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# COMPARATIVE ANALYSIS OF THE AGE STRUCTURE OF THE PROTECTED OLD-GROWTH *PINUS SYLVESTRIS* L. TREES IN FOREST-STEPPE AND STEPPE OF UKRAINE

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*We outlined the importance of preservation of the old-growth trees and shrubs for Ukraine and the world as a whole. We have conducted the comparative analysis of the age structure of the old-growth Scotch pine trees (Pinus sylvestris L.) growing in nature reserves territories of the Forest-steppe and the Steppe of Ukraine. Results of the analysis showed there is greater number of old-growth trees by age categories in the Forest-steppe of Ukraine. The majority of them are protected as nature monuments. Nationwide, the greatest number of protected old-growth pines is in the Cherkassy area of Ukraine.*

**Old-growth trees, longevity, *Pinus sylvestris* L. comparative analysis, nature reserves, nature monuments, Forest-steppe, Steppe.**

The preservation of the old-growth trees (specimens reaching and exceeding 100 years of age) in Europe specimens reaching and exceeding 100 years of age goes back to XVIII century. That is the reason why protection of the old-growth trees and shrubs is currently one of the most important tasks of nature preservation organizations and individuals of the European continent. In this aspect, the special attention to this topic has been paid in the countries of the Western Europe and lately, especially in the last decade, in the countries of the Central Europe. More than 70 percent of the old-growth trees have been registered across Europe as a whole. Such increased attention to the old-growth trees could be explained by the countries realizing not only the need of trees preservation as an autochthonic gene bank, but also as historical and cultural legacy, which these trees conceal.

The protection of the old-growth trees in Ukraine started in the Crimea at the end of the XIX century. Subsequently the focus of protective efforts moved to Central and especially Western Ukraine. During the time period starting with the first protective measures and until now, there were several attempts to inventory the old-growth trees, which were fueled particularly by the enthusiasm of professor A.L.Lypa. Fifteen years ago in Ukraine 3295 unique trees were registered as being over a 100 years old [1, 9]. Recently this number fell down to 2600 trees with most of

them (260 trees) being located in Kyiv. For comparison, currently in the world there are over 100,000 old-growth trees under protection. In neighboring Poland 53,000 old-growth trees are taken under government protection [1, 10, 13] with close to 50 of them given nature monument status. In Ukraine, only about 30 percent of the old-growth trees are protected under the nature monument status. Generally, these are trees which are connected to the names of outstanding people, legends, historical events, etc. [2, 7]. In particular, the most popular are so-called "Shevchenko's oaks". Apropos, it is worth mentioning that during the XX-th century Ukraine lost six oaks aged between 1000 and 1500 years of age. In this regard, we would like to emphasize that to this day Ukraine is lacking even a single more or less complete catalogue of the old-growth trees and shrubs. In the early 1990-s there was a serious attempt to study and protect trees with the nature monument status. That is, in 1991 a number of public and government nature protection institutions began implementation of the program "The Famous and -Historically-important Trees of Ukraine". The goals of this program included information gathering, creation of the computer database as well as setting the stage for the creation of the full catalog of unique trees of Ukraine. In this regard, the special information gathering and verification technique was developed with the questionnaire as its main method [9]. Over time this very necessary work was curtailed and slowly died away. Only in 2009 this work was resumed within the framework of the nation-wide contest in search for the outstanding trees with the age over 1000 years. With the initiative produced by the Kyiv ecologically-cultural center and the Governmental reserve affairs service within the Ministry for Protection of the Environment and Natural Resources of Ukraine the third nation-wide census of the old-growth trees took a start. The contest resulted in a number of trees obtaining the rank "A national tree" [10].

**Research objective** – to conduct the comparative analysis of the age structure of the old-growth Scotch pine trees (*Pinus sylvestris* L.) growing in nature reserves of the Forest-steppe and the Steppe of Ukraine; to show methodically a current protection state of the old-growth trees of this species.

