RESTITUTION OF FLOODPLAIN FORESTS SYNECOLOGICAL SPECIFICITIES

Professor Ladislav Somsak
Department of Soil Sciences
Comenius University
Bratislava, Slovak Republic

This contribution is devoted to the natural regeneration/restitution of the Danubian floodplain forests, and the synecological qualities of this environment. The significance of floods, which are decisive for the natural regeneration of tree species by means of sediment accumulation, is stressed. The willow-poplar forest is regenerated on the youngest sediment accumulation. The willow-poplar forest is regenerated on the youngest sediments, almost exclusively, except for mature forest stands. Apart from the natural floods, resulting from the construction of waterworks on the Danube, it is necessary to evoke simulated floods, which create sediments, even though in smaller numbers. These floods are proposed for the first half of April. Sediments, which rest after the floods, can be settled by willow and poplar seeds in the same year. The regeneration of hardwood floodplain forests is realised under the protection of mature forest stands. The increase of ground water levels helps to revitalise the natural regeneration of the above-mentioned floodplain forests.

Floods as a primary factor of forest composition

Many works have been published on the impact of the Gabcikovo-Nagymaros dam to vegetation. The foremost opinion included a prognosis of vegetation changes published by A. Jurko in 1976. The author indicated the possible changes caused by a decrease or increase in ground water levels. He indicated, on the basis of observed processes, a tendency for succession in almost every floodplain forest's vegetation type. The first knowledge obtained after the damming of the Danube river confirms Jurko's prognosis. This applies to the stretch of increased ground water levels, above the Conovo reservoir, where plant communities of mesophilous types of vegetation, from stagnant waters and swamps, arise. As Jurko predicted, in the draining part along the old Danube river-bed, the rebuilding of communities ends by degraded hawthorn, Crataegetum danubiale, shrub stadia. Similar prognoses, even if in less detail, were published earlier. For example, predictions were made about the impact of planned, but not realised, waterworks.

The rebuilding of plant communities, influenced by a decrease or increase of ground water levels, is visible in non-forest communities, or in the floodplain forests' herb layer. Woody, but mainly tree particles of forest stands, have a more complicated genesis in alluvial conditions. Simple tree species also react to different ground water levels, but their tolerance has a wider span than herb layer plants. It is important to call attention to the whole scale of the lower units of willow-poplar forests, where the herb layer population numbers differ while tree population numbers remain constant. How is it possible to explain this fact?

It is an incontestable fact that the original composition of floodplain forests was formed by floods. Floodplain forests arise along a transverse of the river profile, which is determined by the intensity of the floods. Aggregated ramparts and places of the greatest flood intensity are populated by Salix alba, the only plant surviving in these extreme conditions.

Places of more moderate flooding are populated by Salix fragilis, habitats with shorter lasting floods by Populus alba and higher terraces by hard-tree species, mainly Fraxinus angustifolia. The composition of the floodplain forest is also differentiated by the character of sediments. Gravel sediments in a soft floodplain forest are populated by Populus nigra and finer ones by Salix alba. Shortly said, floods also determine the tree composition of floodplain forests. Ground water level is indeed a serious factor, but it determines the differentiation of the herb layer in a given population structure of floodplain tree species.

Differentiated natural regeneration of floodplain forests

The natural regeneration of floodplain forests from seeds varies considerably. Regularly flooded willow-poplar forests, ash-poplar and ash-elm stands are regenerated differently. Observations on the regeneration of willow-poplar forests have shown that the most effective regeneration is on an original settlement of the youngest river sediments. The regeneration of willow-poplar forests precludes the protection of mature trees. The speed and success of regeneration depends on the germination of willows and poplars.

There are current cases of regeneration by means of tree-snatching, in already existing communities of river-littoral. Long-dated observations also show that sediment texture determines the tree composition of such forests. Populus nigra is snatching on thicker sediments, Salix alba on finer ones; both tree species are unable to snatch onto undifferentiated sediments. An exception is Salix fragilis, which is snatching on uncovered clay soils on the bottoms of dead branches.

