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EXPERIENCE OF APPLYING THE CONCEPT
OF HIGH CONSERVATION VALUE FORESTS IN ARMENIA

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The forests in the Republic of Armenia cover 332,333 thousand ha or 11.17 % of the total territory of the country. The majority of forests is located in the north-eastern regions of Armenia. During the recent decades the forests in Armenia have been under anthropogenic pressure, which resulted in reduction of forested areas and degradation of forest ecosystems. The concept of high conservation value forests (HCVFs) was introduced by the Forest Stewardship Council in 1999 to maintain and conserve respective forest values. Draft national classification and criteria for identification of HCVFs in Armenia were developed in 2016. The national category HCVFs 2 implies relatively large intact forest areas, which support viable populations of most or all naturally occurring species of plants and animals. A potential HCVF area with the territory of 1563 ha in the north-eastern Armenia (Tavush Province) was assessed by the national criteria for identification of HCVF 2. The area mainly corresponds to the national criteria and can be defined as HCVF 2. The area should be under focused protection with no intervention measures in the management plan. It is suggested to modify the criterion on the age structure of HCVF 2. The analysis of field taxation data of the forest enterprise, where the assessed territory is located, as well as the experience of application of the national criteria show that there are no other HCVF 2 areas on the territory of the forest enterprise. Such territories will be rare also in the other forests of Armenia. Identification and proper management of HCVF 2 areas is important for Armenia given the ongoing anthropogenic pressure on forests.

Key words: high conservation value forests, category two, Armenia, national criteria, large intact forests, fragmentation, age class, canopy closure.

Introduction. The Republic of Armenia (RA) is a landlocked high mountainous country in the Caucasus with the territory of 29,740 km². According to the data from 2011 the forests in Armenia cover 332,333 thousand ha, which makes 11.17 % of the total territory of the country [2]. The forests of Armenia are located at the altitudes from 500 m (northern Armenia) to 2,300–2,400 m above sea level (a. s. l.). According to the First National Report on biodiversity of Armenia [1] the broadleaf forests dominate with the main forest species of oak (*Quercus*), beech (*Fagus*) and hornbeam (*Carpinus*). The coniferous forests are represented by pine (*Pinus*) and juniper (*Juniperus*). The dendroflora of Armenia includes 232 species [13]. According to the Fifth National Report [2] the typical forest fauna includes 90 species of vertebrates (6 amphibians, 25 reptiles, 42 birds, 17 mammals) and 2,212 species of invertebrates (95 mollusks, 85 arachnids and 2,032 insects).

The major parts of forests in Armenia are located in north-eastern regions of the country, namely in Lori, Tavush and Gegharkunik Provinces of Armenia. These forests are organized in the structure of 12 forest enterprises of “Hayantar” State Non-Commercial Organization (SNCO) under the Ministry of Agriculture – the state forest manager in Armenia, as well as a number of forest protected areas under the Ministry of Nature Protection (MoNP) – Dilijan National Park and several forest sanctuaries. The total territory under the mentioned administrative units is 258,127 ha [4, 5, 9].

The forest areas in the structure of “Hayantar” SNCO makes 211,554 ha (or 63.7 % of total forested areas of Armenia) and include 211,380 ha of natural forests (95.4 %) and 10,074 ha of forest cultures (4.6 %). The forest glades make about 11,700 ha; this is the main reserve for forest expansion. Fully logged and unrecovered areas (due to the anthropogenic impact) make 6,450 ha. The forests are located on the altitudes of 500–2,300 m a. s. l. with 62.7 % of forests located at the altitudes 1,200–1,800 m a. s. l. The average canopy closure of the main forest species in the region at different altitudes varies as follows: oak (of seed origin and coppice) – 0.45–0.56, beech – 0.43–0.53 and hornbeam – 0.47–0.54. The age groups of beech are distributed as follows: up to 40 years old stands – 1,727.1 ha and above 41 years old – 93,131 ha. The age groups of oak are

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distributed as follows: up to 40 years old stands – 2,206 ha and above 41 years old – 61,568 ha [4, 5].

