Optimization of floodplain management by action at the level of riparian forests

IORDACHE Virgil, BODESCU Florian, DANCIU Mirela
Universitatea din Bucuresti, Spl. Independentei 91-95, 76201 Bucuresti, e-mail: virgil@bio.bio.unibuc.ro

Abstract The purpose of our study was to identify managerial measures at the level of the riparian forest able to sustain the management objectives at the floodplain level. We studied the current structure and management of he production unit Filipoiu in the Big Island of Braila. Rezults showed a large degree of forests fragmentation, the prezence of a rather large area with natural ("unproductive") ecosystems, as well as of seminatural forests, a trees population structure shifted towards young individuals, indicating overexploitation, and a low productivity of the forests. Changes in the managerial regimen are proposed.

Key words: fluvial system, riparian forest, Danube, management

Introduction

There are many excellent books and reviews dealing explicitly or implicitly with the structure and functioning of riparian forests (e.g. [1, 2, 5, 6, 7]). However, few of them discuss the role of riparian forests in the integrating macrolandscapes. But first of all let us define the riparian forests and their position in the integrating landscapes. The macrolandscapes include in their structure, beside riparian forests, other types of ecological systems (aquatic, terrestrial, wetlands different from riparian forests). By interacting with these components of the macrolandscape (in terms of fluxes of matter and energy), the riparian forests contribute to the production of resources of services performed by the macrolandscape, i.e. they have a role in this production. In Fig. 1 we show the structural place of riparian forests in the including landscapes [3].

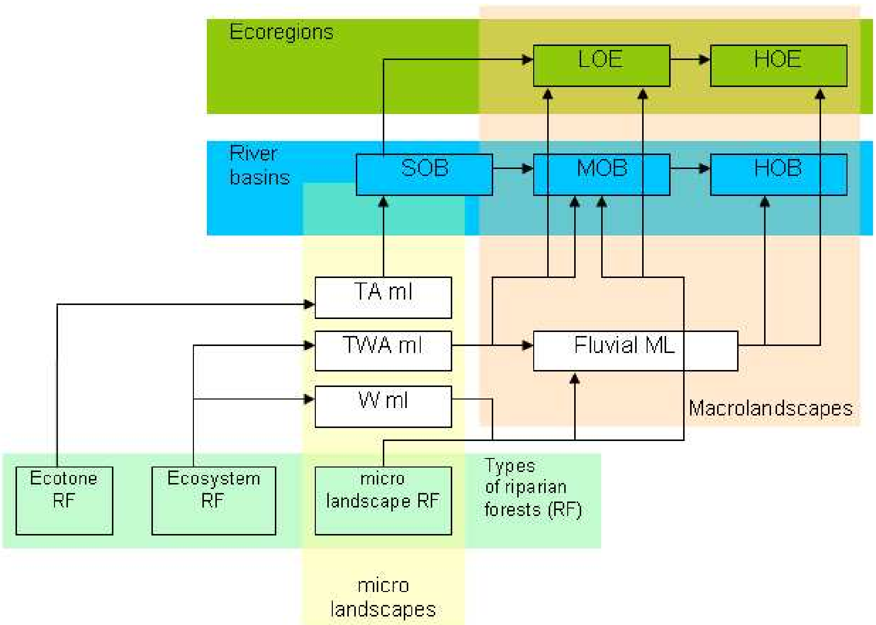


Fig. 1 Inclusion relationships between riparian forests and their integrating systems.
Legend: black arrows = inclusion relationships, ml = microlandscape, ML = macrolandscape, TA = terrestrial aquatic, TWA = terrestrial-wetland-aquatic, W = wetland, SOB = small order river basin, MOB = medium order river basin, HOB = high order river basin, LOE = low order ecoregion, HOE = high order ecoregion.

Vadineanu and his colleagues [9] analyze the particular case of the Lower Danube River System (LDRS) macrolandscape. Most of the Danubian riparian forests are of ecosystem type and of microlandscape type. In order to establish their role in the production of resources and services by LDRS, one has first to characterize their structure at landscape level. Then the functional implications of these structural aspects should be established, and finally management consequences can be drawed. In this paper we illustrate this approach in the case of a forested local landscape situated in the Big Island of Braila, the largest island of the Danube floodplain.

Materials and methods

We have chosen to study a local landscape located in the Northern part of the Big Island of Braila (fig. 2). Its name is the production unit III, Filipoiu, as it is inventoried by Romsilva, the Romanian administrator of the public forests. There were two reasons for our choice. The first one was the fact that this landscape is representative from the point of view of the management practices performed in the Danube's floodplain. The second one was the location of the area in an island having a high recovery potential in case of restoration [3, 4]. We have analysed using GIS the maps and the documentation provided by local Romsilva representatives and performed field visits in order to check the accuracy of this information.

