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About green practices for Albania

ALFRED MULLAJ[1*], PETRIT HODA.[1], LULEZIM SHUKA[2], ALEKO MIHO.[2*], FERDINAND BEGO[2], MIHALLAQ QIRJO[2]

[1]Research Center of Flora and Fauna, FNS, University of Tirana; [2]Department of Biology, FNS, University of Tirana.

*Corresponding authors - E-mails: alfred.mullaj@fshn.edu.al; aleko.miho@fshn.edu.al

Abstract

Forestry, landscape and urban ecology, proper land use, green architecture, green management practices, etc. are fundamental topics nowadays both in education and in the practice of restoration. Albania is unique in the Western Balkan region with two major Moratoria in vigor, one on Forests and the other on Hunting. Both are closely related, for decreased animal populations are in part caused by the poor state of habitats (in forests and shrubs, meadows and pastures, in agriculture and urban areas). The change comes not only with strict measures against woodcutting, but also with a different vision of the whole society, experts and decision-makers about green restoration of natural and urban habitats, about forestry as art and science, about best management practices (especially green BMPs). Based on our experience, we are presenting here examples of green practices for Albania, aiming at the restoration of native vegetation (Thermophilic evergreen sclerophyllous broad-leaved oaks, Mixed broadleaved deciduous oak forests, Beech and mixed beech woods - partly with conifers Mediterranean deciduous and ever green forests and shrubs, Alpine and subalpine pastures, Mediterranean alluvial-riparian forests, Mediterranean pine belt, Reedbed and aquatic vegetation, Submerged marine meadows of *Posidonia*, Medicinal Aromatic Plants, etc.). Green practices are briefly identified in various habitats (forest and bushy areas of hilly zones, rocky slopes along roads, wind green belts, gardens and urban parks). Hence, native plant species, endemic, rare and with ornamental values will be mentioned, concluding with considerations for the greening of Tirana city. We strongly recommend restoring the plant nurseries to propagate and grow the plants for the private and public gardeners, for forestry and MAPs sector, and conservation biology. It can be combined with the advanced breeding technologies as the proper tool to produce healthy seedlings of autochthon trees and other plants with special characteristics adapted to local ecological conditions of the country. In addition, our society and the environment can benefit from plant biotechnology, meeting the demand for restoration of forests and shrubs, combat erosion, healthy and productive medicinal and aromatic plants, ornamental plants, meadows and garden products, protect the native plant and animal species from invasive pests and diseases, etc.

Keywords: Green Albania, moratoria (hunting & forests), green practices, landscape ecology, urban ecology.

1. Introduction

Due to mismanagement of forests and hunting, accumulated in decades, two major Moratoria are now in vigor in Albania, a 10 years Moratorium on Forests (Law 5/2016) [1] and the other one on Hunting, first 2 years (Law 7/2014) [2], extended then 5 years more (Law 61/2016) [3]. Both are in synergy for decreased animal populations, which are in part caused by the poor state of habitats in forests and shrubs. Therefore, forestry, landscape and urban ecology, proper land use, green architecture, green management practices, etc. are fundamental topics nowadays either on education or practical aspects. This paper aims to facilitate the understanding and awareness in all mentioned topics, and stir up the discussion of experts and decision makers towards the implementation of best practices of environment protection and restoration in Albania.

2. Material and Methods

The material reported here about green practices is based on the wide information about taxonomic, morphologic and geobotanic aspects in various basic publications of the Albanian flora and PhD works on flora and vegetation [4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17], as well as in our long experience and lessons learned in the field of Conservation Biology; physic-geographical features

are taken from existing basic books of Physical Geography (i.e. Kabo, 1990-91) [18]. A basic material about all topics presented here is prepared earlier in Albanian by our group (Miho *et al.*, 2016) [19], and submitted to responsible institutions. It is already available in internet (https://www.researchgate.net/).

3. Results and Discussion

3.1. Consideration about the Albanian vegetation cover

Nowadays, it is quite evident that the vegetation cover in Albania is significantly reduced, both in forest and shrubby areas. In the last 60 years, about 1 million ha of forests has been overexploited or even destroyed [20, 21]. The forest areas are reduced up to 10-11% of the available forests in the country; the rest is turned into low, stunted forests (coppice), shrubby or fallow areas. Therefore, the erosion of the slope and of the coast is very high, with unpredictable climate events and flooding. The soil erosion oscillates from 20 to 40 t/ha/year, and in extreme cases it reaches up to 100 t/ha/year [22, 23, 24, 25]. Based on the last report of the National Environment Agency [26], the content of Total Suspended Solids (TSS) in water goes to 226.3 mg/L in Ishmi river up, oscillates 79.6 – 112 mg/L in Erzeni it, up to 74.4 mg/L in Shkumbini, up to 222.2 mg/L in Semani, to 117 mg/L in Vjosa up. In other words, TSS in Albania's rivers is estimated 3-9 times higher than the limit value of 25 mg/L of EU standard 2006/44 on fish life in surface waters [27], as confirmed also by other studies [28, 29, 30].

It is primarily consequence of unsustainable or even bad practices in the last past decades: the extensive development of agriculture, land reclamation, deforestation and terraces for new agricultural land, even in the most fragile hilly slopes, and often mountainous areas, including subalpine and alpine meadows. But the reduction of forest and shrubby areas in the past two-three decades happened from excessive cutting for building materials and firewood beyond the regeneration capacity, unsustainable territorial planning and urbanization, mainly in the hilly and coastal areas, etc. There are not saved even the few forest areas left in Rresheni, Puka, Burreli, as well as the rare remote forests, even the protected areas of Lura and Valbona (both National Parks), as well as the dune Mediterranean pine belt along the coastline, from Velipoja to Vlora, regardless of their sensitivity. Damage was spurred by overgrazing (especially by goats) and frequent fires in the summer, pollution or diseases.

It's worth noting that Albania's natural forests are fragile ecosystems, extending especially in the steep mountainous and hilly areas, with pronounced Mediterranean climate, with heavy turbulent rainfalls, with easily eroded subsoil, and very slow restoration process that exceeds the limits of human's life.

These were all the reasons that forced the State to declare two moratoria both in synergy, one on Forests Logging and the other one on Hunting ban. Although in delay, it’s obvious that their implementation is not without cost to the Albanian society today!

3.2. Biodiversity loss

Although small country, Albania is quite unique for its diverse natural features and complex climate, geology and relief, either in its coastal, or hilly and mountainous zones. Nearly ¾ of territory is stretched between 200 and 2000 m above sea level, with average altitude of 708 m, double the European one. The landscape is quite fragmented, horizontally and vertically, with steep slopes and with variegates and intertwined landscape, sheltering rich flora and fauna. The fact is that over 3'980 higher plant taxa (ferns, conifers and flowering plants) are known so far [31], approximately 30% of total number of plant species found in Europe. It is quite high if considering that Albanian territory is only 0.28% of Europe's continent [32, 33]. More than 110 species per 1000 km^2 occurs within the Albanian territory, when the respective value for the entire European continent is only 2.4 [34]. It represents a great natural and economic resource, but on the other hand,

the biological components are sensitive to human activity, the cause of habitat destruction, pollution and overexploitation. Therefore, it is needed awareness, responsibility and commitment to the biodiversity protection and nowadays even active natural restoration.

Why? Besides the rich biodiversity, there is evidenced high rate of biodiversity loss in Albania. The number of rare or threatened plant and animal species is high and the trend is growing. The National Red List of legally protected species [35] is growing up, including 411 higher plant species (of 361 species in the Red List of 2007) and 575 animal species. On the most utilizable medicinal plants, it is worth of mentioning sage, mountain tea, white oregano, winter savory, orchids, saffron, several pines and junipers, horse-chestnut, ash, linden, elm, walnut, laurel, white poplar, oak, etc. Based on the current trend of exploitation or habitat destruction, some of them possess now the status VU A2C, meaning the rapid decline of > 50% in the last 20 years. Considering the fauna, it is believed that at least 4 mammals have disappeared completely, while 17 bird species do not nest any more in Albania. About 89 species of birds, 27 species of mammals, and 6 species of fish in the last 25 years are believed to have lost over 50% of their population.

