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Editorial

Biodiversity and Conservation of Forests

Panteleimon Xofis [1,*], Georgios Kefalas [1] and Konstantinos Poirazidis [2]

[1] Department of Forestry and Natural Environment, International Hellenic University, GR-66100 Drama, Greece; gkefalas@emt.ihu.gr
[2] Department of Environmental Sciences, Ionian University, GR-29100 Zakynthos, Greece; kpoiraz@ionio.gr
* Correspondence: pxofis@for.ihu.gr; Tel.: +30-697-3035-416 or +30-25210-60430

Forests are extremely valuable ecosystems, associated with a number of ecosystem services that are of significant importance for human wellbeing. Although biodiversity conservation stands at the top of the list of desired ecosystem services, carbon storage, water regulation and supply, wood and non-wood products, recreation, soil protection, and nutrient cycling are also all important. While forests cover only 30% of the Earth's surface, they host 60,000 tree species, 80% of all known amphibians, 75% of all bird species, and 68% of all mammals [1,2]. Tropical forests alone host 60% of the world's vascular plants [2]. The conservation of biological diversity is of crucial importance, not only for ethical reasons, but also for a number of services that are offered by biodiversity to humans, including the provision of food, medicinal plants, and others [3]. Despite the extremely significant contributions of forests to the conservation of world's biological diversity, they currently face different and often contradicting challenges.

On the one hand, the abandonment of marginally productive agricultural land, observed in Europe, North America, and elsewhere, which is associated with socioeconomic changes during the 20th century, provides an opportunity for degraded or even lost forests to recover and reoccupy their pre-human areas. This results in a significant increase in forest cover and a decrease in forest fragmentation [4,5], with positive consequences for biodiversity conservation, as is proved with the recent increase in the distribution and abundance of Europe's emblematic carnivores [6,7]. Furthermore, increased forest cover has been reported to contribute significantly to increased biomass and carbon stock, with positive consequences for mitigating climate change [8]. The increases in forest cover, however, may also lead to an increased degree of landscape homogeneity, with negative impacts on local biodiversity and species that require a mosaic of forested and open areas to cover their needs in terms of food and protection [9,10].

On the other hand, extensive deforestation of the globally important tropical forests, and land conversion to agriculture, continues to occur, threatening the long-term sustainability of these biodiversity hotspots [11]. This deforestation often occurs at large spatial scales without necessarily ensuring significant economic benefits, while the loss of habitats and biodiversity is undoubtedly huge [12]. As a result, an estimated loss of 420 million hectares has been reported since 1990 and, despite the decreasing trend of deforestation, 10 million hectares of forests are still being lost every year [2]. Forest loss, along with other human activities, results in an estimated one million species of the world's plants and animals (out of an estimated total of eight million) facing the threat of extinction [13], and this leads scientists to suggest that the world is currently facing the sixth mass extinction.

All the above issues stress the need for sustainable forest management, and for reconciling land management and socioeconomic development with the need to conserve the global biodiversity at all levels, from genetic variants to species, populations, and ecosystems. In this Special Issue, a collection of articles is published covering a wide range of topics related to forest and biodiversity conservation.

The conservation of genetic diversity and resources is of crucial importance for biodiversity conservation, especially under conditions of climate change, which transforms

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habitats across the globe. Chertov et al. [14] studied the genetic diversity and population structure of *Larix sibirica* in the Urals, concluding that the currently observed differentiations between the populations need to be preserved by maintaining non-fragmented populations and preventing the geographical isolation of existing populations. In the same region, Sboeva et al. [15] reported a limited genetic diversity in *Pius silvestris*, which is explained by the biogeography of the established populations. A similar study by Gong et al. [16] on *Cinnamomum camphora* in East Asia revealed significant differences in genetic diversity among populations and moderate differentiation between populations. They point out the need of enhancing gene flow to reverse the negative effects of genetic drift and reduce the risk of genetic diversity reduction. Significant differences in the within-population genetic diversity, and high differentiations between populations, were observed by Huang et al. [17] in different populations of *Camellia chekiangoleosa*. They recommend the adoption of appropriate management measures to maintain the diversity in the high-diversity populations and increase the gene exchange in the low-diversity populations to restore genetic diversity. Limited genetic variations among studied populations of *Triadica sebifera* are reported by Zhou et al. [18], along with a relatively low within-population genetic diversity. However, the existence of some rare alleles in some populations may prove extremely important in maintaining the level of genetic diversity. Ex situ conservation is proposed in the above studies as an alternative approach for maintaining diversity in ecologically and economically important species, while Liu et al. [19] provide specific instructions for the preservation of the pollen of *Gleditsia sinensis*. A combination of in situ and ex situ conservation is also proposed by Kinho et al. [20] for the endangered species *Pericopsis mooniana* and its introduction into areas that are expected to become suitable as a result of climate change.

