Conservation and Ecological Reconstruction of Oak Forests in Romania

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Nine *Quercus* species grow spontaneously in Romania: *Q. petraea* Liebl., *Q. robur* L., *Q. polycarpa* Schur., *Q. dalechampii* Ten., *Q. cerris* L., *Q. frainetto* Ten., *Q. pedunculiflora* C. Koch, *Q. pubescens* Willd., and *Q. virgiliana* Ten. In ancient times, when forests covered more than 75% of the country's territory, oak forests had a considerably greater extent. The pedunculate oak (*Q. robur*) stands alone occurred on more than two million hectares. Large, compact, monumental forests of *Q. petraea*, *Q. cerris* and *Q. frainetto* were common on hills, plains and plateaus.

Due to historical conditions, oak forests today occur only on a small area (1,139,000 hectares, or 19 percent of the country's forested land). But in spite of this severe reduction, they continue to be of great economic and ecologic importance, because most of these species produce high quality timber. Also, all of them have multiple useful and protective functions in relation to climatic, hydrological, erosion control, scenic, and other values. As a result of Romania's varied relief and climatic conditions, a great biodiversity exists in these oak forests, confirmed by the fact that there are 141 forest types and 74 forest ecosystems in 104 different site types (Radu, 1993, 1995).

Over the centuries, the extended natural oak forests have endured a strong anthropic pressure. Deforestation for agriculture, incorrect practice of coppice systems, abusive grazing, air pollution and acid rains, coupled with prolonged droughts and occasional severe defoliation by insects, led to a dangerous reduction and fragmentation of ancient, large and durable stands. Today, we are confronted with fragile, destructured and simplified stands that are susceptible to ecological problems. The reduction of ranges is connected to the change of species area hierarchy, as today the sessile oak

(*Q. petraea*) stands are more abundant (on 11.6 percent of forest land) than those of *Q. cerris* (2.9 percent), *Q. robur* (2.4 percent), *Q. frainetto* (2.0 percent) and *Q. pedunculiflora* - *Q. pubescens* (0.4 percent).

The forest decline recorded during recent decades elsewhere in Europe also is noted in Romania, particularly in pedunculate and sessile oaks, but also in other oak species. Unfortunately, the aggressive pressure on all forests, including oak stands, is continuing today because of economic difficulties and poverty. In the absence of an effective and practical means of forest protection during the transition to a market economy, the change of the ownership status of forests from state to private property may unleash a new wave of deforestation and illegal cutting on considerable areas. Should this occur, it could result in ecological and economic disaster.

In order to stop the decline and to preserve these valuable forests, considerable silvicultural interventions have been undertaken during the last 50 years. This work had been initiated earlier by the State Forest Service on the basis of scientific research done by the National Forest Institute. These actions were aimed at the reduction of cutting volumes and the preservation of oak stands as protected forests or reserves; the practice of more sophisticated silvicultural systems to assure natural regeneration; the return of coppices to former high forests; reforestation; and, recently, ecological reconstruction (here called "restoration forestry").

In my opinion, it is necessary at this time also to mention other measures taken by Romanian silviculturists and scientists for the conservation of biodiversity in oak forests, *in situ* and *ex situ*. In order to preserve the country's genetic resources and to assure high quality seed production for reforestation, a seed stands catalogue was drawn up for all 29 primary tree species by Enescu in 1986. This catalogue includes a total area of 26,000 hectares of approved (certified) valuable seed stands for oak species in the following proportions: *Q. petraea*, 67 percent; *Q. robur*, 20 percent; *Q. frainetto*, 7 percent; *Q. cerris*, 3 percent; *Q. pedunculiflora*, 3 percent; and *Q. pubescens*, 0.1 percent. At present, a program for the revision and updating of this national inventory of forest genetic resources is underway by the staff of the National Research Institute. In addition, the production of genetically improved seeds is realized in 83 hectares of clonal seed orchards, mainly for rare native oaks.