During the recent decades there have been intensive loggings in the forests of Armenia caused by various socio-economic problems and high demand for wood. The ongoing anthropogenic pressure on forests includes overuse of wood and non-wood resources, grazing and others. It results in the changes in species composition and forest structure and decreased capacities of natural regeneration of forests. The stands dominated by rare tree species such as *Pinus kochiana*, *Taxus baccata* and *Corylus colurna* are being reduced. The natural seed regeneration of oak and beech stands is not satisfactory. Often the valuable forests are being replaced by the steppe-meadow vegetation [2, 4]. According to Vardanyan [10] unsustainable use of forest resources in Tavush province has resulted in alterations in forest cover, fragmentation and degradation of forest ecosystems with subsequent negative phenomena such as erosion, landslides, mudflows, soil degradation and others.

Meanwhile, the presence of relatively large undisturbed forest areas are crucial for safeguarding well-functioning ecological processes and provision of important ecosystem services including water and soil protection. They include forests in protected areas and outside. The proper management of such forest areas is a key to have sustainable services and benefits provided by the forest ecosystems. Hence, identification of such forests is the first step towards their maintenance, protection or other respective management action [8, 11].

Materials and methods. A potential high conservation value forest (HCVF) area in Noyemberyan FE (Northern Armenia) was analyzed and assessed by draft national criteria on identification of HCVF. The data of forest taxation and management plan of Noyemberyan FE were used. The parameters of the forest area were compared to the criteria with thresholds on identification of HCVFs.

The concept of high conservation value forests and significant large landscape level forests. The concept of “High Conservation Value Forests (HCVF)” was developed by the Forest Stewardship Council (FSC) to promote responsible forest management. The Principle 9 of the FSC certification system requires identification, management and monitoring of high conservation values (HCVs) in the forests. The concept was published in 1999 [8].

“HCVs are biological, ecological, social or cultural values which are considered outstandingly significant or critically important, at the national, regional or global level” [6]. There are six internationally agreed generic categories of HCVs. Table 1 below presents generic categories of HCVFs according to Jennings et al. [8].

Table 1

High Conservation Values and Their Elements

HCV	Values and their elements
HCV 1	Globally, regionally or nationally significant concentrations of biodiversity values
HCV 1.1	Protected Areas
HCV 1.2	Threatened and endangered species
HCV 1.3	Endemic species
HCV 1.4	Critical temporal use
HCV 2	Globally, regionally or nationally significant large landscape level forests
HCV 3	Forest areas that are in or contain rare, threatened or endangered ecosystems
HCV 4	Forest areas that provide basic services of nature in critical situations
HCV 4.1	Forests critical to water catchments
HCV 4.2	Forests critical to erosion control
HCV 4.3	Forests providing barriers to destructive fire
HCV 5	Forest areas fundamental to meeting basic needs of local communities
HCV 6	Forest areas critical to local communities’ traditional cultural identity

Jennings [7] defines the category HCVPs 2 as “Forest areas containing globally, regionally or nationally significant large landscape level forests, contained within, or containing the management unit, where viable populations of most if not all naturally occurring species exist in natural patterns of distribution and abundance”. This means necessarily large forests relatively unaffected by anthropogenic activities over the recent time. Usually such landscapes form a mosaic of ecosystems to include also non-forest ones such as meadows, marshes and others.

According to Jennings et al. [8] deforestation, forest fragmentation and degradation has been continuously reducing the areas covered by large relatively intact forest areas. In countries with extensive forest conversion such areas are rather limited. Meanwhile, some countries may have rather large such forest areas, which need to be assessed to be identified as HCVP 2.

For example, according to Yaroshenko et al. [16] the large undisturbed forest areas have become rare in Russia and many such areas have even disappeared due to intensive economic activity. Meanwhile, some pilot projects were implemented in different regions of Russia to identify large undisturbed or pristine forest areas. This included development of applicable (national/sub-national) criteria with thresholds and identification of forest areas under different categories of HCVPs [12, 14, 15]. The assessment of potential HCVP 2 areas implied identification of the features on anthropogenic disturbance (signs of loggings and other economic activities in forests, forest roads and others) as well as the main features of undisturbed forests (presence of old trees with hollows, fallen and dry/dead trees, natural regeneration and others).