**Materials and research technique.** As the preliminary research showed , there are several approaches in determining the tree longevity. For example, Laptev

and Rubtsov separate trees into three groups depending on their life expectancy: short longevity, average longevity and long-lived [11, 12]. At the same time, Kolesnikov, being guided by the limit of the potential tree age, proposes four longevity groups [8], whereas Zayachuk offers five longevity groups by taking into account tree life expectancy [6]. System approach and the comparative analysis of the gathered data obtained from the dendrosozological abstracts associated with the protected old-growth trees and shrubs of the Forest-steppe and the Steppe of Ukraine [3] was applied to achieve the research objective. Dendrosozological abstracts were formed on the basis of field materials produced as a result of the inventory of reserved old-growth woody plants as well as bibliographic sources [4, 5]. *Pinus sylvestris* L. across inventoried territories and regions deemed to be in various longevity groups based on the application of aforementioned methods.

**Research results**. According to literature sources, *Pinus sylvestris* L. is aspecies of woody plants serving as an ecosystem engineer and keystone species, which is known to form forest stands, has an average life expectancy of 200 years at an average height of 25 m and an average crown diameter of 8 m, and the maximum life expectancy of 500 years at the maximum height of 50 m and maximum crown diameter of 15 m [12].

As showed the comparative analysis of the life longevity field data of this species coming from the regions of study, the age variation of the century-plus-old Scotch pine trees is greater in the Forest-steppe, than in a the Steppe of Ukraine. It fluctuates from 100 to 600 years (fig. 1). The most common are 100-200-year old specimens. At the same time, age distribution of the old-growth pines in the Steppe varies between 100 and 170 years (fig. 7). This phenomena is explained by the fact that the Steppe conditions are less favorable for pine survival than conditions in the Forest-steppe since pines growing in the Steppe happen to be outside of their natural habitat boundaries and climatic optimum. That is the reason why the stands of Scotch pine remained intact mainly on the outwash plains like boreal terraces along the rivers of the Steppe of Ukraine.

By nature reserve categories, in both study regions the highest concentration of the old-growth Scotch pine trees is found on the territories with the most favorable

growth conditions such as strict nature reserves as well as man-made parks organized as a landscaping art monuments (fig. 2).

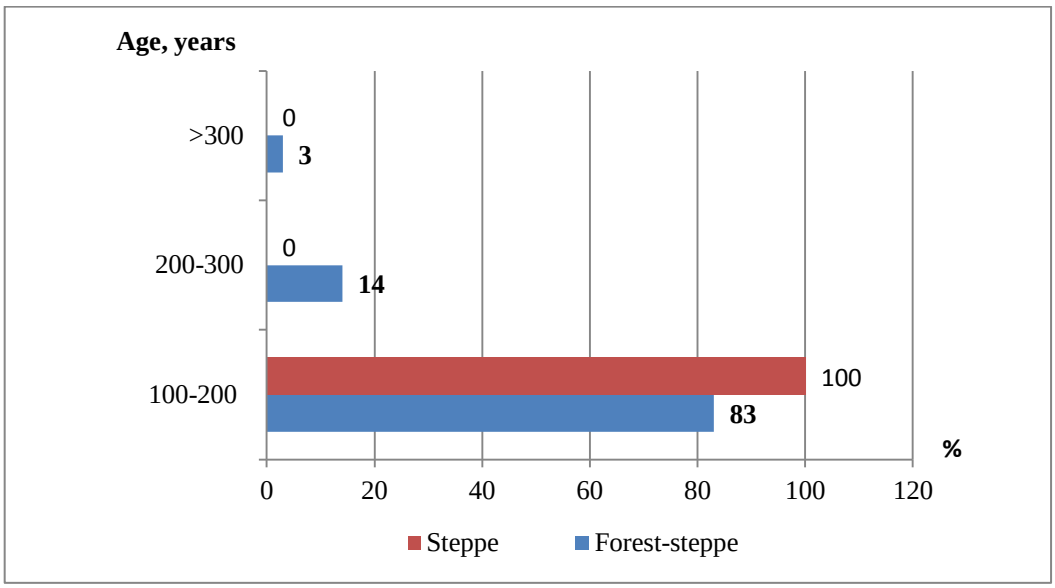


Fig. 1. Distribution of protected old-growth *Pinus sylvestris* L. trees by tree age (in percent of number of trees) in Forest-steppe and Steppe of Ukraine

