MAINTENANCE OF DIVERSITY IN FOREST HABITATS

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Summary

When considering the problem of conserving biodiversity in forest ecosystems, one must not forget the historical influence of humans on forest resources. Although the early phases of human colonization on forest areas were characterized by a relatively minor impact on the natural environment, it is now obvious that this evaluation has not applied for at least some decades in many tropical regions and for at least some centuries in the temperate regions of the western world. Forest losses should be attributed to a complex series of causes, which are not mutually exclusive but rather often interact to cause very serious extirpation patterns of pristine forest formations. Among the various possible causes, the following are identified: (a) conversion to permanent agricultural land (arable cropland, tree crop plantations, forest plantations, and pasturelands); (b) timber extraction or logging; (c) population pressure; (d) shifting cultivations; (e) transmigration or new resettlement programs; (f) infrastructure development involving extensive land use (construction of roads, airports, stadiums, university campuses, new towns, reservoirs mining, oil field development, etc.); (g) biological war involving extensive use of herbicides; (h) charcoal production for iron ore smelting; and (i) areas where local resource use (e.g., for fodder, fuelwood, fruits, and other forest products) begins to exceed the supply. Other sources of human impingement on forests that are also worthy of note include bush burning, overhunting, overgrazing, and tapping of nontimber products. Furthermore, coastal forests and fringing forests at the banks of rivers are susceptible to destruction in the event of such engineering works as control embankment, dredging, harbor development, and land reclamation projects. A focus on regional deforestation problems is thus necessary, especially in those areas where local political instability may produce further dramatic consequences to the general environment (e.g., parts of Africa, Central America, and Asia). Recent examples were provided by the dramatic wars in Rwanda, Liberia, and Sierra Leone, which certainly house important sectors of the Congolese forest zone.

In heavily populated and developed countries, a dramatic situation may be caused by shifting cultivation, logging, urbanization, and a series of road construction and industrial development projects that have hastened deforestation rates. This is particularly the case in the Niger Delta Basin, which is an area over 200 000 km^2 that represents one of the most important wet areas of the African continent and where there is a considerable degree of endemism in many floral and faunal groups. This area is especially environmentally precarious, as it is across the enormous number of rivers and creeks of this area that more than 80% of Nigeria's crude oil is derived (and Nigeria is the greatest producer of oil in the whole Africa, and sixth in the world). This area also houses the main concentration of mangrove forests in all of West Africa; thus, it is evident that the mangrove forest as a whole is rapidly being lost to the exploration and exploitation activities of oil industries. Indeed, large expanses of the forest are cleared for the establishment of oil fields, flow stations, pipelines, refineries, and by incessant oil spillages arising from mechanical failure, oil well blowout, pipeline bursting, sabotage, etc.

In areas of a potentially enormous economic value (as in the study case presented below, the Niger Delta of southern Nigeria), it is evident that a crucial problem for the conservation of biodiversity is not only the direct devastating effects of habitat alteration, but also the indirect, long-term effects caused by industrial developments, including, for example, (a) pollution of air, water, and soil; (b) the indirect increase of rural–urban migration; and (c) the upsurge in urbanization and its concomitant increase in demand for mangrove timber for scaffolding, building construction, fuelwood, etc. Indeed, with local variations, there are many other tropical areas where mangroves thrive, such as in Kenya, Tanzania, Bangladesh, Malaysia, Thailand, Indonesia, Philippines, Vietnam, Australia, as well as Central American and Caribbean countries. This chapter presents a short synthesis of (a) the main areas where mangrove forest biodiversity is being lost, and (b) the various industrial development projects that are at the basis of the mangrove crisis.

There is consequently an urgent need for the conservation and management of forest biodiversity all around the world (and especially in tropical developing countries). Nevertheless, recovery of such endangered or vulnerable habitat is often difficult, as it normally takes quite a long time to recover from stress (e.g., see the case of the Brazilian Amazon).

So, what to do? The first, and absolutely necessary step, is to monitor the rates of disappearance of the forests of the globe, as well as the areas that appear (a) most important in terms of biodiversity, and (b) the areas that are disappearing at the fastest rates. In any case, it should be always remembered that, while stressing the richness of biodiversity of an area may be used to justify its conservation, a danger is that it may be argued that areas of lesser biodiversity are therefore not worth preserving, and this might inhibit authorities from conducting studies elsewhere. Data on the current station of forests indicates that deforestation throughout the world's tropical zone has accelerated. The World Resource Institute (WRI) calculated that approximately 20.4 million hectares of tropical forest is being lost each year, 79% more than the 1982 FAO estimate. Furthermore, preliminary FAO figures show an increased loss, from an annual rate of 0.6% in 1980 to 1.2% of forest—or almost 17 million hectares a year—in 1990.

The breakdown was Africa, 1.7%; Asia, 1.4%; and Latin America, 0.9%. Thus, it is evident that the current situation is very bad, and that the tropical forest biodiversity may be considered, as a whole, in danger. To effectively improve the situation, a series of eight points is presented in this chapter. In particular, it is considered very important to emphasize site-specific ecological studies before attempting any eventual conservation tactics. In fact, although there is little doubt that activities like incessant logging and timber removal, or the conversion of forest by humans to other land uses such as pastures, arable, or urban settlement, are extremely widespread and may be considered large-scale phenomena, it should be also noted that every specific forest patch has its own characteristics, with its own trophic chains, and, often, with its own endemics. Thus, although the large-scale phenomena cited above may cause tremendous effects on biodiversity, including, for example, significant disruption to nutrient cycles and water balances, soil erosion, etc., the small-scale-specific factors should certainly not been forgotten. Consider the fact that the concomitant presence of diverging negative phenomena may cause considerable leaching and washing of nutrients with soil loses of fertility in a short time, therefore resulting in catastrophic effects on the biodiversity as a whole. By way of example, in this chapter we propose the Plateau State of Nigeria as a study case, although this area houses high-elevation grasslands as major habitats, but also contains gallery forests with important biodiversity resources. It has been demonstrated that wherever watershed forests have been destroyed or interfered with, rainfall precipitation is often impaired or even completely inhibited, although clouds may be seen to continue to pass over deforested areas as previously. An elaborate consequence of deforestation is that it affects climate, either at a local scale or more generally. It is recognized that deforestation is responsible for important changes in heat balance, water budgets, and ecological balances on a variety of scales. It affects a wide spectrum of climatic elements at Earth's surface, namely aerodynamic roughness, albedo, net radiation/temperature, and energy balance transfer (i.e., the partitioning of net radiation into sensible and latent heat fluxes). Finally, in areas of extensive deforestation, the load of the greenhouse gas carbon dioxide (which normally would have been absorbed by the forests) builds up in the atmosphere, contributing to a rapid depletion of the ozone layer.

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Biographical Sketch

Dr. Luca Luiselli obtained the degree of Doctor in Natural Sciences at the University of Rome "La Sapienza" with a thesis on the comparative eco-ethology of some populations of Italian vipers. Since 1996 he has been a research associate with several industry organizations of the Ente Nazionale

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