Most endangered vertebrate and invertebrate species are associated with the extreme reduction of virgin and old forests. It's true that all three large European carnivores (bear, wolf, lynx) are still present in Albania, but we are losing *Lynx* (today a critically endangered species), while the wolf and bear populations have fallen to the lowest level of population number of their known history. Populations of birds, bats and other mammals associated with productive forests (old forests) are critically reduced today. Many species of insects and other invertebrates linked with virgin forests have disappeared before even being recognized by science; in an evolutionary context it means "Death of Birth".

More detailed information about endangered status of various plants and animals species can be found in legal acts in vigor [35] or other publications [36, 37, 38, 39, 40], or related materials produced by the National Agency of Protected Areas (Al.: AKZM; http://akzm.gov.al/), the Ministry of Environment, or other responsible institutions (https://www.google.al/?gws_rd=ssl#q=Albania+IUCN+red+List&start=10&*)..

The biodiversity loss is often associated with economic consequences, in forestry and pastures, in medicinal aromatic plants, in fishery, hunting, etc. It is also associated with impairment of air quality, of water quality (surface and groundwater), also flooding, landslides, climate hazards, and decrease of tourism values.

The protection of rare or endangered plant and animal species, cannot ever be achieved separately, but always by preserving and restoring their habitats and plant formations as a whole, as required after the criteria set up by several international institutions and conventions where Albania is already party (i.e. IUCN, CBD, CITES, UNESCO, Ramsar and Bern conventions, etc.).

3.3. Species selection, natives or exotics?

The restoration of vegetation cover and the halt of biodiversity loss need also a different vision of experts and of decision-makers about forestry, about best management practices (green BMPs; i.e. https://www.epa.gov/green-infrastructure), either in natural or urban habitats. Tree species selection is important to reforestation of degraded lands and urban areas success. If a tree is grown under unsuitable soil or site conditions, it will be stressed and thus become susceptible to attacks from insects or competition from weeds. Several factors influence species selection, including the objectives of reforestation, seed availability, and costs associated with reforestation alternatives. Inadequate information on planting sites is a major cause of tree planting failure [41]. Since most tree species used in reforestation are found over broad geographic ranges, there are different land races (varieties) (subdivisions of a species with heritable characteristics, resulting from

adaptation to a specific environmental condition). Tree species races are often described by referring to the geographic location where the race is found naturally. Hence, the species' suitability to a particular site varies depending on the races used. Increases in yield and resistances to disease can be achieved through selection and use of appropriate seeds. Only by planting species and races on the sites for which they are adapted can maximum yields be obtained.

Years ago in Albania, but nowadays in reforestation practices by the forest enterprises it is widely observed use of exotic species, such as *Robinia, Acacia,* palm trees, *Eucalyptus,* etc. Reasons are their abundance, availability, ease of storage, and germination of seeds. But their use involves risks, such as susceptibility to pests and diseases, or unfriendly climatic conditions, because of the high yields possible with exotic species, however, the risks will continue to be taken! Just remember the desperate state of palm trees along the road Tirana-Durresi after the long frost of the past winter (January 2016)!

The potential of using native species in reforestation practices has been largely ignored; it might happen from the scarce knowledge to the lack of seed and seedling supplies of our native plant species. However, native species are adapted to the local environment; hence, they may be less susceptible to stress, serious disease, and pest damage. Moreover, local people are more familiar with their native plants and have more uses for them.

It must be considered that most of our native Mediterranean plant species have a strong root system; if grown separately or combined together, they would be excellent to combat the slope erosion and as ornaments at the same time. Other trees or shrub species can be used as green practices along national roadsides, along natural torrents and drainage channels, along agricultural fields, surrounding industrial areas, etc. The scope would be multiple: combat erosion, protect the river and channel banks, wind belts in the fields, pollution and also noise belts along the roads, as well as excellent shelter for many animals (hedgerows), and in many cases with ornamental and relaxant purposes. In table 1 there are listed the most important species of trees and shrubs from Albanian flora as examples to be used in many green BMPs. Summary of mentioned restoration practices are listed and prioritized in table 2. Moreover, we report 44 plant photos in five color Plates I-V, representing important plant groups (gymnosperms, dicots and monocots), plant communities (forest trees, shrubs, etc.), species with ornamental, or medicinal aromatic values.

Table 1. Trees and shrubs from the Albanian flora as recommended examples for green practices.

Trees		**Shrubs**	
Scientific name	**Albanian name**	***Scientific name***	**Albanian name**
Abies alba; *A. borissi-regis*	Bredhi	*Arbutus unedo*	Mareja
Acer spp.	Panjat	*Cercis siliquastrum*	Lofata
Aesculus hyppocastaneum	Geshtenja e kalit	*Colutea arborescens*	Fshikartha
Fagus sylvatica	Ahu	*Erica arborea*	Shqopa
Fraxinus spp.	Frasheri	*Forsythia aeuropaea*	Boshtra
Picea abies	Hormoqi or Bredhi i zi	*Juniperus* spp.	Dellinja
Pinus heldreichii; *=Pinus leucodermis*	Rrobulli or Arni	*Laurus nobilis*	Dafina
Pinus nigra	Pisha e zezë	*Nerium oleander*	Leandri
Pinus peuce	Arneni	*Punica granatum*	Shega
Pinus pinea	Hartina or Pisha e bute	*Salix* spp.	Shelgje
Platanus orientalis	Rrapi	*Spartium junceum*	Gjineshtra
Populus alba	Plepi i bardhe	*Hedera helix*	Urthi
Quercus ilex	Ilqja	*Roza* spp.	Trendafila
Taxus baccata	Tisi	*Smilax aspera*	Morenxa
Tilia spp.	Bliri	*Vitis* spp.	Hardhia e eger

3.4. Thermophilic evergreen sclerophyllous broad-leaved oaks

It has broader extent from 0 m to 800 m a.s.l., in almost half the country's surface, but very degraded by grazing and other anthropogenic impacts. Nowadays, the true broad-leaved evergreen forests can grow only locally in remote parts. Important trees are *Quercus ilex, Q .coccifera, Phillyrea latifolia,* etc. Cutting, grazing or firing has transformed the forest into *maquis, phrygana, garrigue* or *pseudo-steppe*: *Maquis* is a dense, evergreen scrub up to 3.5 m tall and widespread throughout the Albania, mainly on acid soil in slightly damp places, and most common in the western part. *Maquis* is believed to constitute a local climax vegetation, although it is more often the result of degraded of evergreen forest. *Phrygana* occurs on dry shallow soil over limestone, especially in the southern coast. It is a low scrub, usually not more than 60 cm tall, with the often cushion-shaped shrubs being well spaced. As with the *maquis, phrygana* might represent a local climax vegetation of hot and dry hill slopes, although it is often the result of degraded of taller vegetation. It also constitutes an early succession stage following burning of coniferous forest. Among the dominant shrubs of the *phrygana* there are *Phlomis fruticosa, Coridothymus capitatus, Anthyllis hermanniae, Cistus* spp., etc. Cutting and grazing of *maquis* or evergreen forest may produce similar but slightly taller vegetation called *garrigue*. This anthropogenic vegetation type is common in rocky areas of southern Albania. It is dominated by spiny shrubs, often with small or rigid leaves, e.g. *Quercus coccifera, Calicotome villosa,* etc. Further degradation by overgrazing may convert the *garrigue* into *pseudo-steppe*.

Restoration practices in this zone may consist of natural regeneration through sustainable sylvopastoral practices, protection from fires, goat grazing, and through planting native trees and shrubs.