HCVP 2 in Tavush Province of Armenia. Ghulijanyan [4] suggested to identify a territory of 1,563 ha in Noyemberyan Forest Enterprise (FE) in Tavush Province of Armenia as HCVP. That time there were no national criteria for identification of HCVPs in Armenia and this proposal was based on the generic definition of HCVP 2.

Later Vardanyan et al. [11] developed draft national classification and criteria for identification of HCVPs in Armenia. The national category HCVPs 2 implies intact (relatively not affected) and pristine forest areas, where viable populations of most or all naturally occurring species of plants and animals exist. The following criteria are suggested for identification of HCVPs 2 in Armenia:

- a) Forests with the area of at least 300 ha;
- b) Forest areas not used for timber extraction during the last 50 years;
- c) Maturing, mature and overmature forests;
- d) Forests with canopy closure 06 and more;
- e) Forests with fragmentation less than 10 %;
- f) Forest areas without forest cultures.

A forest area can be identified as HCVP 2 if it meets all the above mentioned criteria. The thresholds in the criteria are based on the general forestry characteristics and specifics of forests in Armenia.

According to Vardanyan et al. [11] identification of HCVPs 2 in Armenia is aimed to support the protection of forest landscapes, which consist of a mosaic of ecosystems and by the size, structure and interlinkages of components are close to their natural state. Respective landscapes should not have the signs of direct and indirect disturbances, such as the signs of logging, ecosystem transformation and fragmentation or the presence of settlements, roads, infrastructure and others. The evidences of undisturbed (close to natural) state include natural distribution, quantity and composition of forest species, the presence of physiologically mature trees, fallen and dry trees and others.

The forest area in Noyemberyan FE suggested by Ghulijanyan [4] as the HCVP was assessed by the draft criteria for identification of HCVPs 2 in Armenia.

According to the management plan of Noyemberyan FE [3] the FE covers 29,254 ha. The area covered by forests makes 89 % of the total FE territory (about 27,000 ha), there is 5 ha of clear-cut and non-recovered area and 386 ha of are with the canopy cover below 0.2 (including 84 ha of sparse forests of anthropogenic nature and 302 ha of natural open woodlands). In total other than forest areas make 4.5 % of the total territory (pastures, hay-making areas and others). The main

forest species are beech, oak, hornbeam and pine. The other accompanying species include ash-tree, maple, walnut, lime-tree, pear, apple, elm, yew, cornel cherry and others. The average age structure is as follows: young stands – 1.3 %, middle age stands – 68.1 %, maturing stands – 18.3 % and mature/overmature stands – 12.3 %. The stands with the canopy closure 0.3–0.4 make 16 % of the total area, 0.5–0.6 – 70.1 %, 0.7 and more – 13.9 %.

Zikatar State Sanctuary with the territory of 150 ha is located as an enclave on the territory of Noyemberyan FE. This forest sanctuary was established in 2010, it is under the MoNP.

The area in Noyemberyan FE suggested as HCVF is located in Voskepar district (quarters 17–25) of the FE. It is far from big settlements and other infrastructures. The closest community Gomshavar is very small (about 20 households) and located at the distance of 5 km by forest road. The bigger community Voskepar is at the distance of 28 km by forest road. There are few more or less passable forest roads in the area. The area is rarely visited due to its distant location and difficult access.

The other main characteristics of the suggested HCVF 2 area are presented below in Tables 2–4 according to the management plan of Noyemberyan FE [3] and Ghulijanyan [4].