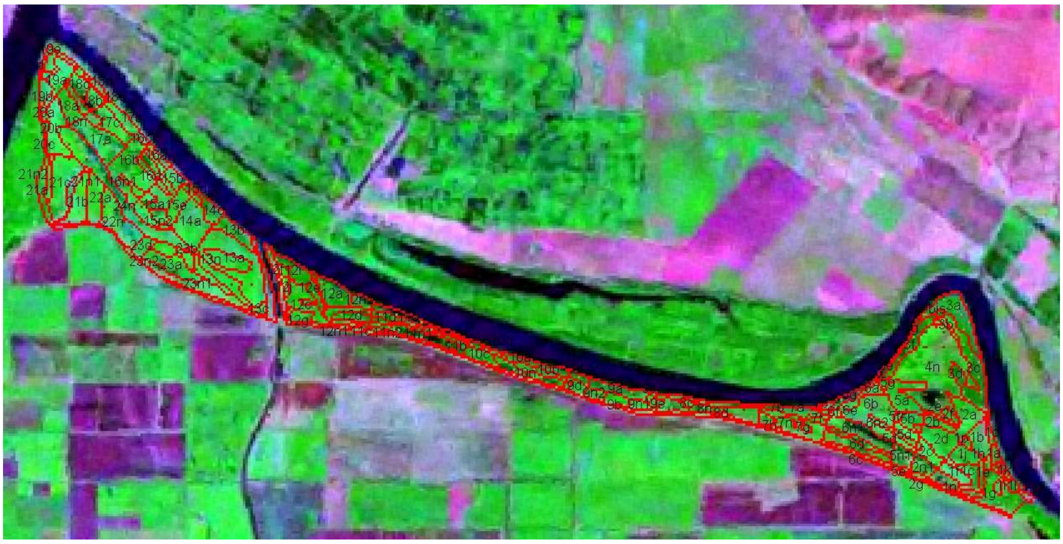


Fig. 2 The Northern limit of the Big Island of Braila and the location of the studied area.
Note. The red contours indicate the limits of the studied landscape, and the analyzed plots (numberd as in the Romsilva inventory). The image is a LANDSAT 7 TM in normal colours.

Results and discussions

The results consisted in the following:

- structural characteristics of the landscape,
- functional characteristics, and
- suggested management measures

The most interesting results with regard to the structural characteristics is that the natural ecosystems still have an important surface in the landscape, namely 206.8 ha. They are classified as "unproductive" by the foresters, include shallow and very shallow aquatic systems (Rotunda and Vederoasa ponds), and show the lowest fragmentation of all ecosystems. The two mentioned ponds are the largest ecosystems of the current landscape. Seminatural forests also have a relatively large surface (about one third of the landscape), but the managers envisage to replace them with willow planted forests, believed to be more productive in terms of wood. Anthropic ecosystems (plantations of willow and poplar) occupy the rest of the current landscape.

Figure 3 presents the distribution of the ecosystems from the point of view of their surface. Most of the forests have surfaces smaller than 5 ha. Taking into consideration that one needs access routes to each forest plot, one can suppose that this fragmentation has a high impact on species with large mobility, such as game species.

Most of the forest ecosystems (67% of the landscape surface) have as dominant species the willow, 30% of the surface is dominated by poplar, and only 3% by other species. The trees populations have a simplified age structure (actually one single age), and most of them are formed by young individuals (up to 14 years). This suggests an extensive exploitation of the wood in previous management stages.

The average wood production is 98 m^3/ha, with an average productivity of 9.8 m3/ha, which are relatively low values. The analyses of the distribution of productivity classes (a forestry, not ecological, indicator, ranging from 1 to 5) show that few ecosystems belong to the highest class, most of them being less productive (classes 3 to 5, fig. 4). The causes of this situation are both the previous overexploitation (reflected by the current age classes), and the hydrogeomorphic characteristics of the ecosystems (mainly the high floodability).

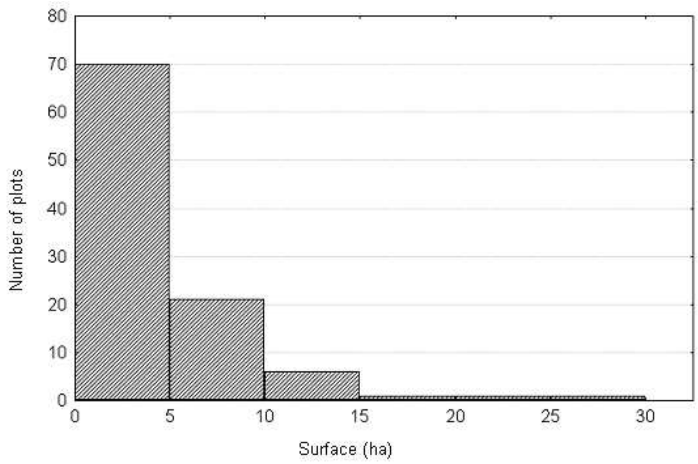


Fig. 3 The distribution of the ecosystems (plots) from the point of view of their surface.

Remark the very high number of plots with small surface.