3.5. Mixed broadleaved deciduous oak forests

Forest formations, dominated by a mix of oak species, including *Quercus cerris, Q. frainetto, Q. pubescens, Q. trojana and Q. petraea*, cover a large area from 300 – 350 m to 1200 m a.s.l., and represents about 1/3 of the forests of the country. The zone is divided into three sub-zones: thermophilous mixed deciduous oak wood, covering the largest area (dominated by *Q. pubescens, Q. frainetto Q. cerris*); the mixed deciduous broad-leaved forests, growing in small areas on more humid and northern exposures and steep slopes (composed of *Castanea sativa, Tilia argentea, Q. frainetto, Q. petraea, Acer obtusatum, Ostrya carpinifolia, Carpinus betulus, Fraxinus ornus*, etc.); the third sub-zone covers the higher part of thermophilous mixed deciduous oak wood, composed mainly of *Q. cerris* and *Q. petraea*.

The most part of these forests are degraded as a result of coppicing for fire wood, livestock grazing, and branch cutting for livestock food basis during the winter. The indicator of this degradation is the presence of higher frequency of species, such as *Juniperus oxycedrus, Stachelina uniflosculosa, Chrysopogon gryllus, Cistus villosus, Dorycnium hirsutum*, etc. Often the high degradation to the forest formations with *Quercus frainetto* and *Q. cerris* leads to their substitution by formations with *Quercus trojana*, replacing them in areas with overexploited soils, without special economic value. The largest distribution of *Q. coccifera* is found in this zone as a result of human activities, its resistance to grazing, wildfires and its resprouting and coppicing ability.

In this belt, it is recommended to reduce the human impact and enable natural regeneration, by combining technical and sylvicultural measures, including replanting of native broadleaved species. Massive woodcutting is not recommended, but only careful and selective cuts, and not during the rainfalls. In degraded oak, it can be promoted not only conservation and natural evolutionary succession, but also afforestation with native broadleaved oak species (*Quercus* spp.). Goats remain a major damaging factor to the regeneration in the new forests.

Isolated broadleaf premountainous woodlands with *Castanea sativa, Quercus petraea, Juniperus*

communis grow up in this belt, starting from 700 m up to the contact with beech woods (*Fagus sylvatica*). These forests have not only biological values, but give also a traditional aspect to the landscape, with added recreational values. It is recommended replanting of native broadleaved species.

3.6. Beech and mixed beech woods - partly with conifers

Oromediterranean formations with *Fagus sylvatica* (beech), *Abies alba* (fir), *A. borissi-regis* (hybrid fir), *Pinus heldreichii* (Bosnian pine) and *Pinus nigra* (black pine) are the most important forests of Albania [42], extending up to 1600-2300 m a.s.l. Beech forests extend mainly in Alps and Central Mountainous Region, and represent the most important source of wood products. In addition, black pine forests are widespread (more than 100,000 ha) (Puka, Korca, Mirdita, Mati, Martaneshi, Tomorrica, Erseka, etc.), with the optimal productivity between 600-1600 m; they extend in between the oak forests and beech forests (below or middle level), occupying less productive soils [43]. Black pine grows also in mixture with *Quercus cerris*, *Q. frainetto*, *Fraxinus ornus*, or maples (*Acer* spp.). Shrubs, such as *Erica herbacea*, *Buxus sempervirens*, as well as the Albanian endemics *Forsythia europaea* and *Genista hassertiana* [9] are very frequent, too. Silver fir (*Abies alba*) forms rarely forests, commonly found mixed in beech forests, either grouped or solitary, or in upper limits of pine forests, also with *Pinus peuce* and *P. heldreichii* [6].

Overexploitation of the beech forests combined with overgrazing and fires in the upper mountainous parts were the main reasons of the decrease of the vegetation cover. Degradation trends have established brushes or brushwood forests (with *Crataegus*, *Cornus*, *Rosa*, *Coryllus* and *Buxus*). Black pine forests are severely damaged by logging for construction material, firewood, by fires and overgrazing more evidenced in the forests of Puka, Mirdita, Dibra, Kukesi, Kruja, etc. It is advisable to control logging (sustainable use) in order to allow the natural regeneration, promoting afforestation activities, and efforts in fire protection. Goats remain a major damaging factor to the regeneration in the new forests. The pine processionary (*Thaumetopoea pityocampa*) is a destructive pest in still remnant pine forests. Efforts to control the pine processionary are recommended, including the advanced biological control, using *Bacillus thuringiensis* [44] or insecticides [45], and also mechanical removal of nests, etc.

3.7. Alpine and subalpine pastures

Mountainous pastures (dominated by different species of *Agrostis*, *Bromus*, *Cynosurus*, *Festuca*, *Thymus*, *Trifolium*, *Phleum*, *Poa*, *Koeleria*, *Narcisus*, *Nardus*) lie mainly on the slopes and crests above 1500 m [46]. Dry and semi-dry stony pastures, meadows and mesophyllic eumesophyllic, are located in relatively deep brown forest soils. They all require sustainable grazing and sustainable harvesting of medicinal aromatic plants, fire protection, etc.

3.8. Riparian Mediterranean forests

The riparian Mediterranean forest is largely dominated by *Platanus orientalis* (oriental plane) colonizing poorly stabilized alluvial deposits along the rivers. They can form species-rich communities with the accompanying flora, including *Salix alba*, *S. elaeagnos*, *S. purpurea*, *Alnus glutinosa*, *Populus alba*, *P. nigra*, *Vitex agnus-castus*, *Rubus* spp., *Hedera helix*, *Clematis vitalba*, *Vitis vinifera* ssp. *sylvestris*, *Ranunculus ficaria*, etc. As a result of wrong exploitation (logging, grazing), most of the riparian forests are in very bad state, especially in close proximity to settlements. Due to the high regenerative potential of the species it has survived for thousands of years. Occupying rivers, streams and sediment cones the forests have protective functions (for the protection of riverbanks and streams throughout the hilly and mountainous areas, and strengthening of the soft land slopes near the water courses, as well as along national roadsides and in urban areas), protective stripes along rivers and serve

on a considerable scale as a "water filter' for water purification, etc.

These riparian plant formations have been continuously under the pressure of gravel mining in riverbed, encouraged by excessive pollution in some rivers of the coastal plain, and other stresses caused by dam construction, tunneling or flow change in hydro-power plants (HPPs), or even diseases; i.e. canker stain diseases in plane trees is widespread along Vjosa, Drino and Bistrica rivers. All the mentioned disturbances help to enhance the riverbank erosion, decrease their stability, landslides; the erosion is spread up to the river estuary and related coastline.

The conservation and restoration practices should consider strictly forbidden logging, being helped by planted seedlings and controlled growth. It should be promoting reforestation of the banks with riparian plant formations (plane, poplar, willow, tamarisk, etc.). It is strongly advisable to control the gravel mining in riverbed, and strictly prohibit the activity in areas near the soft clay shores. Always prudence is needed in building HPP dams and flow changes (channels, tunnels), taking into account the properties and durability of the banks downstream the flow. To combat and control the slope and riverbank erosion, additional measures for the riverbank conservation can be taken through dikes, wooden retaining walls in mountainous water courses, even stone or concrete (when necessary). It is recommended to preventing pollution of rivers and keeping under control the water quality from urban and industrial pollution.

3.9. Mediterranean alluvial and mixed riparian forests

Those wooded areas are generally suited to moist soils that cover both the riverbanks and the nearby plain areas periodically submerged by flooding. They occupy isolated parts of the coastal area (Fushe Kuqe, Mati delta, Kune and Vaini, Buna delta). The dominant species are: the bay-oak (*Quercus robur*), common alder (*Alnus glutinosa*), ash (*Fraxinus angustifolia*), the white poplar (*Populus alba*), the elm (*Ulmus minor*), white willow (*Salix alba*) and the privet (*Ligustrum vulgare*). These forests have great social significance as they provide direct and indirect economic and livelihood support; i.e. most of the well-maintained riverbanks are protected by this vegetation. They also decrease soil erosion and support silt, sediment and nutrient deposits, and are important for fish diversity.