Table 2

Distribution of landscapes (ecosystems) in the suggested HCVF 2

Types of landscapes (ecosystems)	Area, ha	Proportion, %
Forests	1,433.2	91.7
Open woodland	5.2	0.3
Forest glades	5.5	0.4
Non-forested areas	119.1	7.6
Total	1563	100

Table 3

Distribution of stands by dominating species and age groups

Dominating species in the stand	Total area, ha	Age groups, ha				Average age, years
		Young (0–40 years old)	Middle age (41–120)	Maturing (121–140)	Mature and overmature (141 and more)	
Beech	999.7	2.8	504.3	249.2	243.4	130
Oak	418.8	–	368.2	26.6	24.0	15
Hornbeam	14.7	1.9	2.8	–	–	36
Total	1,433.2	4.7 (0.3 %)	875.3 (61 %)	275.8 (19.2 %)	267.4 (18.7 %)	125

Table 4

Distribution of stands by canopy closure (ha)

Dominating species	Canopy closure									Average canopy closure
	0.3	0.4	0.5	0,6	0,7	0,8	0,9	1	Total	
Beech	2.2	21.5	210.9	341.0	388.4	33.7	2.0	–	999.7	0.65
Oak	7.4	44.4	108.4	154.9	72.8	27.5	3.4	–	418.8	0.61
Hornbeam	–	–	–	–	5.1	9.6	–	–	14.7	0.77
Total	9.6	65.9	319.3	495.9	466.3	70.8	5.4	–	1,433.2	0.64

The analysis of information in the above tables shows that the suggested HCVF 2 area is a mosaic of various ecosystems with the dominance of forested areas. The forest ecosystems in the area (the canopy closure above 0.3) make 91.7 % and less than 10 % of the area is represented by open woodlands (canopy closure up to 0.2), forest glades and non-forested areas (pastures, screes and water areas). About 50 % of open woodlands are natural and the other half is of anthropogenic nature. There are no forest cultures (Table 2, Fig. 1).

The stands in the area are dominated by beech, oak and hornbeam. As it can be seen from Table 3 and Fig. 1 the stands with dominance of beech cover 999.7 ha (69.8 %), oak – 418.8 ha (29.2 %) and hornbeam – only 14.7 ha (1 %). The other accompanying species include lime-tree (*Tilia*), ash (*Fraxinus*), maple (*Acer*), pear (*Pyrus*) and others. The average forest composition is 6.2 beech, 2.4 oak, 1.3 hornbeam, 0.1 lime-tree, ash, maple and pear.