Climate and global changes result in significant land use changes and habitat alterations, with subsequent alterations in species' current and future geographical distributions, as well as in their physiological responses. Zhang et al. [21], studying four alpine *Rhododedron* species, revealed a significant expected shrinkage in their geographical distribution as a result of climate change, as well as an expected movement of species to different biogeographical regions. A significant expected decrease in the currently suitable habitats for *Swietenia macrophylla* (mahogany) was reported under different climate change scenarios by Herrera-Feijoo et al. [22]. At the same time, currently unsuitable areas may become suitable in the future, which demonstrates the dynamic nature of any conservation measures, including the designation of protected areas. Climatic patterns affect a number of physiological responses of species, including flowering and fruiting. Dagnachew et al. [23] point out the need for a better understanding of the relationships between climatic variables and species physiological responses, which vary considerably between species, in order to develop an effective conservation scheme for species of high ecological and economical importance.

The dynamic recovery of European forests was confirmed in the study by Referowska-Chodak and Kornatowska [24], covering a period of 75 years in Poland. Irrespectively of the political regime, the study demonstrates the steady increase in forest cover and biomass, as well as in the areas designated as protected. The latter constitutes an important tool for biodiversity conservation, and the NATURA2000 network of protected areas is one of them. The study by Kermavnar et al. [25], however, points out the need for adopting management and conservation measures not only based on broad habitat type definitions, but also based on the specific characteristics of each habitat and on the need to expand the nature conservation actions beyond the designated protected areas. Uprety et al. [26], for instance, identified ecologically important ecosystems outside of the protected areas in the Chure region of Nepal, and point out the need for active conservation measures in the region. An interesting model for the prioritization of areas where conservation actions need to be applied is presented by Vu et al. [27], which has been tested in Vietnam. The model results in seven criteria and seventeen indicators to determine priority areas for biodiversity conservation. In the same direction is the approach presented by Ette et al. [28], where a novel Biodiversity Composite Index (BCI) is proposed for the assessment of the ecosystem, species, and genetic diversity status. Based on this assessment appropriate conservation priorities and objectives can be adopted. An even simpler index derived by remote sensing data, the Normalized Difference Vegetation Index (NDVI), is proposed as a surrogate for field-based biodiversity assessments by Naunyal et al. [29]. NDVI was found to explain 65% of the variation in plant species diversity, while the same study also demonstrates the great value of remote sensing data and methods for monitoring land use changes caused by anthropogenic activities. The latter, as has already been stated above, constitutes a major threat for the integrity of many ecosystems. Mariscal et al. [30], studying an Ecuadorian Andean cloud forest, point out the need to prevent the further loss of primary forests and the further increase in fragmentation. The same study shows that areas that have been under disturbance regimes of varying intensities do not necessarily proceed towards a composition and structure similar to primary forests in the post-disturbance stage. Instead, alternative stable successional stages are observed. The stability of these successional stages is explained by the fact that plant assemblages at any stage reflect the historical and current environmental conditions. Furthermore, as pointed out by Chen et al. [31], shifts in plant functional traits occur with succession, demonstrating complex and diverse trade-offs that result in variation among the ecological strategy spectra of different successional stages and the respective assemblages.

As already mentioned, forests harbor a wide variety of wildlife species, including mammals, birds, arthropods, and others. The strong relationship between bird communities and forest habitat types is demonstrated in the study by Purevdorj et al. [32] in northern Mongolia. The study points out the need for maintaining diverse forest habitats and restoring forests that have been lost or degraded by anthropogenic activities. Given the complexity of forest habitat types, new forest inhabiting species are constantly detected and described by science, such as the new arthropod species described in the study by Jang et al. [33]. However, it is not only the plant and animal species that benefit from increases in forest cover and decreased fragmentation. Increased biomass leads to increased carbon stock, and Abdul-Hamid et al. [34] presented an interesting approach in estimating biomass in the ecologically vulnerable and extremely important mangrove forests. The approach can also be applied to other forest types and different biogeographical regions. The overall positive effects of increased forest cover and decreased fragmentation in a wide range of ecosystem services, including provisioning, regulating, and cultural, is demonstrated in the study by Kefalas et al. [35] in the eastern Mediterranean region.

Beyond any doubt, forests constitute the main terrestrial biodiversity carrier of the world, compared to any alternative land use/cover type. Their conservation is a global challenge, and has to be the first political and social priority. We believe that the studies presented in the current issue provide important and useful insights towards achieving the target of ensuring a sustainable environment for current and future generations.

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