But their surface is continuously declining. Forests dominated by *Quercus robur* that 50 years ago was widely distributed is rarely seen nowadays in coastal areas. Other forests dominated by riparian species, such as *Alnus glutinosa, Fraxinus angustifolia, Quercus ilex* and *Populus alba* can be found fragmentally, affected seriously by clear felling and encroachment. As a result the riverbanks were seriously eroded, destroyed and most of the riparian lands have been disappeared. The main effects of fragmentation are the continuity loss, decline of species and structure composition, with negative impact in biodiversity conservation. Many animal species require this continuity at least for their seasonal migration. The relatively modest density of the vegetation is due to human pressure: cementing, building embankments, and poplar fields have greatly changed the original landscape. Extremely common along the embankments is the false indigo (*Amorpha fruticosa*), an alien species native of North America.

The pressure on Mediterranean alluvial forests in coastal area started early, since the 1960s when the reclamation of Western Lowland started. It caused drastic decrease of their surfaces together with marshlands and lagoons. The pressure increased further during the past two decades in the last few spots of remaining forests, such as in the Velipoja Reserve, Kune-Vaini, Fushe Kuqe, Rrushkulli-Hamallaj, etc. Hence, these forests are very scarce nowadays along the Albanian coast; but they are very important for plant and animal diversity, as well as for the coast stability and climate change mitigation [47]. It is strongly advised to check carefully the coastal territorial planning (sustainable planning), preventing the pressure in sensitive areas of the coastline and in

Table 2. Summary of mentioned restoration practices prioritized for each vegetation types: -, not recommended; +, recommended; ++, strongly recommended.

Restoration practices / Vegetation type	Thermophilic evergreen sclerophyllous broad-leaved oaks	Mixed broadleaved deciduous oak forests	Beech and mixed beech woods - partly with conifers	Alpine and subalpine pastures	Riparian Mediterranean forest	Mediterranean alluvial and mixed riparian forests	Coastal Mediterranean coniferous forest	Reedbed and aquatic vegetation	Submerged meadows of *Posidonia*	Medicinal Aromatic Plants (MAPs)	Parks and urban ecology
Natural regeneration	++	++	++	++	++	++	++	++	++	++	+
Technical and sustainable sylvicultural practices	+	+	+	-	-	-	-	-	-	-	-
Careful and selective cuts	+	+	+	-	-	-	-	-	-	-	+
Replanting native species	++	++	++	+	++	++	++	+	-	++	++
Protection from fires	++	++	++	++	+	+	+	+	-	++	+
Sustainable grazing; protection from goat grazing	++	++	++	++	+	+	+	+	-	++	+
Combat diseases (i.e. pine processionary, plane canker stain)	+	+	++	+	++	+	+	+	+	+	++
Combat erosion (dykes, walls in rivers and torrents, coastal protection, etc.)	++	++	++	++	++	+	++	+	-	+	++
Sustainable harvesting of products (i.e. MAPs, timber, etc.)	++	++	++	++	-	-	-	+	-	++	-
Sustainable land use (urban, agriculture, industry and energetic)	++	++	++	++	++	++	++	++	-	-	++
Control eutrophication (water treatment; sustainable use of nutrients in agriculture)	-	-	-	-	+	-	-	++	++	+	+
Sustainable fishing and aquaculture	-	-	-	-	+	-	-	++	++	-	-
Restore and strengthen plant nurseries	++	++	++	+	++	++	++	+	-	++	++
Produce healthy seedlings of autochthon trees or other important plants	++	++	++	+	++	++	++	+	-	++	++

areas that host high diversity of plants and animals. The few remnant spots should be strictly protected, prohibiting any interference with building, or any infrastructure that inhibits the growth. Moreover, it is encouraged the natural growth and regeneration, and possibly their spread up.

3.10. Coastal Mediterranean coniferous forest

It represented an almost continuous coniferous forest on coastal dunes of Adriatic coast, which is partly natural and partly planted 50 – 60 years ago [8], dominated by *Pinus halepensis, P. pinaster* and *P. pinea*. Nowadays, only some limited parts are preserved (i.e. in the Divjaka NP), with mature trees and very dense canopy cover. As a result of the high shade cast under mature trees, there is an almost total absence of shrubby and herbaceous understory vegetation. In clearings, shrubby and herbaceous understory's exist, dominated by species such as *Myrtus communis, Erica manipuliflora, Rubus ulmifolius*, as well as occasional *Pistacia lentiscus, Juniperus oxycedrus* subsp. *macrocarpa, Lagurus ovata*, etc. The coniferous forest is very important for sandy dune stabilization and to protect arable land. Moreover, it is now a feature of many Mediterranean coastlines and currently they represent habitats with priority status, included in Annex I to Directive 92/43/EEC.

In the last 2-3 decades the coastal coniferous forest continues to be under increasing pressure from deforestation for construction area, but also cutting for firewood or construction, more evidenced in Velipoja, Shengjini-Kune, Durresi-Golemi-Karpeni, lastly in Lalzi Bay (Shen Pjetri) and in Vlora (Soda-Zverneci forest). It happened mainly from increased pressures with coastal tourist infrastructures (not sustainable planning) in the past decades, often raised without care along the sandy belt, with serious consequences for plant and animal biodiversity, but also for the stability of the dunes and the coastline. Hence, it is strongly advised to check carefully the coastal territory planning (sustainable); urbanization should avoid the sandy dunes and their forests, especially in sensitive areas of the coastline as well as along the areas that host high diversity of plants and animals, such as Velipoja (Buna delta), surrounding lagoons of Lezha (Kune-Vaini), Patoku, Divjaka-Karavasta, in the area of Semani (Darezeza) and Vlora (Soda-Narta-Zverneci). Natural restoration and tree planting (mostly pines) should be promoted.

3.11. Reedbed and aquatic vegetation

Reedbed (*Phragmites, Typha*) and aquatic floating vegetation (*Nymphea, Nuphar*) are much less frequent, as in Lake Shkodra (northern shores), in the swamps of Pentari and Velipoja (Shkodra), Tushemishti and Ohrid lakeshore, Lake Prespa, Lake Seferani (Dumre), Flowers Lake (Lura), Ceka-Merxhani (Lezha), in Bishtaraka (Durresi), Karavasta, Narta, Roskoveci (Fieri), etc. [8, 34]. Reedbeds are key habitats for sheltering, feeding and wintering of many organisms, i.e. aquatic invertebrates, fishes, amphibians, water snakes and terrapins, water birds and aquatic mammals. Furthermore, they are good habitats for biological purification of water from pollutants (phytoremediation) brought by rivers. On the other hand, these habitats are continuously under pressure or urbanization, land reclamation, increasing pollution, etc. [34]. It is advisable to be strictly protected, prohibiting any polluting interference or any other activity that impact their natural growth. Moreover, it is encouraged the natural growth and regeneration, and possibly their spread up.

3.12. Submerged marine meadows of Posidonia

Submerged meadows of *Posidonia oceanica*, an endemic grass in Mediterranean, are prevalent along the shores of the Ionian coast, and only in some limited parts of the Adriatic coast of Vlora, Durresi and Rodoni [34, 48]. These marine habitats are very valuable for sheltering, feeding and wintering of many organisms, i.e. invertebrates, fish and other marine animals. Posidonia meadows are very sensitive to the pollution discharged by rivers or other human activities, i.e. not sustainable fishing or aquaculture

along the marine coast. It is necessary the strict enforcement of respective laws on fishery and aquaculture (Law 64/2012 and Law 103/2016) [49, 50]. It is strongly advisable to strictly protect *Posidonia* meadows, prohibiting any activity that adversely impacts their natural growth.

