
УДК 58.006**ВЛИЯНИЕ РЕКРЕАЦИИ НА ЛЕСНУЮ ЭКОСИСТЕМУ****Малыш Надежда Александровна**

Магистрант кафедры «Почвоведения и экологии почв»

г. Санкт-Петербург, Санкт-Петербургский государственный университет

malysh.n.a@mail.ru**Трунова Елена Олеговна**

Эксперт-товаровед

г. Санкт-Петербург, Schmidt & Olofson, Marine

Simonilus@yandex.ru**Аннотация**

Многие любят отдыхать и проводить время на свежем воздухе в сосновых сообществах. Но в связи с последними событиями рекреационная нагрузка на сообщества сосновых лесов резко возросла. Рекреационное влияние на лесную экосистему не принимается во внимание. Но подобные неконтролируемые нагрузки могут привести к тяжелым последствиям в северных лесах, которые обладают относительно низкой продуктивностью и маломощным гумусовым горизонтом. Исследования в этой области помогут оценить ущерб от рекреации и спланировать возможные пути решения данного вопроса.

Ключевые слова: рекреация, лесные сообщества, органический горизонт, гумус**THE IMPACT OF RECREATION ON THE FOREST ECOSYSTEM****Nadezhda A. Malysh**

Master's student of the Department of Soil Science & Soil Ecology

Saint Petersburg, St. Petersburg State University

malysh.n.a@mail.ru**Elena O. Trunova**

Commodities expert

Saint Petersburg, Schmidt & Olofson, Marine

Simonilus@yandex.ru

ABSTRACT

A lot of people like to relax and spend time outdoors in pine communities. But due to recent events the recreational loading on pine forest communities has increased dramatically. The recreational impact on the forest ecosystem is not taken into account. But such uncontrolled loads can lead to severe consequences in the northern forests, which have relatively low productivity and a low-power humus horizon. Research in this field will help to estimate the recreation damage and plan possible solutions of this issue.

Keywords: recreation, forest community, organic horizon, humus

Suburban forests have been popular with vacationers at all times, due to the transport accessibility and cheapness of this kind of recreation. Currently, due to the introduction of movement restrictions during the coronavirus pandemic, trips to the nearest suburb have become even more attractive for different categories of citizens. Consequently, it increases the importance of developing principles for the use and assessment of various categories of forests' suitability for these purposes. Study of recreation intensity which depending on various factors and the introduction of a set of measures aimed at preserving the ecosystem of the forest are also in particular relevance.

It should be borne in mind that the most popular and frequent visits are paid to forests that have high aesthetic, sanitary, hygienic and ecological properties. So most subtypes of coniferous and evergreen, some types of deciduous (birch) and mixed will be discussed. Areas located on waterlogged/stony soils and others are characterized by difficult terrain and so with a low attendance.

Also the type of soil and the totality of soil-forming factors (soil-forming rocks, biota - plant and animal organisms, climate, relief, age) are noteworthy. The ground cover and the upper soil horizon have a decisive influence on the flora of the studied area and determine the character and development of the mentioned flora. In the O. G. Chertova's work (1981), where the soils of the Republic of Karelia are taken as an example, it is concluded that the less is the accumulation of soil organic matter, the less stable the ecological community becomes. The emphasis on the problem of recreation is made by the author due to the fact that after analyzing the input data, it became possible to come to the conclusion that trampling and compaction of the ground cover can cause irreversible consequences.

Object of research: communities of dry pine forests on the territory of the "Figurnoe" lake (Orekhovo, Priozersky district of the Leningrad region).

Objectives of the study:

Geobotanical description of the studied territory's mesorelief ;

Visual analysis and assessment of recreational regression of ground cover and vegetation;

3) Proposal for a problem solution (based on the data obtained) using the special literature.

Research methods:

Overview of the literature;

Visual analysis of the study area.

