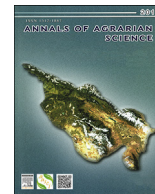




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Forest biodiversity of Georgia and endangered plant species

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ABSTRACT

Biodiversity is the contraction of the phrase, biological diversity” and refers to the variability of life within a species, an ecosystem, a region and across the planet. Georgia is distinguished by its biodiversity, about 400 trees and bushes of various species grow in forests of different climatic zones, from humid-subtropical to temperate, sub-alpine and alpine zones. Local temperature and edaphic factors of each zone, such as soil moisture and depth, are all of importance in determining the composition of vegetation and ecological biodiversity that leads to the establishment of different sub-communities. These and other questions concerning biodiversity of forests of Georgia and the threat of extinction of some species are discussed in the article.

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Introduction

The variety of life on Earth, its biological diversity, is commonly referred to, as biodiversity. The number of species of plants, animals and microorganisms, the enormous diversity of genes in these species, are all part of a biologically diverse Earth [1]. Ecological biodiversity is the diversity of ecosystems, communities and habitats. In essence, it is the variety of ways that species interact with each other and their environment. For example, forests of subtropics differ from the forests of temperate or alpine zones by the type and variety of species found in these ecosystems, as well as, the temperature and rainfall amount.

Biodiversity is extremely important to people and the health of ecosystems. It allows us to live healthy and happy lives. It provides us with an array of foods and materials and contributes to the economy. The most medical discoveries to cure diseases and lengthen of life spans have been made by research in plant and animal biology and genetics. Biodiversity is an important part of ecological services that make life livable on Earth. They include such services as water cleaning and absorbing chemicals, providing oxygen for people and other living organisms to breathe. Today, biodiversity of the planet is under serious threat as a result of human activities. The major dangers worldwide are: population growth and natural resources increased consumption,

climate change and global warming, habitat conversion and increasing temps of urbanization, invasive alien species, over-exploitation of natural resources and environment degradation.

Extinction has always been a natural part of life on Earth. In historical process most of the species evolved and then gradually extinguished due to natural shifts in the environment over long periods of time. Today, species are extinguished at an accelerated and dangerous rate due to non-natural environmental changes, caused by human activities. Some of the activities have direct effects on species and ecosystems, such as: degradation, over-exploitation, spread of non-native species and diseases. Some human activities also have indirect but adverse affects on biodiversity, including climate change and pollution [2]. All these threats put a serious strain on the biodiversity and different species of flora and fauna on the planet.

According to the International Union for Conservation of Nature (IUCN), globally, about one third of all known species are threatened by extinction. In 2012, the IUCN RED LIST featured 3079 animal and 2655 plant species as endangered worldwide. The figures for 1998 were, respectively, 1102 (on 36per cent less) and 1197 (45 per cent less) [3]. If we do not stop the threats to biodiversity we will face mass extinction with adverse consequences to environment and human health. Losing just 21 percent of the species in a given ecosystem can reduce the total amount of biomass in that ecosystem as much as 10 percent and that's a conservative estimation [4]. The major driver of human impacts remains our need for food and different kind of materials.

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Results and analysis

The territory of Georgia is 69700 km². About 40 percent of its territory is covered by forests. But forests are spread uneven in the country. Along with forest rich regions such as Abkhazeti, Ajara, Svaneti, Racha, Borjomi and Akhmeta, there are lesser forest rich regions like Akhalkalaki, Abasha, Ninotsminda, Kazbegi. In west part of the country there are more forests (51%), than in the east (30%). The major reason of such unbalance is the soil-climatic differences of the regions.

About 98 percent of forests of Georgia are growing in the mountains and only 2 percent in plane, mainly in Kolkheti lowland and on flood lands of the lower parts of flowing of rivers: Mtkvari, Alazani, Iori, Khrami and others. About 27 percent of forests grow under 1000 m. above the sea level and about 73 percent above 1000 m. The major part of the forests (78%) are growing on the steep (21°–35°) and very steep (36° and more) slopes [5,6]. Such disposition of forests determine their importance as being protecting of soil and watershed. The forests around highland resorts with mineral waters, regulate water output and have recreational facilities. They protect the local villages from strong winds, landslides and snow-slips.

Forests of Georgia are notable by its biodiversity. About 400 different species of trees and bushes grow in our forests, among them many relicts and endemics. The main wood-formative species of forests in Georgia from deciduous species are: Beach-tree (*Fagus orientalis*) –51.8% from the total growing wood-stock, oak-trees (mostly *Quercus iberica*)–5.5%, Hornbean (*Carpinus*)–5.7%, Edible chestnut (*Castanea sativa*) –2.9%. From coniferous species: Fir-tree (*Abies nordmanniana*) –17.2%. Spruce (*Picea orientalis*)–7.5%, Pine-trees (*Pinus Sasnovski*, *Pinus eldarica*)–3.4% [5,7,8].

