird species, the time from habitat fragmentation to species extinction has been estimated to have a half-life of approximately 50 years for fragments of roughly 1,000 hectares (Brooks et al. 1999). In Amazonian forest fragments of less than 100 hectares, half of the bird species were lost in less than 15 years, whereas fragments larger than 100 hectares lost species over time scales of a few decades to perhaps a century (Ferraz et al. 2003).

On the one hand, these time lags mean that estimates of current extinction rates may be underestimates of the ultimate legacy of habitat loss. For example, for African primate populations it is estimated that over 30% of species that will ultimately be lost as a result of historical deforestation still exist in local populations (Cowlishaw 1999). On the other hand, the time lags offer opportunities for interventions to be put in place to slow or reverse the trends, so long as in this case the period to habitat recovery is shorter than the time to extinction.

4.5.3 Key Gaps in Knowledge and Data

Certain gaps in knowledge and data relating to biodiversity are almost certain to prove critical over coming years, and efforts are urgently needed to gather this information, particularly if biodiversity indicators are to become more reliable and informative.

- Data are sparse for certain key taxa—especially invertebrates, plants, fungi, and significant groups of microorganisms, including those in the soil. These groups are especially important for ecosystem services, yet global syntheses and trend information on even significant subsets are entirely missing. It seems likely that both extinction rates and local diversity and endemism may be lower among microorganisms than in the well-studied groups, suggesting that intense monitoring may not be so important. However this remains to be validated. Taxonomy as a discipline underpins much of this work yet is in decline worldwide.
- Conservation assessment has proceeded at increased intensity over recent decades. However, knowledge of biodiversity trends falls far behind knowledge of status. Too often assessments are undertaken using new methods, new measures, or new places. Trends, which are critical to current questions, rely on a time series of comparable measures.
- Local and regional datasets are generally of higher quality and cover longer time periods than global data. A better understanding of the relationship of local to global processes and the development of techniques to allow local dynamics to inform large-scale assessments would allow rapid progress to be made in large to global-scale assessments.
- There are far fewer studies at the genetic level than for populations, species, and ecosystems, yet these are significant components of biodiversity for assessing present and future adaptability to changing environments.
- Marine and freshwater areas are less well known than terrestrial areas. Among terrestrial habitats, biodiversity trends in biomes such as drylands and grasslands are less well known than trends in forests.
- The impacts of biodiversity change on ecosystems services are still poorly understood. Even where knowledge is better, there are almost no studies documenting the trends over time.

Alongside new data, approaches to long-term, large-scale continuous monitoring of biodiversity and attitudes to data sharing will need to be developed, as well as the infra-structure and technical and human resources that such an effort will require.

4.6 A Summary of Biodiversity Trends

The evidence presented in this chapter supports three broad conclusions about recent and impending changes in the amount and variability of biodiversity: there have been and will continue to be substantial changes that are largely negative and largely driven by people; these changes are varied—taxonomically, spatially, and temporally; and the changes are complex, in several respects.

First, changes are substantial and predominantly negative. Although there are very real limitations in the extent and quality of our knowledge of the changing state of nature, we already have overwhelming evidence that humans have caused the loss of a great deal of biodiversity over the past 50,000 years and that rates of loss have accelerated sharply over the past century. Current rates of species extinction are at least two orders of magnitude above background rates and are expected to rise to at least three orders above background rates.

Among extant species, 20% of all species in those groups that have been comprehensively assessed (mammals, birds, amphibians, conifers, and cycads) are believed to be threatened with extinction in the near future. For birds (the only taxon for which enough data are available), this proportion has increased since 1988 (BirdLife 2004a). Even among species not threatened with extinction, the past 20–40 years have seen substantial declines in population size or the extent of range in most groups monitored. These include European and North American farmland birds, large African mammals, nearly 700 vertebrate populations worldwide (Loh 2002), British birds, waders worldwide (IWSG et al. 2002), British butterflies and plants (Thomas et al. 2004a), amphibians worldwide (Houlahan et al. 2000; Alford and Pechmann 2001; Stuart et al. 2004), and most commercially exploited fish. These declines in populations are broadly mirrored by declines in the extent and condition of natural habitats (Jenkins et al. 2003).

Second, changes are varied. Rates of biodiversity decline, although very largely negative, vary widely on at least three dimensions. Taxonomically, certain groups appear more vulnerable to change than others: thus amphibians, and freshwater organisms in general, exhibit higher levels of threat and steeper rates of population decline than do better-known groups such as birds or mammals (Houlahan et al. 2000; Alford and Pechmann 2001; Loh 2002). Within groups, phylogenetically distinct, ancient, and species-poor lineages seem consistently to be faring disproportionately badly. Some generalist species are expanding their ranges, either naturally or as invasive aliens, whereas many ecological specialists are in decline.

Spatially, most species losses to date have been concentrated on islands. Disproportionately high rates of contemporary habitat conversion in endemic-rich areas of the tropics, where areas of dense human settlement and high species richness tend to coincide, mean that impending extinctions are particularly concentrated in tropical island and montane systems. In temperate regions, in contrast, substantial historical reductions in habitat extent have led to relatively few global extinctions (due in part to species having larger ranges at higher latitudes). Currently, populations and habitats are expanding in some temperate regions, such as temperate forests (Jenkins et al. 2003). Freshwater and marine patterns are less well documented.

Temporally, two patterns stand out. The first is that the scale of loss is in general increasing (although it is important to note that, both on land and at sea, preindustrial human-caused losses