3.13. Medicinal Aromatic Plants (MAPs)

More than 300 species from Albanian flora are considered important for their medicinal or aromatic values, where more than 180 species are common and most of them exported [51]. MAPs. After Skreli & Imami (2014) 'MAPs are a major agro-forestry business in Albania, especially in terms of international trade and employment. More than 95% of total MAPs collected are exported. Since 2000, Albanian exports have been increasing (in quantity and value) and, in 2013 they scored 9,330 Tons (or almost twice as high compared to late 2000', namely 2009), while in value it reached almost 20 Million EURO (almost 1/3 increase for the same reference period). Exports of MAPs account for 18% of agricultural exports. Estimate of people involved in the sector … is 70,000 – 80,000 people - making MAPs the most important forestry sub-sector in terms of employment generation in mountainous areas communities.' [52]

Besides the economic importance of the MAPs sector, in past decades the harvesting practices are unfortunately considered not sustainable, failing to preserve the natural resources as fundamental for the traditional and commercial use of wild MAPs. Unlicensed collectors, improper harvesting, etc., have reduced the supply of wild plants, reduced their distribution range, the quantity and the species survival, as confirmed by different reports and publications [51, 52, 53, etc.]. This leads to decreasing the genetic variation, or even species extinction, with severe economic and environmental consequences. Due to overexploitation, the Red List of rare and endangered plants under protection [35] includes today about 300 species of MAPs that require limited natural collection.

The Law 10120/2009, amended latter by the Law 42/2013 [54, 55], is the most important legal act, aiming for the management and protection of the MAPs. However, after the short comments given by REC (2014) in their assessment of the forest status in Albania during 1990-2014 [21], the respective legislation is not properly applied; the real function of responsible institutions has been too weak, not clear, and not aware about the importance of the sector. It is strongly recommended the sustainable harvesting, strict control and licensing, in accordance with the mentioned laws. Instead of natural harvest, it is strongly suggested the cultivation of some MAPs (increase the quantity and extend the cultivation in more regions), such as sage, thymes, oregano, cornflower, mint, fennel, etc. Advanced breeding technologies can be used as the proper tool to produce healthy seedlings of autochthon MAPs (sage, oregano, thymes, etc.) with special characteristics, adapted to local ecological conditions.

3.14. Recommendations for parks and urban ecology

Urbanization is increasing rapidly in Albania, mostly in Western Coastal Lowland (Tirana, Durresi, Shkodra, Vlora, Fieri, Lushnja, Kavaja, etc.) [34], bringing towards the needs of increasing and enriching the green surface. Green areas, gardens and parks are set up in accordance with the seasonal changes, their size, shape and color that constitute the most significant elements of urban environment. Benefits and their uses range from psychological and aesthetic, to improving urban climate and mitigation to climate change, air pollution, noise, etc. Historically the main benefits from these habitats were primarily related to human health, aesthetic, leisure and recreation.

In urban planning it is strongly recommended to preserve the proper ratio between green and urban areas. We consider the urban land use today is rather intensive, with an unfavorable ratio of urban area/green area ratio, exceeding European and Albanian standards. Urban planning should not touch

the green areas, except in specific circumstances; certainly in that case a proper compensation is needed.

The selection of suitable forest species for urban use should depend not only on sylvicultural characteristics of trees, the morphological characteristics of leaves, the crown surface and the lifespan of the leaves (deciduous and evergreen species) but also by their ability to retain air pollutants (i.e. heavy metals, vehicle exhaust gases, etc.). The use of multipurpose trees and polyculture plantings (with many species of trees) is becoming increasingly important, especially in densely inhabited areas. Multifunctional species are also recommended, with aesthetic values, good absorption capability and resistant to high concentrations of various urban pollutants, such as *Nerium oleander*, *Platanus orientalis, Pinus pinea*, *Cupressus sempervirens,* etc.

As mentioned above, native flora species with ornamental values are recommended even in urban parks; some of them endure the harsh conditions of urban environments and they are more resistant to various pests and diseases. Some of the highly recommended wild plant species with ornamental values are reported in table 1, and illustrated with photos, including endemic, rare or threatened species, i.e. *Aesculus hippocastanum, Tilia platyphyllos, Tilia* spp., *Taxus baccata, Forsythia europaea, Quercus ilex, Punica granatum, Cercis siliquastrum, Salvia officinalis, Satureja montana,* etc. [33]. It is worth of mentioning that *Forsythia europaea* (Boshtra) is an Albanian endemic shrub species, very similar with other forsythias with ornamental values known in the whole European region; the same can be confirmed about *Syringa vulgaris* (Jargavani), native species to the Balkan, and widely cultivated as an ornamental, or even naturalized in other parts of Europe or North America. Beside their ornamental values, *Salvia officinalis* (Sherbela), *Satureja montana* (Trumza), etc. are also important MAP species.

In our gardens, along with traditional ornamental species of the genera *Dianthus, Pelargonium, Rosa, Malva, Pittospora,* etc., can easily grow the beautiful Albanian endemics: *Tulipa albanica* (Tulipani shqiptar), *Aster albanicus* (Ylli shqiptar), *Lilium albanicum* (Zambaku shqiptar), *Orchis albanica* (= *Anacamptis morio* subsp. *caucasica*; Salepi shqiptar), etc. Covering the walls, rocky and other steep slopes along the roads, etc. can be easily achieved by planting vine species, such as *Hedera helix, Smilax aspera, Legume* spp., *Hippophae rhamnoides, Clematis* spp., *Lonicera* spp. *Roza* spp., *Vitis* spp., or woody species like *Castanea sativa,* etc. Many other fruit trees can grow well also along roadside for decoration, land and noise protection, or as green wind belts along agriculture lands; i.e. *Citrus* spp., *Olea* spp., etc.

Even in urban green BMPs, it must be very careful with the cultivation of exotic or non-native species. A large part of them are considered invasive species with significant impacts on native biodiversity loss and adverse effects on near natural environment, as well as to the economy and social life. Moreover, we do not recommend afforestation practices or urban greening practices using coniferous species, such as pines or cedars, due to their adverse effects in the soil acidification. The use of plane trees along the city roads is often problematic, due to their strong and superficial roots, which damage the sidewalk.

3.15. Considerations for the greening Tirana capital

Almost 10% of 1600 plant species (nearly half the flora of Albania) that grow in Tirana region [56] are ornamental. Greenery in Tirana is represented by the Great Tirana Park, other small public parks and gardens, streets and private gardens. The bulk of ornamental plant species seems to be very poor, dominated mostly by exotic or introduced species. Unfortunately, some of them have lost or degraded their ornamental values, not performing their function, due to environmental pollution by gases, dust, noise, quick urbanization, climate change, associated with temperature increase and moisture reduction. Besides the above mentioned considerations about greening practices in urban areas, we can further recommend the following plants as proper ornamental species to

be used in Tirana streets and parks, listed also in table 1, and illustrated with photos: *Arbutus unedo*, *Cercis siliquastrum*, *Forsythia europaea*, *Colutea arborescens*, *Spartium junceum*, *Cistus* spp. (Menishte), *Chamaecytissus* spp., *Crataegus monogyna* (Murrizi), and *Erica arborea* (Shqopa).

4. Conclusions

The strict measures against woodcutting or hunting, against fires, overexploitation, pollution and urbanization are strongly recommended as shown in table 2. Nevertheless, a different vision is needed by forestry experts and conservation biologists, urbanists and decision-makers, conceiving the forestry, landscape planning and conservation biology as art and science, better qualification and awareness in regeneration practices is required in finding the best green practices.