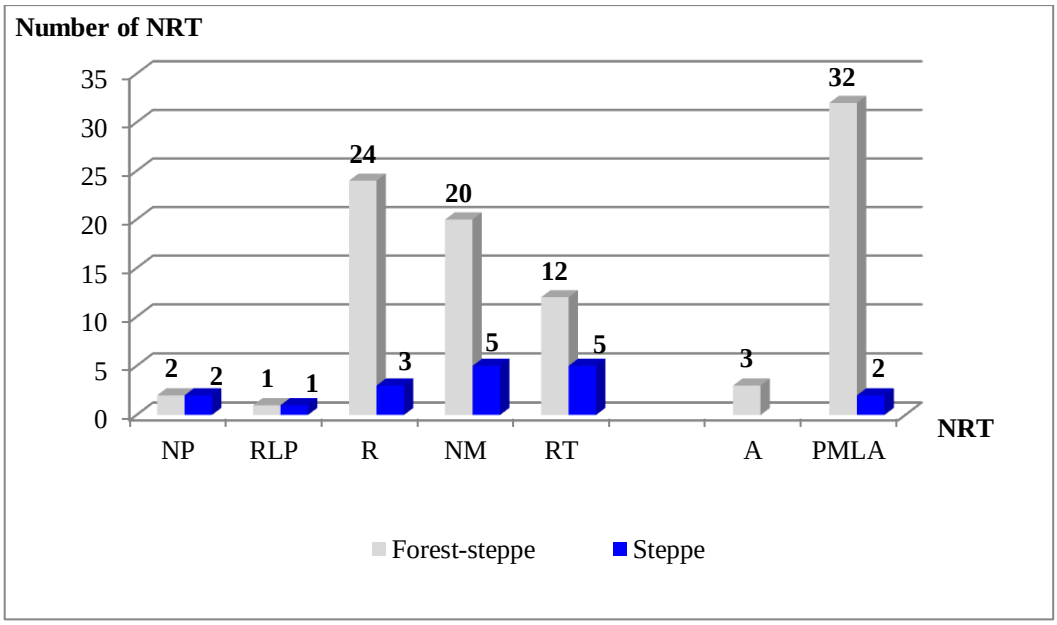


Fig. 2. Distribution of old-growth *Pinus sylvestris* L. trees of Forest-steppe and Steppes of Ukraine by nature reserve types
Note: Nature Reserve Type (NRT) include:
National parks (NP), Regional landscape parks (RLP ),
Reserves (R), Nature monuments (NM),
Reserve tracts (RT), Arboretums (A),
Park-monuments of landscape art (PMLA).

The group of protected old-growth *Pinus sylvestris* L. trees with the highest

tree ages in the Forest-steppe and the Steppe of Ukraine are found on aforementioned land categories as well as in national nature parks. *Pinus sylvestris* L. trees that are 300 year of age were located in the arboretums, which is a part of so-called artificial nature reserve land category (fig. 3).

