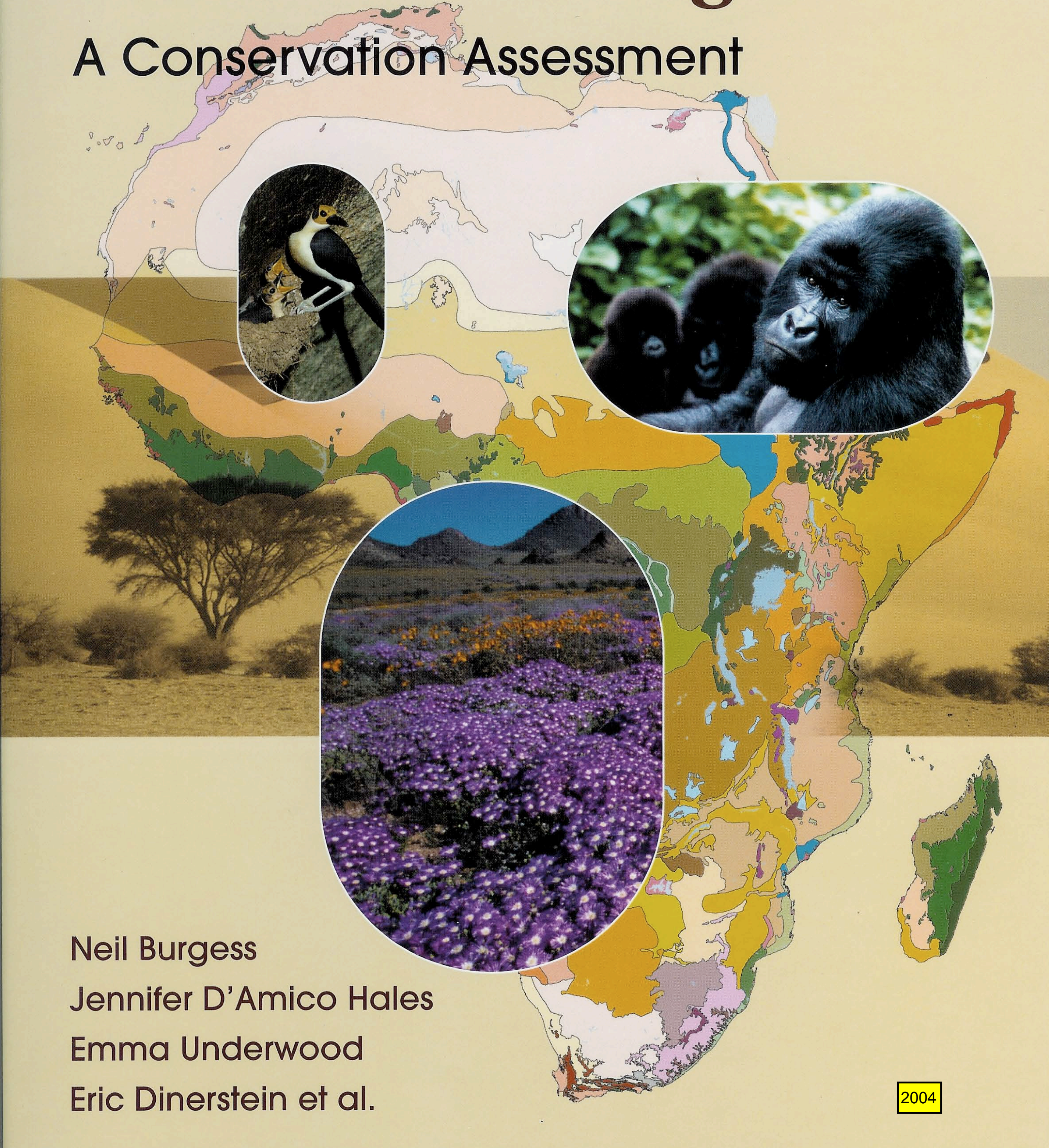
Terrestrial Ecoregions of Africa and Madagascar

A Conservation Assessment



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Wildlife Health in Africa: Implications for Conservation in the Decades Ahead

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The fundamental goals of conservation include maintaining ecological and evolutionary processes, viable populations, and blocks of natural habitat large enough to be resilient to large-scale disturbances (Noss 1992). Conservationists strive to achieve these goals through landscape-level planning. Yet the role that parasites and disease play in ecosystem dynamics by their impact on the size and distribution of species populations, and hence community structure, often is overlooked when such plans are being developed. Diseases, particularly introduced diseases, have had large impacts on wildlife populations throughout Africa. Notable examples include the rinderpest pandemic in ungulates and outbreaks of canine distemper virus and rabies in African wild dogs (*Lycaon pictus*), Ethiopian wolves (*Canis simensis*), and lions (*Panthera leo*) (Plowright 1982; Roelke-Parker et al. 1996; Sillero-Zubiri et al. 1996; Murray et al. 1999; Woodroffe 1999). Similarly, livestock disease control measures (e.g., for tsetse fly and foot-and-mouth disease) have opened large areas of wild land to unsustainable subsistence agriculture and subsequent loss of wildlife and habitats. Although these issues have been a focus of the veterinary community for decades, only in recent years has the broader conservation community recognized their importance (Osofsky et al. 2000; Deem et al. 2001).