Modern forestry in particular deals with various aspects, such as: provide wood as raw material for the wood-products; preserve the natural habitats; preserve the surface and ground water quality; take care of recreational facilities; landscape and community protection; create new jobs; landscape architecture; biodiversity protection; watershed management; erosion control; control of CO_2 fixation/O_2 production; global warming, etc. In order to meet this challenge, Albania must restore the previous nurseries, support strongly this activity focused on propagation and growth of plants; nowadays, only nurseries in agriculture sector (vegetables and fruit trees) are supported; but similarly, nurseries can also supply with healthy seeds and seedlings, the private and public gardeners, forestry, MAPs sector, as well as conservation biology sector (conservation of rare and endangered plants).

Forestry and other green practices cannot remain outside the plant biotechnology techniques. Advanced breeding technologies can be used as a proper tool to produce healthy seeds and seedlings of autochthon trees and other important plants with special characteristics. Not to forget that the diseases often appear with severe impacts on our forests. Our society and the environment can benefit also from plant biotechnology, meeting the demand for restoration of forests and shrubs, combat erosion, healthy and productive medicinal and aromatic plants, ornamental plants, other meadows and garden products, protect the important plant species from invasive pests, and conserve the genetic found.

The reported information in this paper can only be considered only as guidelines and advises which should not exclude the opinion given on case by case bases by the experts of forestry and conservation biology together, in order to define the best eventual practices for each selected area.

We believe that the Ministry of Environment, Ministry of Agriculture and other responsible governmental bodies, as well as the private sector, should make the necessary efforts for the protection and regeneration of vegetation cover, both in wilderness and urban areas. It will certainly improve the protection of rare and endangered plant species and plant communities, together with the rare and threatened animal species they host, ultimately assuring a better life and human health.

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6. References

1. Law 5/2016 (I Ndryshuar): **Per shpalljen e moratoriumit ne pyje ne Republiken e Shqiperise**. http://www.ikub.al/ligje_category/16/02/18/PeR-SHPALLJEN-E-MORATORIUMIT-Ne-PYJE-Ne-REPUBLIKeN-E-SHQIPeRISe-0189.aspx
2. Law 7/2014: **Për Shpalljen e Moratoriumit të Gjuetisë në Republikën e Shqipërisë**.

www.mjedisi.gov.al/.../Ligj_7-2014_30_01_20_14_per_moratoriu...

3. Law 61/2016: **Për shpalljen e Moratoriumit të Gjuetisë në Republikën e Shqipërisë** https://www.parlament.al/wp-content/uploads/2016/06/ligj-nr.-61-dt.-2.6.2016.pdf
4. *Anonymous*: **Flora e Shqipërisë**. Albanian Accademy of Sciences, 1, 1988, 456 pp.; 2, 1992, 446 pp.; 3, 1991, 332 pp.; 4, 2000, 502 pp.
5. Demiri M.: **Flora Eskursioniste e Shqipërisë**. Ed. Shtëpia Botuese e Librit Shkollor, Tiranë. 986 pp. 1983
6. Vangjeli J.: **Asociacionet e rrobullit - *Pinus heldreichii* subsp. *leucodermis* ne Shqiperi**. Buletini i Shkencave Natyrore, nr. 1: 83-89. 1984.
7. Mersinllari M.: **Studim gjeobotanik i formacionit te ahut (*Fagus sylvatica*) ne Shqiperi**. Disertacion. FShN, UT. 133 pp. 1989.
8. Mullaj A.: **Vegjetacioni bregdetar i Shqipërisë**. PhD Theses. University of Tirana: 224 pp. 1989
9. Hoda P.: **A geobotanical survey of the black pine (*Pinus nigra* Arn.) forests in Albania**. Annali di Botanica. LI, 77-92: 2002.
10. Mitrushi I, Karaduni S, Haska H.: **Frytet dhe farat e drurëve dhe shkurreve të Shqipërisë**. ASHSH, IKB. Tirana: 558 pp. 2005
11. Vangjeli J.: **Excursion Flora of Albania.** In English with Latin names. 661 pp. 2015. ISBN 978-3-87429-477-5
12. Xhulaj M.: **Praktikat mësimore në Botanikë**. FShN, UT. 388 pp, with more than 870 plants in color. 2015
13. Pils G.: **Illustrated Flora of Albania.** Edition: 1, Publisher: Gerhard Pils, Editor: Gerhard Pils, ISBN: 978-3-200-04853-9. 576 pp. (including 377 colour plates, with 5769 single illustrations). 2016.
14. Vangjeli J.: **Atlas Florae Albanicae**. Volume 1: **Pteridophyta to Apiaceae**. Koeltz Botanical Books. Oberreifenberg / Germany (with ca.1700 color photographs, ca. 1700 dot maps. 931 pp. - In English. (ISBN 978-3-946583-08-0). 2017.
15. Malo S.: **Studim i diversitetit bimor në rrethin e Gjirokastrës**. PhD theses, Faculty of Natural Sciences, University of Tirana. 179 pp. 2010.
16. Mahmutaj E.: **Studimi dhe kartografimi i habitateve dhe florës së Parkut Kombëtar Tomorr-Kulmak, me fokus kryesor ata prioritarë (sipas Natura 2000), të rrallë e të kërcënuar.** PhD Theses. FShN, UT. 211 pp. 2015. http://www.fshn.edu.al/doktorata-dhe-publikime
17. Gjeta E.: **Studim mbi florën, bimësinë dhe diversitetin e habitateve natyrore në pellgun ujëmbledhës të lumit Shkumbin, në rrjedhën e mesme të tij.** PhD Theses. FShN, UT. 153 pp. 2014. http://www.fshn.edu.al/doktorata-dhe-publikime
18. Kabo M. (Ed.): **Gjeografia Fizike e Shqipërisë**, I, 1990 (400 pp.) and II, 1991 (590 pp.). Albanian Academy of Sciences. Geographic Centre, Tirana; 1990-91.
19. Miho A, Mullaj A, Bego F, Qirjo M.: **Mendime dhe këshilla për kthesën në gjelbërimin e vend**it. 18 pp. 2016. https://www.researchgate.net/publication/297013694_Mendime_dhe_keshilla_per_kthesen_ne_gjelberimin_e_vendit
20. WB (ed.): Ecological survey of high forest of Albania, World Bank (WB) ed, Tirana. 230 pp. 1997.
21. REC (Ed.): **Pyjet dhe tranzicioni. Vlerësimi i gjendjes së pyjeve për peridhën 1990-2014**. REC Shqipëri, 156 pp. 2014
22. Lako A.: **Assessment of Soil Erosion Risk in Albania**. Journal of Environmental Science and Engineering B1: 1175-1178. 2012. Formerly part of Journal of Environmental Science and

Engineering, ISSN 1934-8932. http://www.davidpublishing.com/davidpublishing/Upfile/1/21/2013/2013012103145540.pdf

23. Shuka L, Malltezi J, Mersinllari M, Vardhami I.: **Dynamics of vegetation cover of Prespa Lakes and its watershed (Albanian side)**. Proceedings BALWOIS, 2008. p. 1-8: 2008

24. Shuka L, Malo S, Vardhami I.: **The impact of global warming in Southern Albanian grassland ecosystems.** Proceedings of ICE, Tirana. p. 656-670. 2011a

25. Shuka L, Malo S.: **The transboundary important plant areas as conservation units of European green belt (Eastern Albanian zone)**. *Journal of Environmental Protection and Ecology*..11, (3): 866–874. 2010

26. AKM (Ed.): **Raporti për Gjëndjen e Mjedisit**. Ministria e Mjedisit. Agjencia Kombëtare e Mjedisit, Tiranë: 132 pp. 2014. http://www.mjedisi.gov.al/files/userfiles/Monitorim_Mjedisor/Raporti_gjendjes_mjedisit_20131.pdf

27. Fish Directive 2006/44/EC of **the European Parliament and of the Council of 6 September 2006 on the quality of fresh waters needing protection or improvement in order to support fish life**. http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32006L0044