Experience further shows that the natural regeneration of mature willow-poplar forests only occurs after the accumulation of new sediments by floods. Regeneration from seeds is less spontaneous in this case and it is limited by the expansion of some species of the herb layer. An

example is Urtica dioica, which is regenerated several times during the year following a flood. The contemporary existence of willow-poplar forests is, in the majority of cases, a result of vegetation regeneration, following a previous felling of mature trees. Populus alba also prefers regeneration from seeds in areas adjacent to the mature forest stand, where the most frequent uncovered margins of dead branches -whose surface is more humid during germination - occur.

The regeneration of hardwood trees Fraxinus angustifolia, Quercus robur, Ulmus minor in ash-poplar forests, ash-elm forests, and elm-oak forests is regulated by the properties of the forests. This means that they are regenerated under the mature forest stand, regardless of floods, that are even rarer here. But is has been proven that a good contact of the roots with the ground water level helps in the snatching of the seeds of some tree species. Similar data has been presented about ash regeneration in floodplain forests of the Danubian lowland.

A majority of the European rivers' monocultures of cultivated poplars prevail at present. Their greatest part was established on levelled soil surfaces. Thus, soil condition differences were eliminated and, very importantly, the liquidated seed bank of original trees became a resource for their possible vegetation regeneration, on trunks and roots. The cutting period of poplar monocultures is 25-30 years, the same as when they were established. Therefore, it will be necessary to regenerate them to a considerable extent in the inundation territory of the Danube river. However, natural regeneration is less probable and near impossible. Here, it is possible to use only artificial reforestation. This fact is necessary, regardless of the various considerations about the restitution of the floodplain forests' natural conditions, including proposals for the creation of biocentres.

Restitution of the Danubian natural floodplain forest

The construction of waterworks on the Danube river has created the possibility for natural floods, which provide the conditions for the natural regeneration of willow-poplar floodplain forests. It is necessary to relate their restitution or natural regeneration to simulated floods of the inundation territory. The first attempt with artificial flooding came in 1995 and confirmed the rise of fine sediments, mainly in terrain depressions. There is also the possibility for a natural regeneration of willow-poplar floodplain forests by means of Salix alba seeds snatching onto these youngest deposits.

But for this process to be successful, it is necessary to keep in mind some principles, summarised as follows:

- Simulated floods with a planned discharge of 234 m/sec are needed to support this process.
- The timing of floods is important, in order for new sediments to rise preceded by a period of willow and poplar germination. This means that simulated floods should be realised by the first half of April. By that time, the flood should have the possibility of snatching the floodplain forests' seeds onto uncovered sediments and establishing a base for the regeneration of the natural stands of willows and poplars.
- The largest thickness of sediments, after the artificial flood in 1995, was concentrated at the bottom of the higher situated dead branches, where in the majority of cases, monocultures of cultivated poplars are not established. Therefore, the natural forest existence must also be taken into account by forest management in the future.
- The increase of willow-poplar monocultures has given rise to legislation proposing to leave some smaller areas without interference, particularly areas where thicker sediments remain after stimulated floods. Regarding the anemochorous character of willow seeds, it is possible to suppose their distribution by wind from distant trees.
- The revitalisation of the natural regeneration of hardwood floodplain forests can be confirmed, following the increase of groundwater levels in the Conovo reservoir.

A graduate of the Faculty of Natural Sciences, Comenius University, Bratislava, Professor **Ladislav Somsak** worked as Assistant and Associate Professor at the Department of Geobotany, before becoming full Professor of Botany in 1984. He has served as Head of the Department of Geobotany and Director of the Botanical Gardens of Comenius University, and is, presently, Professor of Botany at the Department of Soil Sciences. His main scientific activities are in the field of phytocoenology and nature preservation, and he lectures on geobotany, dynamics of vegetation, and basic problems of forests.