The selection and establishment of protected areas (national parks, forest reserves, monuments of nature and other protective categories) was another effective measure to protect and conserve *in situ* valuable forests. Between 1932, when the first forest reserve for an authentic oak ecosystem (Forest Mociar) was set up, and the present day, a considerable number of valuable forest areas were established, managed or proposed as protected areas. Table 1 shows the occurrence of oak species in 34 forest reserves in Romania. In spite of the dispersed locations and, in some cases, reduced area of these reserves, the data reveal the large biodiversity of oak reserves in this country and their uniqueness and scientific importance in a framework of a future European network of forest reserves.

In order to avoid the extinction of some rare oak species, *Quercus virgiliana* Ten. was included (Radu, 1995) in the "Red List" of threatened plants as a rare species. But efficient protective measures must be taken as well for the stands with *Q. pubescens* Willd. and *Q. pedunculiflora* K.Koch.

Like other trees, oak taxa (species, subspecies, ecotypes, valuable populations, biotypes, cultivars, etc.) can be preserved *ex situ* in arboreta, according to their ecological requirements, using generative (seeds) or vegetative propagation. Until recently this kind of conservation was used mainly for introduced (exotic) species, and only occasionally for native oaks.

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Table 1

OCCURRENCE OF OAK SPECIES IN SOME FOREST RESERVES IN ROMANIA

(Excerpt from: Radu, 1994. *Inventory of natural and semi-natural forest in Romania*)

No.	Name of Reserve	Location (County)	Area of Forests (hectares)	Short Description - Importance
1	NP Cozia	Vîlcea	6747	— Natural and quasi-virgin forests of beech, sessile oak, spruce and fir. Occurrence of *Q. robur* at high altitudes (1800 m).
2	Nat. P. Portile de Fier	Mehedinti	423	— Semi-natural stamds on limestone along the Danube, with *Fagus* (*F. sylvatica, F. taurica, F. orientalis*) and Quercus (*Q. cerris, Q. pubescens, Q. virgiliana, Q. polycarpa* and *Q. dalechampii*).
3	FR Bavna (Fersig)	Maramures	26	— Old virgin oak forest (*Q. robur*).
4	FR Dumbrava - Vînatoril Neamtului	Neamt	866	— Old oak natural forest (*Q. robur*).
5	FR Runcu-Grosi	Arad	932	— Old quasi-virgin and natural sessile oak forests.
6	FR Domogled	Caras-Severin		— Natural stands with *Q. pubescens, Q. cerris, Q. frainetto,* and other submediterranean broadleaved species on limestone in Domogled Mts. Occurrence of Pinus nigra var. banatica.
7	FR Tudora	Botasani	126	— Remnants of old natural beech-hornbeam-sessile oak forest preserving scattered *Taxus baccata.*
8	FR Uricani-Ciurea	Iasi	63	— Natural oak forest (*Q. robur, Q. petraea*).
9	FR Hârboanca-Brahasoaia	Vaslui	70	— Natural oak forest (*Q. pedunculiflora, Q. pubescens, Q. dalechampii, Q. virgiliana*) in sylvic-steppe, with occurrence of their natural hybrid populations.
10	FR Calinesti	Vaslui	365	— Old natural sessile oak-beech forest.
11	FR Mociar	Mures	50	— Remnants of old natural oak forest (*Q. robur*) on heavy, moist soils.
12	FR Dalhauti	Vrancea	138	— Remnants of old sessile oak-beech forest.
13	FR Cristian	Brasov	372	— Natural sessile oak-fir mixed forest (azonal relict) at 900-930 m. elevation.
14	FR Prejmer	Brasov	252	— Natural oak (swamp ecotype of *Q. robur*) forest with other rare and endemic spp.
15	FR Dumbrava Vadului	Brasov	395	— Natural thinned oak forest, sheltering an abundant occurrence of *Narcissus stellaris.*
16	FR Spataru	Buzau	174	— Natural and semi-natural ash (*Fraxinus pallisae, F. angustifolia*) with oak on primary saline soils.

