

History of forest development and anthropogenic transformations. A comparison of Europe and Japan

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Photosynthetic organisms such as vascular plants, algae and cyanobacteria are basic components of the Earth ecosystems. As primary producers they lie at the base of the food chains. Life of human beings, located at the top of the food chain, depends actually on the existence of photosynthetic organisms. Distribution of plants on the Earth is associated with geological evolution of the planet, transformations of land and marine environments, climate history and co-existence of plants and fauna. Relatively new factor in the geological history which influences vegetation cover is man with his ability to use tools and fire. He contributes to migrations of flora and fauna, changes of biota and climate.

Flora of northern Eurasia belongs to the same geobotanical unit called Holarctic kingdom, reflecting close floristic (taxonomic) affinities of the vast Eurasian territories. The pattern of vegetation distribution and floristic diversity in northern Eurasia is associated with climate variety. The natural features of flora and vegetation of northern Eurasia results from the Pleistocene history of climate fluctuations in the rhythm of glacial/interglacial cycles and associated changes of habitats. The subsequent advances of continental ice-sheets in Europe decreased its floristic diversity in the northern areas. Migrations of plants from the north to the south were significantly restricted by the longitudinal distribution of mountain ranges of Alps and Carpathians. Palinological reconstructions in Japan suggests that the forest flora may have survived in the Japanese Archipelago during the last cold epoch.

Since the end of the last glacial and transition to the present warm period of Holocene, the dominant natural vegetation in the west and in the east of Eurasian continent is forest vegetation. During the Holocene, both in Europe and in Japanese Archipelago, human impact on vegetation cover became significant. The main threshold in the man-environment relationships occurred due to introduction of plant cultivation and animal husbandry as a new subsistence system in the history of humanity. The introduction of agriculture was called in the West as the "Neolithic revolution". Agricultural activity caused an opening of European landscapes due to forest clearings for cereal cultivation and forest transformations of their structure and composition as consequence of intensified exploitation of forest resources. Development of agriculture contributed to the growth of human population and further increase of anthropopressure on ecosystems.

The process of forest transformations in Europe and in Japan seems however to be different due to differences in subsistence economy. It concerns main plants and habitats used for cultivation as well as in presence or absence of animal breeding. Main crops in the west of Eurasian continent such as wheat (*Triticum*), barley (*Hordeum*), oat (*Avena*), rye (*Secale cereale*) but also millet (*Panicum milaceum*) resulted in intensive exploitation of dry, terrestrial habitats occupied by mixed oak forest, beech or hornbeam forests. Introduction of rice (*Oryza sativa*) in Japan as a main cultivated cereal led to the exploitation of habitats mainly in the river valleys with riparian vegetation.

A very important factor for the development of vegetation cover in the West became animal husbandry. Domesticated animals such as cows, sheep, goats and pigs needed a significant amount of plant resources from pastures, meadows and forests. The animals were grazing in open

pasturelands (formed after forest clearings) in valleys and uplands, but also under tree canopy within forests. Foliage from trees and acorns were collected by farmers to breed domestic animals in winter time. It is assumed that some types of deciduous forests like 'xerothermic light oak forest' (*Potentillo albae-Quercetum*) in central Europe may have developed in a consequence of long process of forest grazing by domesticated animals. Goat activity in the Mediterranean areas contributed to the early devastation of forest cover. In the contrary to Europe, the lack of animal husbandry in the prehistoric and early historic Japan may have reduced the impact of human economy on the forest ecosystems.

Another feature of cultural differences for consideration, is the issue of continuity or discontinuity of human populations and settlement activity in prehistoric and early historic times. In the case of Europe, migrations and exchange of population in local and regional scale have been confirmed in archaeological records and historical sources. Geographical features of Europe with vast lowlands, which connect western and eastern Europe, make human migrations relatively easy in the east-west direction. Such different human groups in Europe, probably also of different ethnicity, represented various values and attitude to nature and exploitation of natural resources. Differences in land use and attitude to forest resources, which could be connected with basically different populations, have been observed in fossil pollen records. In the case of Japan a higher degree of population continuity seems to occur, what is connected with isolation of the insular and mountainous land.

Human impact on the vegetation cover in Europe was diversified in time and space according to the process of civilization development. The southern Europe entered earlier the sphere of civilization than its northern territories. During the times of Roman Empire, the lands beyond river Rhine and Carpathians, were occupied by Germanic tribes which still lived in 'dense forests' inaccessible for Roman troops. Palynological data from central and northern Europe shows that the human impact and development of cultural landscape in the prehistory and early historical times stimulated to some extent increase of floristic diversity. This growth was partly associated with the floristic newcomers which settled in the areas of western, eastern and northern Europe, along with the set of introduced cultivated plants, accompanied by numerous weeds originating from the territories of western Asia and southern Europe. The agricultural activity developed a mosaic of habitats within the previous 'sea of forests'. This mosaic landscape with patches of forests, meadows, fields, ruderal and fallow lands, stimulated existence of ecologically diversified plant species. The floristic diversity became endangered along with the further intensification of forest clearings, increase of settlement activity and exploitation of natural resources for growing human populations. In the areas of central Europe it happened in the historical times, and especially as a result of industrial revolution during 19th century. In the Japanese Archipelago, a balanced mosaic landscape with forests, paddy fields and rural settlements, preserving floristic diversity, represents today *satoyama*.