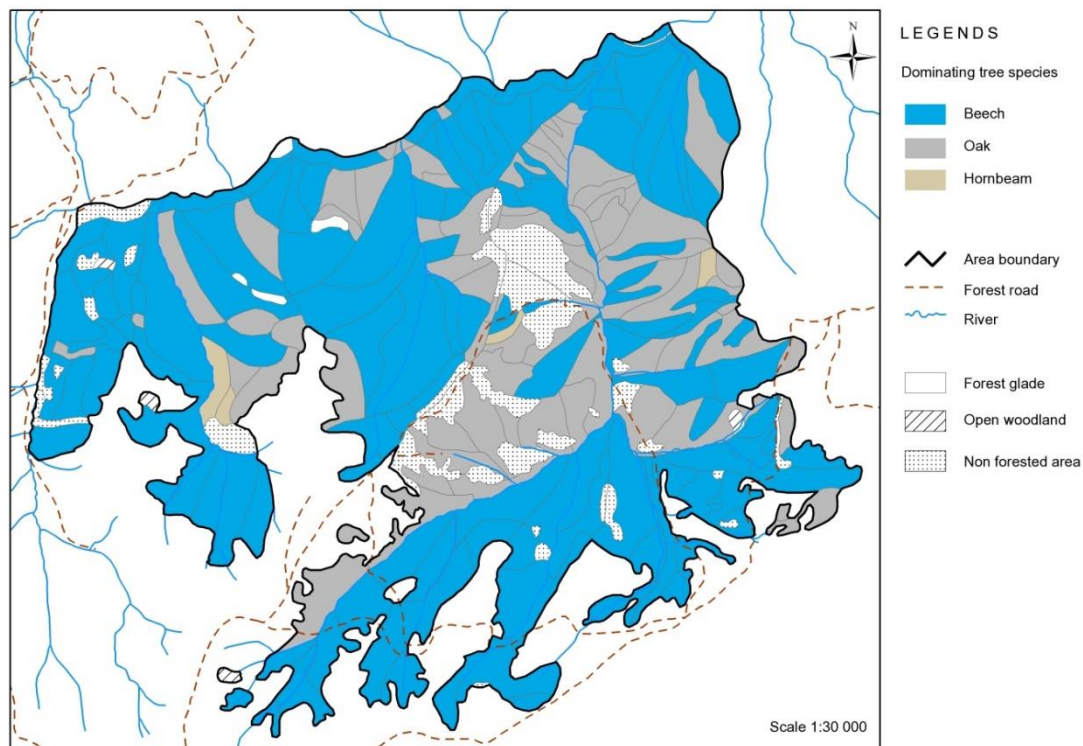


Fig. 1 – Distribution of landscapes and dominating tree species

Table 3 shows that only 0.3 % of forests are in the category of young age group, the middle age group stands make 61 % of the forests, whereas maturing and mature/overmature stands make 19.2 % and 18.7 % respectively. The distribution of stands by age classes is as follows: age classes I and II – 14.7 ha, III – 67.6 ha, IV – 43.6 ha, V – 166.9 ha, VI – 276.9 ha, VII – 450.7 ha, VIII – 181.6 ha, and IX – 231.2 ha. Thus the stands belonging to the VIth and VIIth age class (100–140 years old) cover 727.6 ha or 50,8 % of the area. The stands above 100 years old (VI–IX age classes) make 1,140.4 ha or 79.6 % of the forested area.

Table 4 shows that the average canopy closure irrespective of dominating species is above 0.6: the average canopy closure of beech dominated stands is 0.65, oak – 0.61 and hornbeam – 0.77. The areas with the canopy closure below 0.6 totally make 394.8 ha (27.5 %) and the majority of forests (1,038.4 ha or 72.5 %) have the canopy closure above 0.6.

In the area there are no signs of timber extraction, in the stands there are fallen, standing dry and drying trees, which are the evidence of no intervention during the recent decades. The forest management plan envisages only protection for the area without any plans for intervention (loggings, rehabilitation or others).

Table 5 below summarizes the correspondence of the suggested area to the national criteria on identification of HCVF 2.

The further analysis of the field taxation data and the management plan of Noyemberyan FE showed that there is no other such areas in the FE to be suggested as potential HCVF 2.

Conclusions.

1. The assessed area mainly corresponds to the national criteria for identification of HCVFs 2 in Armenia. The partial inconsistency is only with the criterion on the presence of maturing, mature and overmature forests, which make only 37.9 % of the forests.

Correspondence of the suggested forest area to the national criteria on HCVF 2

National criteria for identification of HCVFs	Respective characteristics of the suggested area	Correspondence to national criteria
Forests with the area of at least 300 ha	Totally 1,563 ha with 1433.2 ha of forests	Corresponds
Forest areas not used for timber extraction during the last 50 years	No signs of timber extraction during the recent decades	Corresponds
Maturing, mature and overmature forests	Maturing, mature and overmature forests make 37.9% of the forested area. The stands above 100 years old make 79.6 % of the forested area	Corresponds partially
Forests with canopy closure 06 and more	Average canopy closure 0.64	Corresponds
Forests with fragmentation less than 10 %	Forests make 91.7 %, no regular roads or other infrastructure	Corresponds
Forest areas without forest cultures	No forest cultures	Corresponds

2. Natural forest ecosystems normally consist of the stands with different age classes, which are formed during the long period of natural development without external intervention. Therefore, the formulation of the criterion “maturing, mature and overmature forests” is too strong. It is almost impossible to find such forests. Thus, it is suggested to reformulate the criterion as “the prevalence of stands above 100 years old”, which will show that the forest area has been developing naturally during long time and should be close to its natural state.