17	FR Gîrboavele	Galati	450	—	Remnants of natural *Q. pubescens* and *Q. pedunculiflora* forest. Occurrence of hybrids.
18	FR Caraorman	Tulcea	841	—	Semi-natural ash-oak (*Q. robur, Q. pedunculiflora*) and poplar forest on river-marine sand dunes, in Danube-Delta.
19	FR Letea	Tulcea	2746	—	Natural and semi-natural oak-ash and *Alnus* forests, on river-marine sand dunes in Danube delta.
20	FR Hagieni	Constanta	207	—	Natural forest of *Q. pedunculiflora* and *Q. pubescens* with *Carpinus orientalis*.
21	FR Ciornuleasa	Calarasi	254	—	Natural and semi-natural mixed oak forest (*Q. robur, Q. pedunculiflora*) with lime, ash and *Prunus mahaleb*.
22	FR Comana	Giurgiu	439	—	Complex natural oak (*Q. robur, Q. pedunculiflora, Q. pubescens, Q. frainetto, Q. cerris*) forest, which includes reserves for rare and threatened species (*Convallaria majalis, Paeonia peregrina, Ruscus aculeatus*).
23	FR Snagov	Ilfov	1727	—	Remnants of ancient natural Querceto-Carpinetum. Sporadic occurrences of beech species and *Q. petraea.*
24	FR Caldarusani	Ilfov	468	—	Old natural *Q. robur* forest with white poplar and willow.
25	FR Seaca-Optasani	Olt	434	—	Old remnants of ancient 2000-ha pure massif of *Q. frainetto*.
26	FR Topana	Olt	473	—	Remnants of mixed *Q. cerris-Q. frainetto* forest and of pure *Q. frainetto* natural stands.
27	FR Plopeni	Prahova	254	—	Old remnants of natural *Q. robur* forest with some endemic herbaceous species.
28	FR Tismana-Pocruia	Gorj	220	—	Remnant groups of natural *Castanea sativa*, dispersed in natural oak (*Q. petraea, Q. cerris, Q. frainetto*) or beech stands.
29	FR Bejan	Hunedoara	235	—	Natural occurrences of eight native oak species (all except *Q. pedunculiflora*) and famous genetic center for natural hybrids among these species.
30	F Drinova-Lugoj[+)]	Timis		—	Old growth mixture of *Q. petraea* and *Q. robur*; high quality ecotype of *Q. petraea.*
31	F Neudorf-Lipova[+)]	Arad		—	Old growth mixture of *Q. petraea* and *Q. cerris.*
32	F Labasint-Lipova[+)]	Arad		—	Old growth stand of *Q. petraea.*
33	F Bistra-Lunca Timisului[+)]	Timis		—	Old natural stand of *Q. robur* with other local broadleaved species.
34	F Cheveres-Lunca Timisului[+)]	Timis		—	Old growth *Q. robur* monumental stand, proposed as " monument of nature."

Legend: NP = National Park; Nat. P. = Natural Park; FR = Forest Reserve; F = Forest
+) = Forests described by Smejkal, Bîndiu and Visoiu, 1995, in "Benater Urwälder"

Oak Forests in Romania . . .

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Due to their size, longevity and durability in time, oaks play a significant role in the spiritual and cultural lives of peoples. Thus, many single oak specimens also are protected in this country as ancient, famous or historic trees. It is very important to keep records, on a national level, for all tree species and to protect them before their disappearance due to human ignorance or enmity.

Storing a great biodiversity, oak ecosystems changed in time their composition and structure. These changes resulted, unfortunately, in degradation and instability. During the last centuries, silviculturists attempted (through great efforts which often were misunderstood by the public) to save these ecosystems in order to make them vital and useful for society, from economic and (more recently) ecological points of view.