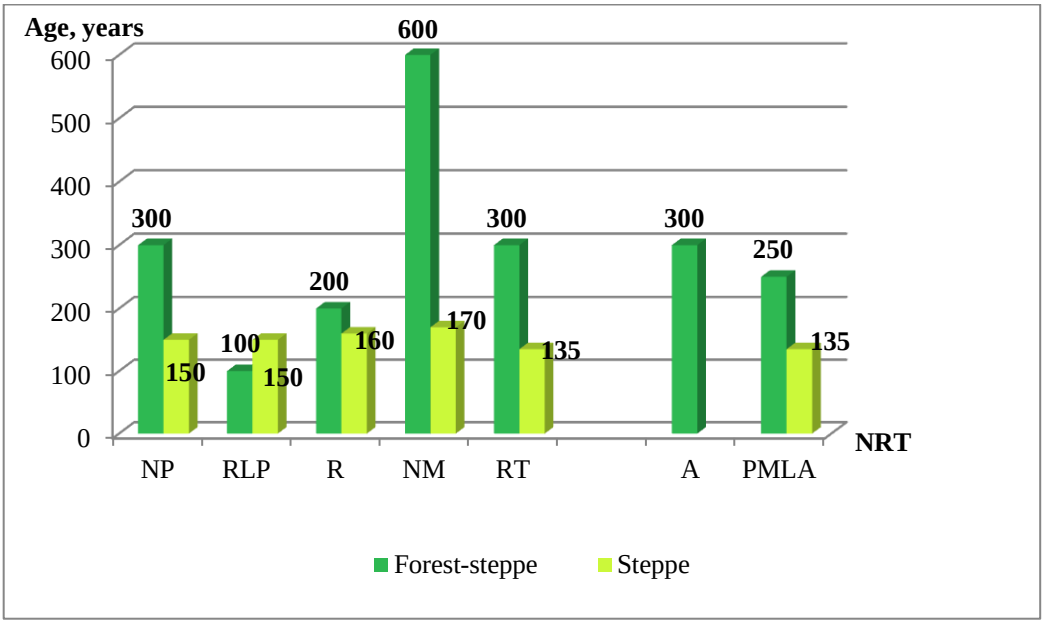


Fig. 3. Age distribution of old-growth *Pinus sylvestris* L. trees by nature reserve types in the Forest-steppe and Steppe of Ukraine
Note: The abbreviation for Nature Reserve Types (NRT) is described under Fig. 2 narratives

The comparative analysis of the old-growth trees age structure by region reviled that in the Forest-steppe of Ukraine the greatest number of the old-growth Scotch pine trees is concentrated in the Cherkasy area. Somewhat smaller number of the old pine trees remains in Vinnytsia, Kyiv and Sumy regions, as well as within the city limits of Kyiv (fig. 4). The group of the oldest 600-year old trees is found in Poltava region (Lokhvitsa, Pine Park), whereas 300-year old trees are found in the Kyiv, Kharkov, and Cherkasy regions of the Forest-steppe, as well as in Kyiv.

The greatest number of protected old-growth *Pinus sylvestris* L. trees in the Steppe of Ukraine is concentrated in Lugansk region (fig. 6) on the second boreal terrace of the Seversky Donets River and in the Dnepropetrovsk region on the second boreal terrace of the Dnepr River. In Kherson region the sandy arenas represent the most favorable conditions for pine.

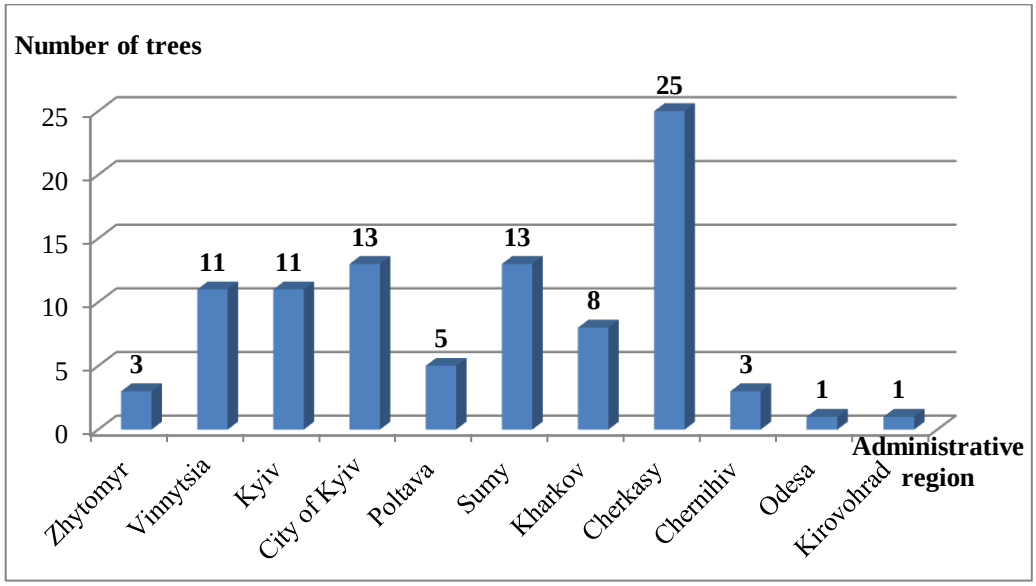


Fig. 4. Representation of protected old-growth *Pinus sylvestris* L. trees within the administrative regions of the Forest-steppe of Ukraine