"Figurnoe" lake (another name is "Verkholino") is located in the Vsevolozhsky district of the Leningrad region on the territory of the Orekhovsky Forest Park, 2 kilometers from the Orekhovo railway station. The attractiveness of this area is due to the proximity of settlements (several villages), highways and rail transport. On the other hand, sometimes the slopes to the reservoir are steep and clayey, so the attractiveness is reduced for certain categories of the population (the elderly, children, the disabled).

The landscape began to form in the Holocene epoch (approximately 10 thousand years ago), forming sandy kams after the melting of the glacier, forming hollows, subsequently filled with water from underground springs. After melting of the glacier moraine ridges opened up (significant territories of sand, clay, earth, gravel). Pioneer species, such as pines and birches, began to settle on nutrient-poor quartz sands; thus a forest community was formed. About 5-6 thousand years ago the first spruce trees appeared (Saksa, 2010).

In addition it is worth noting that recently in the pine forest pronounced signs of succession can be observed. The appearance of a spruce forest in the areas of pine gives reason to conclude that the soil was able to accumulate enough organic matter for the vital activity of a more demanding species (Komarova T. A., 2011).

Soils are predominantly acidic in nature, which is due to the microbiological activity of fungi, since coniferous litter consists of hard-to-decompose organic substances. This causes the presence of a subzolation process (KiDPR, 2004), which implies the decay of primary and secondary minerals with subsequent leaching down the soil profile. It should also be noted that basidiomycetes, the largest number of which is observed in the forest litter, form a mycorrhiza with many trees (birch, pine), thereby helping to extract nutrients from the soil by expanding the root system, as well as contributing to better assimilation of hard-to-reach phosphorus. In such conditions, the coarse humus character of the forest litter and the organic horizon of the soil are formed (Netrusov; Kotova, 2009).

Visual analysis of the territory adjacent to the lake showed that some areas are in the last stages of recreational digression (stage 4 and 5) - tree roots and the general destruction of the ground cover are visible. Also an important role was played by wind erosion, which is a result of the felling of shrubs by tourists (for their own convenience). Vegetation on the trampled areas is present in an amount of 5-10% compared to the control one located further from the coast. An abundance of blueberry and lingonberry bushes, forest cereals, lilies of the valley, heather are visible on this site.

Returning to the areas of abundant recreation, it is worth noting that vegetation is almost completely absent here, with the exception of rare and small bushes of blueberries and heather. The almost complete absence of ground cover and the exposure of the mineral horizon suggest that the biological activity of these sites is minimized.

The roots of trees under such conditions are subjected to increased stress: trampling causes physical damage to the root system (Zakamsky, Musin, 2013). Since not only the microbiota's biological activity, but also the root system's one take place in the organic horizon, the destruction of the root system will have a detrimental effect on the forest in the future. Thin root hairs under such circumstances cannot perform their natural functions, moreover, the entire suction zone of the tree root is on the surface, since the underlying soil horizons are depleted of nutrients, but there is a fairly powerful illuvial horizon (Chertov, 1981; Rozanov, 2004; Mirchink, Stepanova, 1982).

In addition, frequent human visits to forest or park areas lead to over-compaction of the forest floor. This provokes violations of the water-air regime, which adversely affects the transformation of the soil organic matter. Due to the appearance of the soil crust and trampling of the forest floor, natural processes do not take place in the organic horizon, the death of the ground cover is noticeable as a result. The change in the water regime consists in fact that the disturbed porosity of the soil prevents the water exchange with moisture from the atmospheric air. In addition, the absence of an organic horizon makes it difficult to retain moisture. It evaporates from the surface of the mineral horizon. Thus, trampling damages the roots of plants and contributes to the disruption of the water-air balance of the soil organic horizon (Fedorchuk, 2005).

There is also a threat of forest fires, especially in the dry and hot season. Equipped places for barbecues were not found near the "Figurnoe" lake, there are iron constructions installed unauthorizedly in some places with violations of safety standards. Numerous traces of bonfires can be noted after vacationers' departing.