The latest research on causes of the decline of oaks stipulates, first of all, an analysis of the components of ecosystems which may influence the vitality and stability of trees. These components include climatic, site, silvicultural and biotic factors. To separate and establish the hierarchy of different factors in a particular local case is a very difficult task, demanding solid knowledge, due to the complexity of decline and the interference of provocative associated factors. Since the stand constitutes the basic component of a forest ecosystem, the decline affects the main characteristics of the stand: species composition, horizontal and vertical structure, soil-site complex, as well as other silvicultural characteristics.

The gradual (or rapid) and, in most cases, irreversible passage from a normal stand structure to successive ranks of deterioration (weak, moderate or intense) is accompanied by changes of main stand structural features characterized by the following:

- the decrease, inclining toward total extirpation, of valuable oak species (suitable to the site or to the climax stage) and their replacement by secondary or pioneer species or by grassland formations;
- the reduction of stand density and breaking of the stand layers, concomitant with the luxurious development of undergrowth, composed of light-demanding or fast-propagating shrub species;
- the gradual replacement of typical understory flora by a dense and compact carpet of grasses, which makes it very difficult to establish natural forest seed regeneration;
- the appearance of simplified, disturbed and chaotic structures, due to the disappearance of the superior stand layer and of the closed canopy profile;
- the drastic reduction of valuable timber volume by unit area;
- the reduction of soil depth and fertility due to rapid litter decomposition, leaching of the humus layer and erosion;
- the decrease of stand vitality, stability and resistance to different stresses; and
- the reduction of biodiversity for some categories of plants (trees, shade herbs) or animals (large mammals), and the temporary increase of others (certain insects and birds).

Of course, in a managed forest the owner cannot wait inactively until, after a long period of vegetation succession, he might record the spontaneous reestablishment of a more or less valuable forest. Economic necessities oblige

him to interfere in the sense of an active forestry restoration. For these reasons, the ecosystem reconstruction includes a complex of actions to be applied in deteriorated stands, with the aim to realize a certain structure of sites able to assure an ecological equilibrium of ecosystems and the fulfillment of their multiple functions in the environment (Ianculescu, Donita, 1995; Stanescu, 1996).

Consequently, the works practiced in the frame of ecological reconstruction belong to a great variety of interventions suitable to the stage of the stand and the degree of its deterioration. If the stand is not affected by an intense dieback and the main oak species are still sufficiently represented, the stand gaps can be planted with associated broadleaved species and shrubs in order to insure an optimal stand density and to protect the soil. In extreme cases, completely destroyed stands must be replanted using species and technologies adequate for the site.

In so-called "derived stands" (second growth), with a predominance of hornbeam (*Carpinus*), lime (*Tilia*), maples (*Acer*) or other broadleaved associate species that appeared as a result of degradation in former mixed oak forests, the oak species can be reintroduced by planting of transplants in small groups. In many cases, direct acorn seeding is preferable, but frequent scarcity of fructification is limiting this method. Also, wild boars inflict serious damages to acorn seeding in autumn, and up until now no efficient repellant has been found to stop this.

In simplified pure oak stands, it is recommended, according to site conditions, to reintroduce the associated broadleaved species (*Fagus, Tilia, Acer, Fraxinus, Carpinus*) and for soil protection, to introduce different native shrubs in moderate density.

Because some stands have not lost their natural regeneration capabilities and produce small annual amounts of acorns, preparing the soil in small square or circular plots before seedfall can stimulate the establishment of young oak plants. Concomitantly, advance regeneration must be protected during logging and promoted by removal of competing vegetation. Tree shelters also can be an effective aid to oak establishment, particularly in areas exposed to grazing.

I think these considerations are not only of local importance, but can constitute a useful exchange of thoughts and experiences in our common efforts to save the oak, rightly called by the famous Romanian silviculturist, Dr. Martin Dr_cea, "the aristocrat of the forest and the diamond of woods."

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