3. There are no more other sites in Noyemberyan FE to correspond to all the national criteria for identification of HCVF 2. Meanwhile, the FE is one of the best in terms of forests and there is a forest sanctuary with the area of 150 ha in the midst of the FE. Most probably there will be no many such areas also in the other FEs of Armenia. Therefore, HCVF 2 areas need special attention and focused protection. In particular, the identified area should be subject to detailed field study and no intervention measures should be envisaged during the update of the management plan.

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ДОСВІД ЗАСТОСУВАННЯ КОНЦЕПЦІЇ ЛІСІВ ВИСОКОЇ ПРИРОДООХОРОННОЇ ЦІННОСТІ У ВІРМЕНІЇ

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У статті представлені результати застосування концепції лісів високої природоохоронної цінності (ЛВПЦ) у Вірменії. Концепція ЛВПЦ була запропонована в 1999 р. Проект національної класифікації та критеріїв для виділення ЛВПЦ у Вірменії був розроблений у 2016 р. Національна категорія ЛВПЦ 2 передбачає виділення порівняно великих непорушених лісових територій, які створюють умови для підтримання життєздатних популяцій більшості або всіх видів рослин і тварин, що трапляються. Було проведено аналіз і оцінювання потенційної ділянки ЛВПЦ площею 1 563 га в північно-східній Вірменії (Тавушська область) згідно з національними критеріями для виділення категорії ЛВПЦ 2. Результати аналізу і оцінювання показали, що територія переважно відповідає національним критеріям і може бути виділена як ЛВПЦ 2. Територія повинна пріоритетно охоронятися, план управління не повинен передбачати будь-яких заходів щодо використання лісу. Пропонується модифікувати національний критерій щодо вікового складу ЛВПЦ 2. Аналіз результатів таксації лісового господарства, в межах якого розташована оцінена лісова територія, а також досвід застосування національних критеріїв свідчать, що в цьому лісовому господарстві немає інших ЛВПЦ 2. Таких територій також буде небагато в інших лісах Вірменії. Виділення і відповідне управління ЛВПЦ 2 у Вірменії вважають актуальним через тривалий антропогенний вплив на ліси.

Ключові слова: ліси високої природоохоронної цінності, категорія 2, Вірменія, національні критерії, непорушені лісові території, фрагментація, клас віку, повнота деревостану.

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ОПЫТ ПРИМЕНЕНИЯ КОНЦЕПЦИИ ЛЕСОВ ВЫСОКОЙ ПРИРОДООХРАННОЙ ЦЕННОСТИ В АРМЕНИИ

1. Национальный аграрный университет Армении

2. WWF-Армения

В статье представлены результаты применения концепции лесов высокой природоохранной ценности (ЛВПЦ) в Армении. Концепция ЛВПЦ была предложена в 1999 г. Проект национальной классификации и критериев для выделения ЛВПЦ в Армении был разработан в 2016 г. Национальная категория ЛВПЦ 2 предполагает выделение сравнительно крупных незатронутых лесных территорий, которые создают условия для поддержания жизнеспособных популяций большинства или всех встречающихся видов растений и животных. Были произведены анализ и оценка потенциального участка ЛВПЦ площадью 1 563 га в северновосточной Армении (Тавушская область) согласно национальным критериям для выделения категории ЛВПЦ 2. Результаты анализа и оценки показали, что территория в основном соответствует национальным критериям и может быть выделена как ЛВПЦ 2. Территория должна пріоритетно охраняться, план управления не должен предусматривать каких-либо мероприятий по использованию леса. Предлагается модифицировать национальный критерий касательно возрастного состава ЛВПЦ 2. Анализ результатов таксации лесного хозяйства, в пределах которого расположена оцененная лесная территория, а также опыт применения национальных критериев показывают, что в данном лесном хозяйстве нет других ЛВПЦ 2. Таких территорий также будет немного в других лесах Армении. Выделение и соответствующее управление ЛВПЦ 2 в Армении считается актуальным из-за продолжающегося антропогенного воздействия на леса.

Ключевые слова: леса высокой природоохранной ценности, категория 2, Армения, национальные критерии, незатронутые лесные территории, фрагментация, возрастной класс, полнота древостоя.

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