The impact of intensive and uncontrolled recreation has a detrimental effect on the phytocenosis of forests and ground cover, thereby disrupting biological soil processes, causing the extinction of cenoses. We would like to note that the frequent appearance of people increases the probability of their unscrupulous behavior (abandoned garbage, an un-extinguished fire, broken branches). Thus, we conclude that the nature reserves are protected at the legislative level from the construction of harmful industries and municipal facilities, but they are completely vulnerable to recreational activities. Rare near-water plant species will be threatened with extinction since the zone of the most active recreation is located directly near the shore of the lake (Environmental Protection Law, 2002).

The following can be proposed to solve the problem. The regulation at the legislative level must be declared for the recreational activities. It is especially actual for natural areas in need of a special protective regime. In most cases it will be necessary to involve such specialists as ecologists, soil scientists, landscape architects to accurately determine the state of the landscape. Thus, it will be possible to organize recreation places competently and without disturbing the phytocenosis, taking into account the recreational load and the features of the landscape. It is strongly recommended to use biologically safe materials for their organization. It is also necessary to equip suitable places with bungee and other primitive attractions or prohibit them completely. In areas which popular among the population as trails it is necessary to make special decking to avoid trampling of the ground cover and forest litter. Careful monitoring of undesirable human activities is also needed (for examples - garbage disposal, campfire, construction of any objects in the wrong place) and the introduction of a system of fines. The arrangement of barbecue areas will significantly reduce the number of unauthorized campfires and allow people to cook food safely, eliminating the risk of a forest fire (Nefedov, 2002).

Visual analysis of the terrain and geobotanical description showed that the forest ecosystem is currently in an active phase of succession from cranberry pine grove to spruce coppice. That may indicate a shift in the organic horizon towards the accumulation of humus substances. However, the study of soil organic matter requires a more detailed laboratory study of chemical parameters (biological activity, fractional composition, pH, humidity, etc.) with an analysis of the soil profile (Vorobyova, 1988). In addition, differences in relief have shown following facts. Despite similar edaphic conditions, vegetation and soil cover may differ slightly, thereby distributing soil and climate resources by types of soil cover in the community. Basing on the above, the conclusion

could be come at tourists can cause great damage to the ecosystem, especially considering the fact that pines and firs have a low-power humus horizon, which completely disappears under the action of trampling. Therefore, it is necessary to pay more attention to these territories for protection against the death of phytocenosis and forest litter. The involvation of specialists not only in the field of ecology and soil science, but also in the field of landscape design will help to equip places for recreation competently and with preservation not only in the soil and vegetation aspects, but also aesthetics features. Updating and clarifying the legislative framework will allow solving a number of issues related to recreation. Introducing a more clearly structured environmental policy also will be possible.