From 4130 species of plants growing in Georgia about 3000 grow on reserved territories, 300 among them are endemics of Caucasus and Georgia. Some reserved areas have been created for protection of unique habitats of such relict and endemic species as: Strawberry tree (*Arbutus andrachne*), Caucasus rhododendron (*Rhododendron caucasica*), Birch-trees of Litvinov, Medwedew and Radde (*Betula Litwinowii*, *Betula Raddeana*, *Betula Medwedewii*), oak-trees (*Quercus imeretina*, *Quercus pontica*), European bladdernut (*Staphilea pinnata*), Colchis bladdernut (*Staphilea colchica*), Long stem oak-tree (*Quercus longipes*), Dzelkva (*Zelcova carpinifolia*), Jew-tree (*Taxus baccata*), Celtis (*Celtis caucasica*), Sakhokia willow-leaved pear (*Pyrus Sachokiana*), Backthorn (*Rhamnus imeretina*), Caucasian wingnut (*Pterocaria ptherocarpa*) and others [9–14]. All these species are included in the „Red List“ of Georgia.

The best way of preserving of these relict and endemic species is enlarging the reserved areas. Today, the total area of protected territories of Georgia is- 600717 hectare, which amounts to approximately 7 per cent of the country's territory. There are 14 Strict Nature Reserves-140672 hectares, 11 National Parks-352566 hectares, 19 Managed Nature Reserves-70393 hectares, 41 Natural Monuments- 2378 hectares and 2 Protected Landscapes-34708 hectares [15–17]. Especially must be noticed the Jew-tree stands, the relict of Tertiary period flora, that grows in Batsara strict nature reserve on the area of about 240 hectare. Some exemplars of the trees are 1500 years old. In the Babaneuri strict nature reserve there is a stand of Dzelkva (*Zelcova carpinifolia*). Alone trees of Dzelkva grow in Ajameti managed nature reserve and Sataplia state strict nature reserve too. The large stand of Imereti oak-tree (*Quercus imeretina*), the endemic species of Georgia, is also grow in the Ajameti managed nature reserve.

In the last decade some species of flora in Georgia are being threatened by extinction. Especially must be noticed the relict species of Georgia-Colchis box-tree (*Buxus colchica*). It is an ever-green shrub or a small tree of 9–10 m. of height. Besides Georgia it

grows in the subtropics of Turkey, Azerbaijan and Iran (Its synonym - *Buxus hyrcana*). In Georgia, the most valuable stands of *Buxus colchica* are located in the strict reserved territories of Bitshvintamjusera and Mtirala. Besides these reserved territories it grows in Ajara, Samegrelo, Tchorotsku, Imereti, Kvemo Svaneti, Racha-Letshkhumi and Kakheti.

Buxus colchica is very closely related to European box-tree (*Buxus sempervirens*) and commonly treated as a synonym. It does not differ from *Buxus sempervirens* in any visible character. The total area of *Buxus Colchica* in Georgia is about 2000 hectare.

It all began in 2009, when the first distinct signs of box-tree forest degradation have been detected. The situation worsened when box blight broke out in some protected areas of west Georgia. This new disease is caused by a dangerous invasive fungal pathogen, its scientific name is- *Calonectria pseudonaviculata*, it is also known by synonym-*Cylindrocladium buxicola*. The disease has been spreading so quickly, that it embraced all areas of west Georgia where box-tree grows. The fungus feels especially well in humid and warm (18–25°) conditions which are aerated badly [18–20]. From this point of view in Ajara and Samegrelo there are the most comfortable conditions of growth. According to some mass media sources, about 90% of Colchis box-tree stands are already destroyed [21]. According to the Ministry of Environment Protection and Natural Resources of Georgia, it is only 30 percent [22]. Today, there is no effective method of protection from this disease. Scientists estimate the present condition of box-tree stands as pandemic.

The situation caught the Agency of Protected Areas of Georgia (APA) unprepared. APA turned to the International Union of Conservation of Nature (IUCN) to help. This collaboration helped APA to better face this challenge. APA and FLEG II (Forest Law Enforcement and Governance) built up a strategy [21]. They conducted several field trips in three National Parks under APA's management. These areas were Mtirala National Park, Kintrishi Protected Area and Ajameti Managed Reserve. The same investigations and analysis have been made in five more regions under the NFA (National Forest Agency) control that also been affected by box blight: Samegrelo-upper Svaneti, Guria, Imereti, Racha-Lechkhumi, Lower Svaneti and Kakheti.

The ENPI East Countries FLEG II is a program of complementary measures for some former Soviet republics, Georgia among them, supported by the Austrian Development Agency (ADA) with funds of Austrian Development Cooperation. The program is being implemented by the World Bank in participation with WWF and IUCN. It complements the EU-funded FLEG II Program. The objectives of the Program are to support these countries in strengthening forest governance through improving implementation of the relevant international processes, enhancing their forest policy, legislation and institutional arrangements and developing, testing and evaluating sustainable forest management models at the local level on a pilot basis for further replication.

The outcomes of the studies provided a solid foundation on which to build a national plan to stamp out forest pests and diseases. The plan outlines specific activities to be implemented in 2016–2017 and will be submitted to the Georgian Government for approval. With help of FLEG, the Ministry of Environment Protection and Natural Resources of Georgia (MEPNR) is now seeking funds to establish a Ministry –owned laboratory. Another key action undertaken by the MEPNR was the launch of the video campaign, „Save the Box Tree“, aimed to prevent the heavy harvesting of box-trees by the population during the Easter time. In Georgian culture, box-tree is considered a sacred tree and its branches are collected and sold during the Easter. Every year this tradition leads to the cutting of a great amount of box-trees, whose transportation favors the spread of the blight.

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