28. Miho A, Cullaj A, Hasko A, Lazo P, Kupe L, Schanz F, Brandl H, Bachofen R, Baraj B.: **Gjendja mjedisore e disa lumenjve të Ultësirës Adriatike Shqiptare. / Environmental state of some rivers of Albanian Adriatic Lowland.** Tirana University, Faculty of Natural Sciences, Tirana (In Albanian with a summary in English): 267 pp. 2005. ISBN 99943-681-9-2 http://www.fshn.edu.al/home/publikime-shkencore

29. Miho A, Çullaj A, Bachofen R. (Eds.): **Bovilla (Albania) – Limnological Study / Studim Limnologjik**. Julvin 2, Tiranë: 350 pp. 2009. ISBN 978-99956-14-29-4 http://www.fshn.edu.al/home/publikime-shkencore

30. Shuka L, Çullaj A, Shumka S, Miho A, Duka S, Bachofen R.: **The Spatial and Temporal Variability of Limnological Properties of Bovilla Reservoir (Albania).** Water Resources Management: 25, 12, p. 3027-3039. 2011b, DOI: 10.1007/s11269-011-9788-z.

31. Zeneli G, Shuka L, Bego F, Kashta L, Shumka S, Hoxha S, Diku A, Bano E, Krasniqi F.: **National Biodiversity Strategy of Albania (2012-2020).** Tirana: 146 pp. 2014.

32. Fremuth W. (Ed.): **Albania - Guide to its Natural Treasures**. ECAT-Tirana & EURONATURE. Klemp: 80 pp. 2000. https://www.researchgate.net/publication/266265341_Albania_Guide_to_it's_Natural_Treasures

33. NEA/AKM (Ed.): **Albania: Convention on Biological Diversity. Biodiversity Strategy and Action Plan (National Report).** National Environmental Agency (NEA), Tirana. 100 pp. 1999. http://planet.uwc.ac.za/nisl/Biodiversity/pdf/al-nbsap-01-en.pdf

34. Miho A, Kashta L, Beqiraj S.: **Between the Land and the Sea - Ecoguide to discover the transitional waters of Albania.** Julvin 2, Tirana. 462 pp. 2013. ISBN 978-9928-137-27-2. http://www.fshn.edu.al/home/publikime-shkencore;

35. *Anonymous*: **Urdhër për miratimin e listës së kuqe të florës dhe faunës së egër. Ministria e Mjedisit**; 2013. http://www.mjedisi.gov.al/files/userfiles/Biodiversiteti/urdhera_dhe_udhezime/2013-Urdher_nr_1280,_dt_20.11.2013_Miratimi_Listes_Kuqe_Flores&Faunes_Eger.pdf

36. Vangjeli J, Ruci B, Mullaj A.: **Libri i Kuq – Bimët e kërcënuara dhe të rralla të Shqipërisë**. Akademia e Shkencave, Instituti i Kërkimeve Biologjike, Tiranë. 169 pp. 1995

37. REC (Ed.): **Libri i Kuq (Botime, Shoqërime Bimore dhe Kafshë të Rrezikuara)**. Shoqata për Ruajtjen dhe Mbrojtjen e Mjedisit Natyror në Shqipëri, Shoqata për Ruajtjen e Shpendëve dhe Gjitarëve të Shqipërisë, Shoqata e Biologëve të Shqipërisë. The Regional Environmental Center (REC), Tirana: 312 pp. 1997

38. Misja K.: **Libri i Kuq i Faunës Shqiptare**. Ministria e Mjedisit, Pyjeve dhe Administrimit të Ujërave. Tiranë. 256 pp. 2006

39. MoE (Ed): **Libri i Kuq i Florës Shqiptare**. Ministria e Mjedisit, Pyjeve dhe Administrimit të Ujërave. Tiranë. Ministria e Mjedisit, Pyjeve dhe Administrimit të Ujërave (MMPAEU Ed.). Tirana. 256 pp. 2006

40. *Anonymous*: **Libri i Kuq i Florës Shqiptare**. Ministria e Mjedisit, Pyjeve dhe Administrimit të Ujërave (MMPAEU Ed.). Tirana. 256 pp; 2008

41. Elevitch R. C.: **The Overstory Book: Cultivating Connections with Trees**. 2nd Edition. Permanent Agriculture Reseurces. Holualoa. Havai'i, USA. 2004. http://agroforestry.net/

42. Dinga L, Hoda P.: **Fitogjeografia**. ShBLU, Tirane. 314 pp. 2004.

43. Dida M, Ducci F, Zeneli G.: **Black pine (*Pinus nigra* Arn.) resources in Albania**. 2001. http://www.fao.org/docrep/004/Y2316E/y2316e0d.htm

44. ICNF (Ed.): **Processionária do pinheiro (*Thaumetopoea pityocampa* Schiff.). Diagnóstico e meios de control**. 8 pp. 2015. http://www.icnf.pt/portal/florestas/prag-doe/resource/doc/proc/proc-florest-2015.pdf

45. Germano M. A.: **Regime Florestal. A Century of Existence**. DGRF. Lisbon, 2004. In ICNF (Ed.): Legislative Framework of the Forest Regime. http://www.icnf.pt/portal/florestas/gf/regflo/enqleg

46. Buzo K.: **Bimësia e kullotave dhe livadheve natyrore të Shqipërisë.** SHBLU, 176 pp. 1991

47. Bego F, Mullaj A, Kashta L, Zotaj A.: **The status of the habitats of European Conservation Interest along the Adriatic Coast of Albania**. IJEES: Vol.3/2: 203-210. 2013

48. Kashta L, Beqiraj S, Mato Xh, Xhulaj M, Gaçe A, Mullaj A.: **Marine underwater meadows – green lungs of the Mediterranean**. APAWA, Ed. Julvin. Tirana: 1-48. 2005. (in Albanian)

49. Law 64/2012: **Për peshkimin**. www.ligjet.org

50. Law 103/2016: **Për akuakulturën**. https://www.parlament.al/wp-content/uploads/2016/10/ligj-nr.-103-dt.-20.10.2016.pdf

51. Imami D, Ibraliu A, Fasllia N, Gruda N, Skreli E.. **Analysis of the medicinal and aromatic plants value chain in Albania**. Gesunde Pflanzen, 67(4), 155-164. 2015. doi:10.1007/s10343-015-0354-0

52. Skreli E, Imami D.: **Medicinal and Aromatic Plants - Mini-sector Study**. FAO Ed. Through the project GCP/ALB/014/EC IPA 2009. 71 pp. 2014

53. Çela M.: **Bimët aromatike të Qarkut të Gjirokastrës**. Master theses. Department of Plant Production. Faculty of Agriculture and the Environment, Agriculture University of Tirana. 54 pp. 2012

54. Law 10120/2009: **Për mbrojtjen e fondit të bimëve mjekësore, eterovajore e tanifere natyrore.** Amenduar nga Ligji 42/2013: **Për disa ndryshime dhe shtesa në ligjin nr. 10120**. http://faolex.fao.org/.

55. Law 42/2013: **Për disa ndryshime dhe shtesa në ligjin nr. 10120, datë 23.4.2009, Për mbrojtjen e fondit të bimëve mjekësore, eterovajore e tanifere natyrore, të ndryshuar**.

56. Paparisto K, Qosja Xh, Demiri M.: **Flora e Tiranës**. Universiteti i Tiranës. 520 pp. 1962

PLATE I: Important gymnosperms from Albanian flora: 1, *Pinus nigra* (Pisha e zeze) the Flag Pine in the Llogora NP (Vlora); 2, *Pinus pinea* (Pisha e bute) in the Divjaka NP; 3, *Picea abies* (Hormoqi - Bredhi i zi) in the Valbona NP; 4, *Juniperus communis* (Dellinja) in the Hotova-Dangellia NP (Photos: A. Miho).