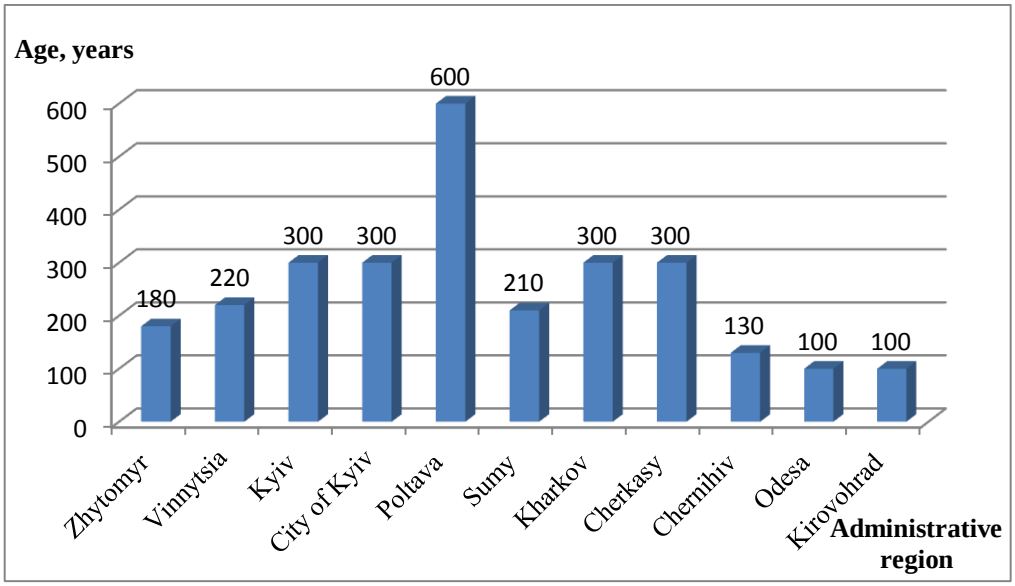


Fig. 5. Regional representation of the age structure of protected old-growth *Pinus sylvestris* L. trees in Forest-steppe of Ukraine

Among the studied old-growth Scotch pine trees there are many of monumental status. In particular, this group includes so-called “Gogol’s Pine”. The story goes that in the middle of the 1830-s in Cherkasy region M.V. Gogol (an outstanding Russian and Ukrainian writer), while in transit from his family estate (Vasilyevka village of the Mirgorod district), had visited his friend N.A. Maksimovich in Prokhorovka village. Possibly this is the exact location where the plot for novella ”Viy” had been written. In honor of his friend N.A. Maksimovich had designated a 250-year old Scotch pine growing near to his estate as ”Gogol's

Pine". By the decision of the Cherkasy regional executive committee from 27.06.1972 No. 367 this pine was given a nature monument status. In Sumy region there is a 200-year old "Palitsyn's Pine", which was planted in 1806 on Palitsyn's wife Yevdokiya Aleksandrovna's grave. Yet, to this day the studied regions contain many old pine trees which are lacking protective status. In particular, Dnepropetrovsk region has a 200-year old Scotch pine that needs to be preserved.