Widespread anthropogenic changes to the environment (i.e., land cover change, habitat fragmentation and degradation) have amplified the role of disease as a regulating agent (Deem et al. 2001). Stresses resulting from edge effects, the loss of genetic diversity, overcrowding, and more extensive contact with domestic stock may increase a species' susceptibility to disease outbreaks (Lafferty and Gerber 2002) that may further stress populations and compound other threats. Because many protected areas have become "islands" surrounded by altered landscapes, epidemics can easily facilitate the extinction of a host species, particularly those with restricted ranges or small populations.

Anthropogenic changes to ecosystems and changes in human behavior also increase contact between humans, domestic animals, and wildlife, resulting in the greater likelihood of pathogen transfer and the emergence of new disease vectors or changes to the ecology of existing diseases. For example, HIV has moved from primates to humans (Hahn et al. 2000). Nonhuman primates are also threatened by diseases from humans, such as measles in mountain gorillas and polio in chimpanzees (Daszak et al. 2000). However, some of the most severe impacts on wildlife populations have come from domestic animals. Introduced species often are the source of epidemics; for example, cattle introduced rinderpest to African ungulates in the late 1800s (Lafferty and Gerber 2002). The African wild dog (*Lycaon pictus*) also suffered critical declines and local extinctions caused by rabies and canine distemper viruses related to the presence of domestic dogs (Alexander and Appel 1994).

We are also learning more about other factors that can increase susceptibility to parasites and disease, such as invasive species, pollution, poor nutrition, resource exploitation, and climate change. Global climate change is already being linked to shifting distributions of disease vectors (Norris 2001; Epstein et al. 1998). For example, annual increases in temperature are associated with the expansion of malaria in the Usambara Mountains of the Eastern Arc (Matola et al. 1987) and in the Kenyan Highlands (Some 1994). Extreme weather patterns (Epstein et al. 1998) can also increase the vulnerability of range-restricted species to disease outbreaks.

Should epidemics and wildlife health issues be addressed in a conservation and management context? Maximizing the viability of species and communities is a common goal for both conservationists and animal health specialists, particularly for small, threatened populations, for which the risk of extinction is greatest. Yet conservationists and livestock specialists have often worked in opposition to each other. In the past, most disease control efforts were aimed at allowing the expansion of domestic livestock, often at the expense of biodiversity conservation and the long-term maintenance of environmental goods and services. Early efforts to control tsetse fly and the use of game fencing to manage foot-and-mouth disease severely affected wildlife populations over time.

Too often, decisions focused on single resources have had multiple adverse resource consequences. Examples include the control of foot-and-mouth disease to support a subsidized beef export market in Botswana and the control of tsetse fly in the Zambezi Valley in Zimbabwe. In Botswana, inappropriately sited fences decimated major wildlife populations and preempted sustainable wildlife tourism options (Pearce 1993). In Zimbabwe, subsistence farmers rapidly migrated into marginal areas cleared of tsetse fly, where they overwhelmed the autochthonous culture, displaced a rich wildlife resource, and developed an area that now depends on food aid in most years (Cumming and Lynam 1997). These kinds of decisions are starting to change as epidemiologically based tools, coupled with more appropriate economic analyses and natural resource accounting, gain wider acceptance in land-use planning and policy, wildlife and livestock management, and monitoring (Osofsky et al. 2000).

In recent years large-scale planning efforts across many parts of Africa have done much to advance the conservation of biodiversity. Yet as conservation landscapes are mapped and refined, we still know little about the factors needed to ensure the persistence of ecosystems and species. Corridors and buffer zones often are used to increase the functional size of areas. However, they can also facilitate the transfer of diseases into populations not already in contact with other pathogens and their hosts (Woodroffe 1999). Applying epidemiological approaches in planning can mitigate such risks. In most cases, however, conservationists lack even the most rudimentary baseline knowledge of what diseases already exist in species and populations of conservation interest. Obtaining such baseline information is the only way to begin monitoring the health of species and spaces.

Epidemiological modeling is increasingly being used by conservationists to identify the desirable size and structure of host populations to help reduce the likelihood of extinction. For example, new disease risk models have helped identify the amount of resources, habitat patch size, and viable population size that might be targeted to help ensure the survival of the critically endangered Ethiopian wolf (Haydon et al. 2002). Disease monitoring and surveillance, with the help of local communities, can also prevent epidemics in wildlife populations (Karesh et al. 2002). In places such as the Horn of Africa, the last known reservoir of rinderpest, local pastoralist communities working with veterinary authorities are able to identify the presence of rinderpest in their cattle and help mitigate its spread to wildlife populations.

There is a growing need for collaboration between veterinary scientists, epidemiologists, conservation biologists, economists, and a range of other disciplines in landscape and reserve planning and at the interface between agricultural lands and, for example, protected areas. Only a multidisciplinary approach is likely to prove successful in efforts to mitigate disease (Karesh et al. 2002). With many species now restricted to small areas surrounded by agricultural and urban landscapes, data on the presence, susceptibility, and transfer of pathogens should be evaluated in planning protected area networks, corridors, and multiple-use areas.

Collaboration between the conservation and health fields has already begun in academic consortia. Recently, scientists from two international animal health associations (one wildlife focused, the other agriculturally oriented) committed to the Pilanesberg Resolution, a call for more integrated approaches among health scientists and other disciplines to address wildlife and livestock health and the concomitant impacts on human livelihoods (http://www.wildlifedisease.org/includes/Documents/resolution.html; Karesh et al. 2002). Collaborations such as this present an opportunity for the environmental community to engage other disciplines in wildlife conservation in the context of development. As ecosystems are increasingly altered and the ecology of diseases changes, a more holistic understanding of the links between ecosystem integrity and ecological health will be important, if not essential, to the long-term persistence of biodiversity in the decades ahead.