PLATE II: Important angiosperms (eudicots) (trees and shrubs) from Albanian flora: 1, *Quercus robur* (Rrenja) in the Rrushkulli-Hamallaj reserve; 2, *Quercus ilex* (Ilqia) in the Rrushkulli-Hamallaj reserve; 3, *Populus alba* (Plepi i bardhe) in the Divjaka NP; 4. *Aesculus hyppocastaneum* (Geshtenja e kalit); 5, *Nerium oleander* (Leandri) from Porto-Palermo; 6, *Forsythia europaea* (Boshtra) from Shkopeti reserve; 7, *Tamarix hampheana* (Marina) in Kune reserve; 8, *Spartium junceum* (Gjineshtra) in Kavaja Rock (Photos: A. Miho, A. Mullaj, L. Shuka).

PLATE III: Important angiosperms (eudicots) (trees and shrubs) from Albanian flora: 1, *Crataegus monogyna* (Murrizi) from Velipoja reserve; 2, *Punica granatum* (Shega) from Kopliku; 3, *Cercis siliquastrum* (Lofata) from Butrinti NP; 4, *Lotus cytisoides* (Thuapule) from Rrushkulli-Hamallaj reserve; 5, *Erica arborea* (Shqopa) from Shkopeti reserve; 6, *Arbutus unedo* (Mareja) from Rodoni Cape reserve; 7, *Vitex agnus-castus* (Konopica) from Kuta (Vjose); 8, *Myrtus communis* (Mersina) from Spille (Photos: A. Miho, A. Mullaj, L. Shuka, L. Kashta).

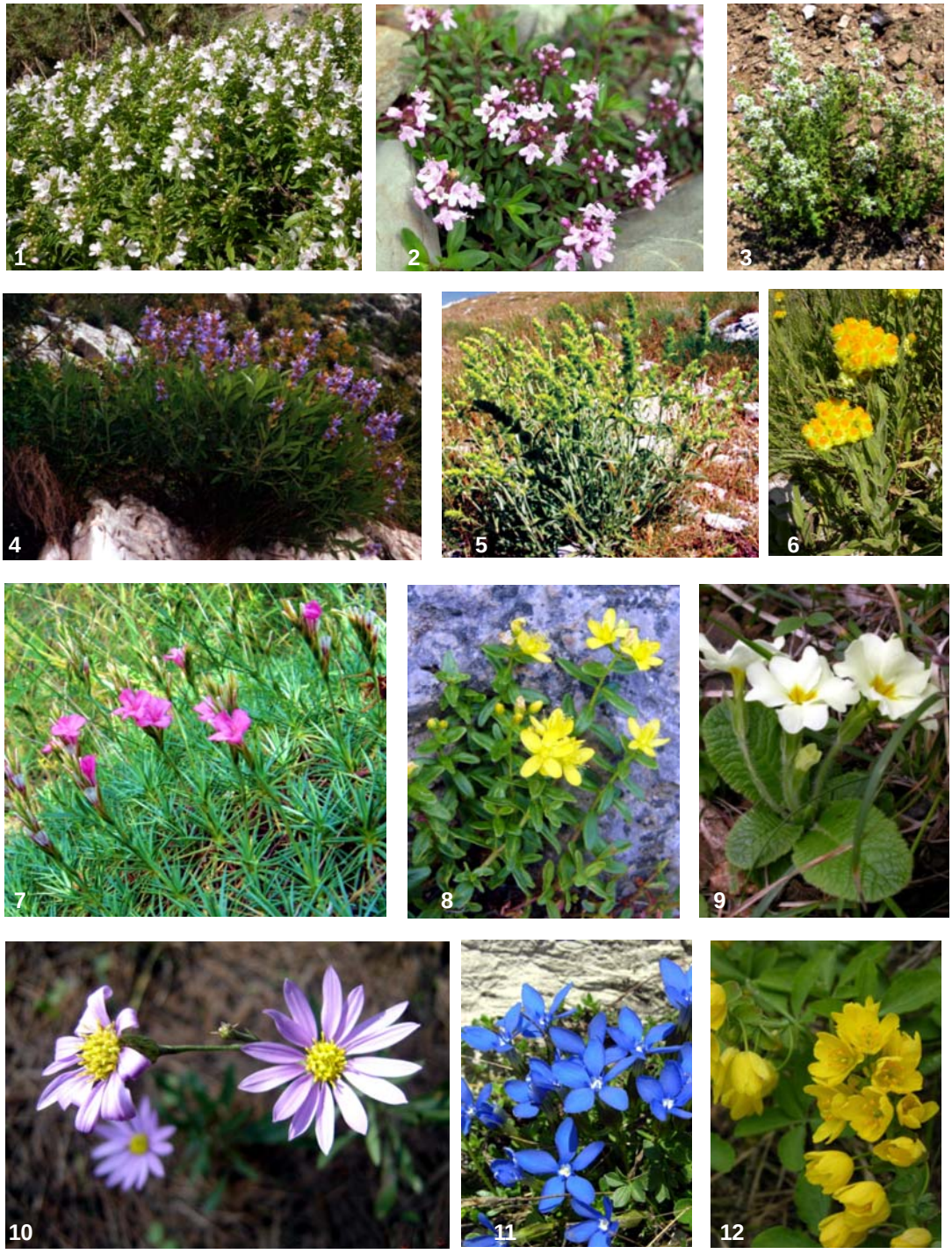

PLATE IV: Important angiosperms (eudicots) from Albanian flora: 1, *Satureja montana* (Trumza) from Gjirokastra; 2, *Origanum vulgare* subsp. *viridulum* (Rigoni i bardhe) from Gjrokastra; 3, *Thymus longicauilis* (Zhumrica) from Bovilla (Dajti NP); 4, *Salvia officinalis* (Sherebela) from Bovilla (Dajti NP); 5, *Sideritis raeseri* (Çaji i malit) from Nemerçka (Gjirokastra); 6, *Helychrisum plicatum* (Akçe) from Nemerçka (Gjirokastra); 7, *Acantholimon albanicum* (Akantolimoni) from Boboshtice (Korça); 8, *Hypericum haplophylloides* (Lulebasani) from Llogora NP (Vlora); 9, *Primula vulgaris* (Aguliçia) from Dajti NP; 10, *Aster albanicus* (Ylli shqiptar) from Divjaka NP; 11, *Gentiana verna* (Saneza), from Shtegu i dhenve, Thethi NP; 12, *Gymnospermium maloi* (Lulehelmi i malos) from Picari (Gjirokastra) (Photos: A. Miho, L. Kashta, L. Shuka).

PLATE V: Important angiosperms (monocots) from Albanian flora: 1, *Colchicum autumnale* (Xherrokulli) from Poçemi (Vjosa); 2, *Lilium albanicum* (Zambaku shqiptar) from Qafethore (Thethi); 3, *Tulipa albanica* (Tulipani shqiptar) from Kolshi (Kukesi); 4, *Ophrys sphegodes* (Salep) from Gjirokastra; 5, *Orchis albanica* (=*Anacamptis morio* subsp. *caucasica*) (Salep) from Semani area (Fieri); 6, *Leucojum aestivum* (Leukoium) from Buna (Shkodra); 7, *Pancratium maritimum* (), from the coastal dunes of Poro (Vlora); 8, *Iris pseudacorus* (Shpatore) from Buna (Shkodra); 9, *Narcissus tazetta* from Zverneci Island; 10, *Stenbergia lutea* (Stenbergia) from Langarica in the Hotova-Dangellia NP (Permeti); 11, *Ammophila arenaria* (Bari i dunave) in Rrushkulli-Hamallaj reserve; 12, *Typha latifolia* (Shavari) from Shkodra lake (Photos: A. Miho, A. Mullaj, L. Kashta, L. Shuka, D. Bejko).