Aims of the TERMERD „Assessing forest naturalness in Hungary" project

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The aim of this project is to assess the naturalness status of Hungarian forests with a reliable estimate that has the following characteristics:

- it is based on a sample that is representative of all Hungarian forests;
- it uses quantitative descriptors of several important components and processes (canopy, understorey, shrub and herb layers; tree regeneration; effects of games; site degradation);
- it uses a continuous scale.

With this assessment we plan to achieve the followings:

I. To set a benchmark of forest naturalness in Hungary at the turn of millennia.

II. To answer the questions below:

1. What is the status of Hungarian forests in terms of the naturalness of individual criteria (tree stand, shrub and herbaceous layer, etc.) and of the stand as a whole?
2. What is the naturalness status of forests in individual forest regions?
3. What is the naturalness status of semi-natural stands compared to those of plantations of both exotic and native tree species?
4. What are the effects of site characteristics and the applied sylvicultural systems on forest naturalness?

III. To improve the methods of forest naturalness assessment.

IV. To formulate recommendations for the practice of forest management and conservation.

Our assessment focuses on individual forest stands that are represented by forest subcompartments as units of management.

Since our study is aimed at assessing the naturalness of Hungarian forests, first we define the characteristics of the hypothetic natural forest that we use as a reference. This is a prerequisite of answering questions like "What is the naturalness status of Hungarian forests?". In spite of the difficulties of defining the features of virgin forests, for all studied attributes, we have to make clear those values and/or status that – to our opinion – increase naturalness.

The basis for deciding if a biological characteristic increases or decreases naturalness is to judge if it makes the forest more or less similar to the hypothetical natural stand of the site in question, i.e., to our reference stand. The natural stand – as we assume – has been formed by natural dynamical processes that followed natural disturbance events, i.e., without any human influence. Since the basic unit of our study is the forest subcompartment (3 to 10 hectares in size), we can compare the studied forest stands to the stand scale characteristics of the natural reference. This means that we have to disregard landscape scale features, which in fact, is a limitation of our study. The naturalness value we use is not a direct measure of intactness. Instead, it is a derived continuous variable based on both compositional and structural characteristics of the forest stand.

Based on these assumptions, naturalness is increased by the biological characteristics listed below:

Tree species composition

- dominance of site adapted, native, late successional tree species (lack of them not necessarily decreases naturalness);
- presence of associate tree species that are linked to certain forms of natural disturbances and/or site heterogeneity (optimal proportion of these tree species depends on site, forest type, and successional stage, they can even be locally dominant, e.g., pioneer species in gaps);
- lack of non-indigenous (exotic) species;
- lack a native but not site adapted species.

Tree stand structure

We assume that under the prevailing climatic conditions of Hungary, small-scale gap-phase dynamics is the dominant disturbance regime in most forest communities. Even-aged tree stands originating from larger scale and more intensive disturbances, such as wildfire and windstorm, are rather rare (at the 3 to10 hectare scale). Intensity, frequency and spatial pattern of disturbance vary among forest communities, resulting in differences in stand structure. In spite of all these, in general, we assume that the value of naturalness increases if:

- living stems belong to several age and/or size classes;
- living stems much older than the rest of the stand (or groups of them) are present;
- veteran tree individuals of several hundred years of age are present;
- the form of living stems is variable (leaning and forked individuals grow together with slender ones);
- living stems with hollows and dead branches are present;
- upper canopy layer is not densely and uniformly closed, smaller and larger gaps are present;
- standing dead trees and snags are present;
- standing dead trees include individuals of large diameter (former dominants of the upper canopy);
- lying dead timber is present;
- lying dead wood includes logs of large diameter;
- dead wood is present in all possible decay phases at the same time

Species composition of the shrub layer

- presence of native shrub species that are representative of the potential natural forest community in question, and non of these species gains disproportionate dominance;
- lack of non-indigenous (exotic) species, and native species not matching site conditions;

Structure of the shrub layer

- individuals belong to several age and/or size classes;
- pattern of shrub cover follows that of abiotic and biotic conditions, i.e., is usually spatially heterogeneous;
- signs of intensive game browsing are missing.

Species composition of the forest floor vegetation (herbs and bryophytes)

- dominance of native species that are representative of the potential natural forest community in question;
- presence of associate species that are representative of the potential natural forest community in question;
- presence of species specialized on certain stand structural elements (e.g., dead wood dwelling species), and microhabitats (e.g., rock outcrops);

- low abundance of species that are adapted to human-induced disturbances;
- lack of non-indigenous (exotic) species;
- low abundance of species capable of invasion.

Structure of the forest floor vegetation (herbs and bryophytes)
- besides forming large almost pure patches, dominant species also occur mixed with other abundant species;
- high proportion of species with intermediate abundance (high equitability of vegetation);
- signs of intensive game browsing are missing.

Species composition of tree regeneration
- presence of regeneration
- presence of both the natural dominants and associate species that are representative of the potential natural forest community in question;
- lack of non-indigenous (exotic) tree species;

Structure of tree regeneration
- several age classes are present;
- distribution of regeneration is spatially heterogeneous (patchy);
- signs of intensive game browsing on the morphology of seedlings and saplings (e.g., leaders are browsed, forked growth) are missing.

Site characteristics
- soil erosion is moderate, it is in harmony with natural conditions (topography, density of vegetation cover), there is no sing of human impact on the intensity of erosion;
- dominant humus form is in harmony with natural vegetation;
- lack of human impacts that cause soil compaction and mixing of soil horizons;
- intactness of soil surface is broken up by only natural processes (root plates, optimal game density);
- soil moisture regime has not been changed considerably (i.e., having adverse effects on vegetation);
- rock outcrops, springs, gullies, depressions with stagnant water are present in their natural status.

During the field survey the observer identifies the ***potential natural forest community (PNFC)*** for the forest subcompartment. The identification is based on site characteristics, neighbouring stands, site-vegetation analogies, presence of diagnostic species (or species combinations), and other available information (vegetation map). By PNFC we regard the theoretical climax or subclimax forest community that would develop in the area under actual site conditions in the absence of any human impacts. We compare several attributes (indicators) of the actual vegetation with those of the corresponding age class (development phase) of the PNFC. Since this is a rather static approach of assessing naturalness, we supplement our assessment with studying stand scale characteristics of ***natural forest dynamics***. We apply this approach as a substitute for using the virgin forest as a reference, since our knowledge on virgin forests is rather limited, and there are serious methodical constraints on basing our comparison upon its features that are hard to standardize.