Список литературы

1. Закамский В. А., Мусин Х. Г. Оценка лесных территорий для массового отдыха по стадиям рекреационной дигрессии. // Вестник ПГТУ, №2. - 2013. С. 20-30.
2. Комарова Т. А. Сукцессии и актуальные вопросы их изучения. Общество. Среда. Развитие. №1(18). 2011. С. 233-238 6) Классификация и диагностика почв России // авторы и составители: Л. Л. Шишов, В. Д. Тонконогов, И. И. Лебедева, М. И. Герасимова. Смоленск: Изд-во Ойкумена, 2004. 342 с.
3. Мирчинк Т. Г., Степанова Л. Н. Биомасса мицелия и спор грибов в разных типах почв // Биологические науки, 1982. №1(217). - С.97-102
4. Надпорожская М. А, Зубкова Е. В, Фролов П. В, Быховец С. С, Чертов О. Г. Соподчиненность почвенных условий и растительных сообществ в сосняках как следствие действия комплекса факторов. Вестник ТГУ. СЕРИЯ: БИОЛОГИЯ И ЭКОЛОГИЯ. 2018;(2):122-138.
5. Нетрусов А. И. Микробиология: учебник для студ. высш.учеб. заведений. / А. И. Нетрусов, И. Б. Котова. - 3е изд. испр. - М.: Издательский центр «Академия», 2009. - 352 с.
6. Нефедов В. А. Ландшафтный дизайн и устойчивость среды. - СПб.: 2002. - 295.: ил.
7. Сакса А. И. Древняя Карелия в конце I - начале II тысячелетия н.э. Происхождение, история, культура населения летописной Карельской земли. - СПб.: Нестор-История, 2010. - С. 28-33., ил.
8. Розанов Б. Г. Морфология почв: Учебник для высшей школы. - М.: Академический Проект, 2004. - 432 с.
9. Федеральный закон от 10.01.2002 N 7-ФЗ (ред. от 27.12.2019) "Об охране окружающей среды"
10. Федорчук В. Н., Нешатаев В. Ю., Кузнецова М. Л. Лесные экосистемы северо-западных районов России: Типология, динамика, хозяйственные особенности. СПб.: СПбНИИЛХ, 2005. 382 с.
11. Чертов О. Г. Экология лесных земель (почвенно-экологическое исследование лесных местообитаний). - Л.: Наука, 1981. - 192 с.

References

1. Chertov O. G. Ekologiya lesnykh zemel' (pochvenno-ekologicheskoe issledovanie lesnykh mestoobitaniy) [Ecology of forest lands (soil-ecological study of forest habitats)]. Leningrad, Nauka Publ., 1981, 192 p.

2. Federal Law 10.01.2002 N 7-FZ (red. 27.12.2019) "Ob okhrane okruzhayushchei sredy" [About protection of environment].
3. Fedorchuk V. N., Neshataev V. Y., Kuznetsova M. L. Lesnye ekosistemy severo-zapadnykh raionov Rossii: tipologiya, dinamika, khozyaistvennye osobennosti [Forest ecosystems of the north-western regions of Russia: typology, dynamics, economic features]. Saint-Petersburg, 2005, 382 p.
4. Komarova T. A. [Succession and current issues of its study]. Obshchestvo. Sreda. Razvitie, 2011, no. 1(18), pp. 233-238.
5. Mirchink T. G., Stepanova L. N. [Mycelium biomass and fungal spores in different types of soils]. Biologicheskie nauki, 1982, no. 1(217), pp. 7-102.
6. Nadporozhskaya M. A., Zubkova E. V., Frolov P. V., Bykhovets S. S., Chertov O. G. [Subordination of soil conditions and plant communities in pine forests as a consequence of the action of a complex of factors]. Vestnik TGU, 2018, no. 2, pp. 122-138.
7. Netrusov A. I. Mikrobiologiya: uchebnyk [Microbiology: textbook]. Moscow, Akademiya Publ., 2009. Pt. 1, 352 p.
8. Nefedov V. A. Landshaftnyi dizain i ustoichivost' sredy [Landscape design and environmental sustainability]. Saint-Petersburg, 2002, 295 p.
9. Rozanov B. G. Morfologiya pochvy: Uchebnyk dlya vysshei shkoly [Soil morphology. High-school textbook]. Moscow, Akademicheskii Proekt Publ., 2004, 432 p.
10. Saksa A. I. Drevnyaya Kareliya v kontse I - nachale II tysyacheletiya n.e. Proiskhozhdenie, istoriya, kul'tura naseleniya letopisnoi Karel'skoi zemli [Ancient Karelia at the end of the I - beginning of the II millennium A.C. Origin, history, culture of the population of the chronicle Karelian land]. Saint-Petersburg, Nestor-Istoriya Publ., 2010, pp. 28-33.
11. Zakamskii V. A. Musin K. G. [Assessment of forest areas for mass recreation with stages of recreational digression]. Vestnik PGTU, 2013, no. 2, pp. 20-30.