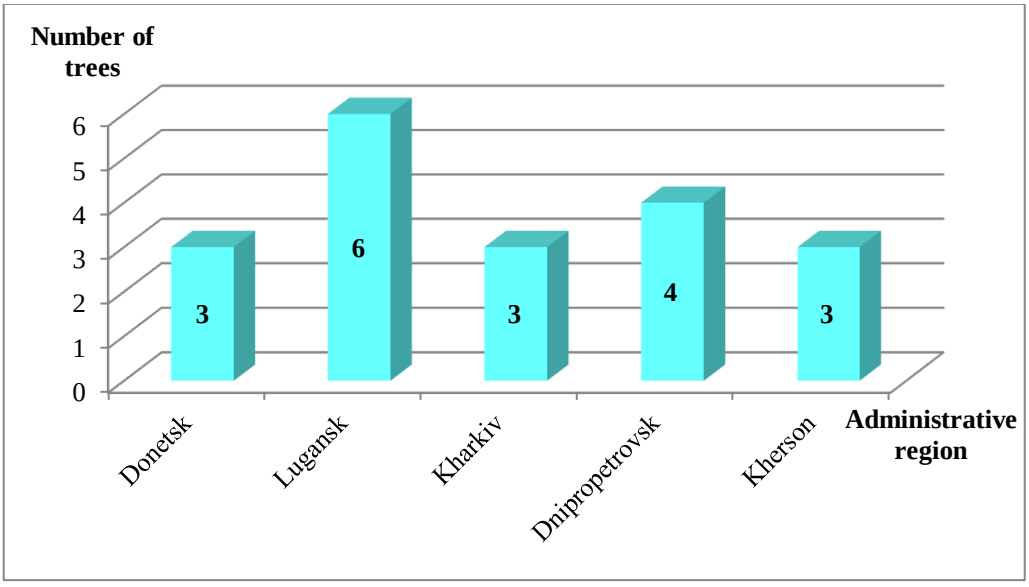


Fig. 6. Representation of protected old-growth *Pinus sylvestris* L. trees within the administrative regions of the Steppe of Ukraine

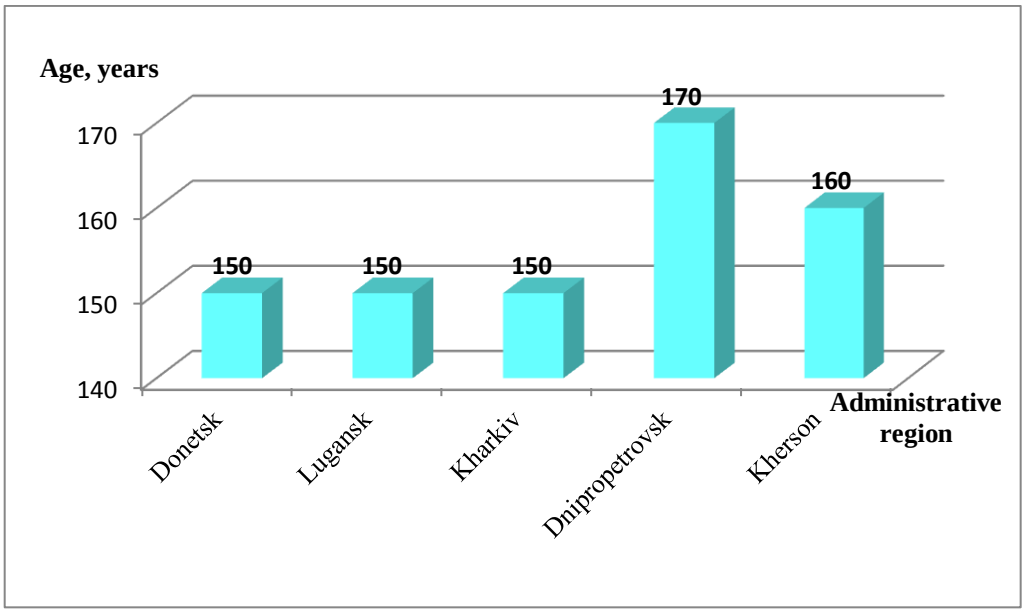


Fig. 7. Regional representation of the age structure of protected *Pinus sylvestris* L. trees in the Steppe of Ukraine

Considering the said above, it is necessary to remember at all times about former and current threats that may lead to disappearance of the old-growth trees.

These threats include natural factors, biotic (tree age, plant pathogens), as well as abiotic and anthropogenic factors (fires, recreation), etc. Taking this into consideration, it is necessary to pay constant attention to such methods of preservation of the old-growth trees as governmental measures, public initiatives, and cultural traditions and others.