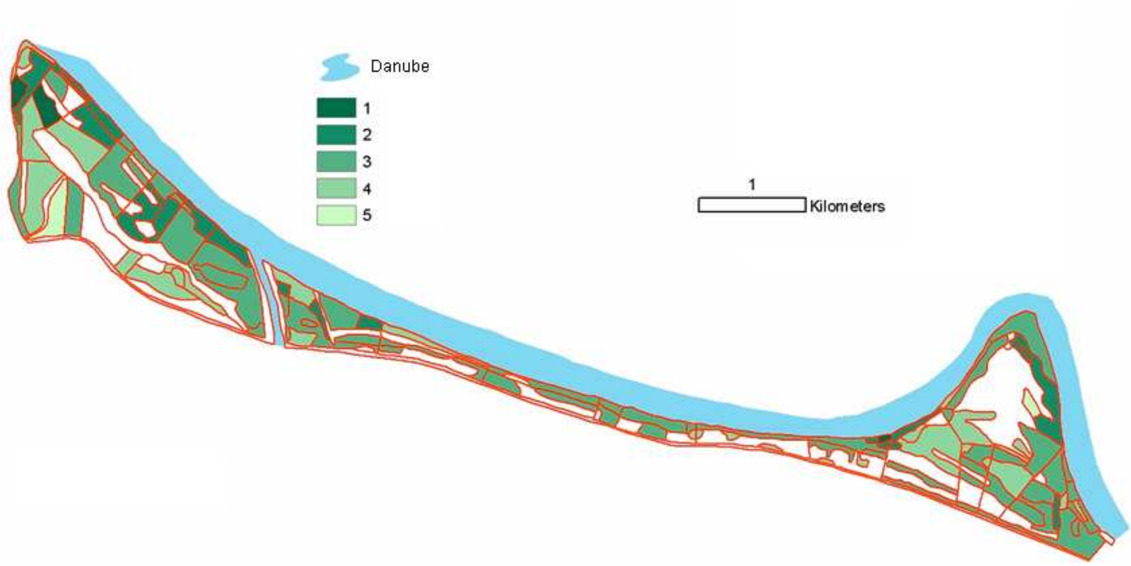


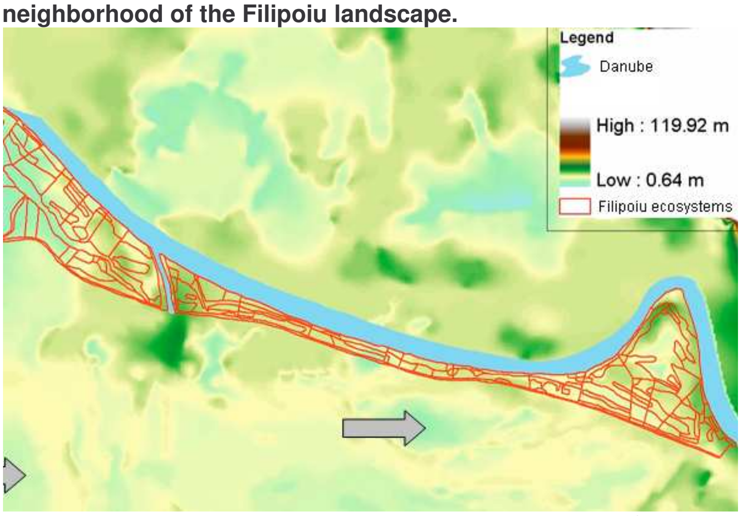
Fig. 4 The distribution of the ecosystems (plots) from the point of view of their productivity.

Green areas indicate forested ecosystems. White areas indicate other types of ecosystems. Lighter green indicates lower productivity than darker green (5 grades as indicated in the graphical legend). The image has been produced in the GIS laboratory of the Department of Systems Ecology of the University of Bucharest.

The forestry management is oriented mainly towards the use of the forests in order to protect the main dike of the Big Island of Braila, and only secondary towards the maximization of the wood production. However, neither the biogeochemical services and the species diversity services are taken into consideration, nor the production of other types of renewable resources.

Taking into consideration the recent steps towards the elaboration of a restoration plan for the Big Island of Braila [3], performed in the larger context of the Lower Danube River System restoration [8], we believe that the areas located between dike and Danube should benefit of a special management regimen. These landscapes should be directed towards a state in which they would effectively function as recolonisation sources for the future restoring ecosystems. For instance in the Big Island of Braila the hydrogeomorphic units still preserve morphometrical characteristics similar with those in the reference state (before diking), which makes them able to some degree of restoration (fig. 5). Consequently, it seems appropriate to preserve the Filipoiu landscape (as well as other dike-shore landscapes of the Big Island of Braila) in a state as similar as possible with the reference one, and in particular to give up the plans of convering the seminatural forests into planted ones.

Fig. 5 DTM in the neighborhood of the Filipoiu landscape.



Arrows indicates current depressions located in the diked area (Big Island of Braila) which might benefit from the recolonisation potential of the populations located in the Filipoiu landscape.

Conclusions

The main management actions need for maximizing the role of the Filipoiu landscape in the potential restoration of the Big Island of Braila are giving the conversion of the still seminatural forests and reducing the fragmentation degree of the landscape. A management plan which would explicitly take into consideration the biogeochemical and species diversity services is also desirable.

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