**Conclusion**. The conducted comparative analysis represents the first attempt to examine the current state of the preservation of the old-growth trees in nature reserves of the Forest-steppe and the Steppe of Ukraine with Scotch pine as an example. The analysis by the tree age categories indicated the prevalence of the protected trees in the Forest-steppe of Ukraine. The majority of these trees are protected as nature monuments. By other natural reserve categories the number of the old-growth pines is higher inside the natural reserves, national parks, protected tracts, and man-made parks organized as landscaping art monuments. Within the nature reserves of the Forest-steppe the highest number of the old-growth pines was associated with Cherkasy region, whereas within the nature reserves of the Steppe the highest number of the old-growth pines was found in Lugansk region of Ukraine.

## References


1. Борейко В. Е. Кадастр выдающихся вековых деревьев Киева / В. Е. Борейко. – Гуманитарный экологический журнал. – 2009. – № 2. – С. 69-79.
2. Вакулюк П. Г. Оповіді про дерева / П. Г. Вакулюк. – К.: Урожай, 1991. – 296 с.
3. Дендросозологічний каталог природно-заповідного фонду Лісостепу України / Під ред. С. Ю. Поповича. – К.: Аграр Медіа Груп, 2011. – 800 с.
4. Заповідна дендросозофлора Лісостепу України: монографія / С. Ю. Попович, Н. П. Степаненко, Я. М. Дяченко, А. А. Дзиба [та ін.] ; за ред. С. Ю. Поповича. – К.: «ТОВ Аграр Медіа Груп», 2010. – 262 с.
5. Заповідна дендросозофлора Степу України: монографія / С. Ю. Попович, А. С. Власенко, Є. І. Берегута, А. А. Дзиба [та ін.] ; за ред. С. Ю. Поповича. – К.: «ЦК КОМПРИНТ», 2013. – 260 с.
6. Заячук В. Я. Дендрологія. Підручник / В.Я. Заячук. – Львів: Апріорі, 2008. – 656 с.
8. Івченко С. І. Дерева-пам'ятники / С. І. Івченко. – К.: Наук. думка, 1967. – 93 с.
9. Колесников А. И. Декоративная дендрология / А. И. Колесников. – М.: Лесная пром-сть, 1974. – 704 с.
10. Кушнір А. І., Сіренко І. П., Юхимець А. І. Знамениті та історичні дерева України: перші підсумки вивчення // Ойкумена. Укр. екол. вісник. – 1995. – №1-2. – С. 158-159.

11. Стародавні дерева України. Реєстр-довідник / [Гриник П. І., Стеценко М. П., Шнайдер С. Л. та інш.] – К.: ПРООН Україна, 2010. – 34 с.

12. Рубцов Л. И. Долговечность декоративных деревьев и кустарников / Л. И. Рубцов. – К.: АН УССР, 1953. – 52 с.

13. Рубцов Л. И., Лаптев А. А. Справочник по зеленому строительству / Л. И. Рубцов, А. А. Лаптев. – К.: Будівельник. – 1971. – 310 с.

14. Шнайдер С. Л., Борейко В. Е., Стеценко Н. Ф. 500 выдающихся деревьев Украины / С. Л. Шнайдер., В. Е. Борейко, Н. Ф. Стеценко. – К.: Київський еколого-культурний центр, Державна служба заповідної справи Мінприроди України, 2011. – 204 с.

*Очерчена актуальность сохранения вековых древесных растений в мире и Украине. Осуществлено сравнительный анализ состава вековых деревьев сосны обыкновенной (Pinus sylvestris L.), которые произрастают на природно-заповедном фонде Лесостепи и Степи Украины. Результаты анализа показали преобладание по категориям возраста заповедных деревьев в Лесостепи Украины. Большая часть из них охраняется как памятники природы. Наибольшее число заповедных вековых сосен в Черкасской области.*

***Вековые деревья, долговечность, Pinus sylvestris L., сравнительный анализ, природно-заповедный фонд, памятники природы, Лесостепь, Степь.***