Salty Lake. All mentioned cause the cluttering of the territory and a decrease of its recreational significance.

Figure 5. Photo on the left: satellite image of the coastal territory of Salty Lake, Photo on the right: parking on the territory of the protected area "Salty Lake" (photo by Yu.A. Postarnak, 06.24.2021)

Conclusion. The studied area is of extremely great recreational and balneological significance. At the same time, it is very important for the preservation of unique biodiversity on the species and ecosystem levels, including the rare gene pool of Russia. However, the fact of irrational use of these resources is noted without taking into account the recreational capacity of ecosystems, compliance with the requirements of water and environmental legislation, which causes the degradation of vulnerable littoral sandy and halophilic landscapes. It is necessary to develop a comprehensive program for the sustainable recreational use of the territory, which allows combining favorable conditions for the recreation of the population and the preservation of landscapes. It is required to determine the norms of recreational loads on natural complexes.

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Zabolotnaya E.A., Pikalova N.A., Semenova S.N.

Recreational Pressure on Changes of Soil Density of the Protected Area

*Kuban State University
(Russia, Krasnodar)*

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Abstract

Recreational use of the resource potential of protected areas is associated with anthropogenic impact on the components of the ecosystem, which at its high level can lead to negative consequences. The purpose of the article is to assess the transformation of soil properties depending on the recreational load and their genesis. The relevance of this work is due to the high anthropogenic load on suburban forest ecosystems. The object of research is the protected area "Rock Zerkalo".

Keywords: recreation, recreational load, soil density, transformation of soil properties, forest ecosystems, morphological characteristics of soil.

Аннотация

Рекреационное использование ресурсного потенциала ООПТ сопряжено с антропогенным воздействием на компоненты экосистемы, что при его высоком уровне может привести к негативным последствиям. Цель статьи: оценка трансформации свойств почв в зависимости от рекреационной нагрузки и их генезиса. Актуальность данной работы обуславливается высокой антропогенной нагрузкой на пригородные лесные экосистемы. Объект исследования – ООПТ «Скала Зеркало».

Ключевые слова: рекреация, рекреационная нагрузка, плотность почв, трансформация свойств почв, лесные экосистемы, морфологические характеристики почвы.

Introduction

The protected areas, which are places of mass recreation, experience constant increasing recreational loads. Their consequences are expressed in changes in the components of forest ecosystems, in particular in changes in the characteristics of soil density, which negatively affects its water-physical properties and the stability of ecosystems [1; 2].

The danger of degradation and destruction of soil cover causes the need to study the effects of recreational soil disturbance, in particular an increase in soil density. For the rational and effective use of such sites and to ensure their sustainability, the present research is conducted to study the changes in the components of ecosystems during recreational activities.

The purpose of our work is the assessment of the transformation of soil properties depending on recreational load and their genesis.

The relevance of this paper is stated by the high anthropogenic pressure on suburban forest ecosystems. The danger of degradation and destruction of soil cover causes the need to study the effects of recreational soil disturbance.

Materials and methodology of the study

To determine the actual recreational load in accordance with generally accepted methodology [4; 5], we conducted the calculation on weekdays and weekends for one hour in the periods: from 9 am to 10 am, from 12 pm to 1 pm and from 4 pm to 5 pm in triple repetition.

The determination of the volume mass was carried out by the granulometric method using a 39.69 cm³ cylinder in triple repetition. The sampling was conducted 70 centimeters and 3 meters from the trail. The object of the research was the protected area “Rock Zerkalo”. For the study the areas were selected where there were linear objects on which tourists move, with the manifestation of degradation of vegetation cover.

The “Rock Zerkalo” is a part of the complex of the protected area located on the Abadzehskaya mountain. Petushok rock, Dantovo gorge and waterfall Pas’t D’yavola are also presented in addition to the object of the article [3].

The level of recreational load on the study area is mainly determined by the presence of the mentioned recreationally attractive objects for residents of the Municipality of Krasnodar, located at a distance of about 50 km.

One-day and multi-days routes are popular to the Abadzehskaya Mountain area. However, there are no specially equipped sites for setting up tents, making bonfires, etc. for this kind of recreation on the territory.

The consequence of this type of tourism is: the laying of a network of paths, the formation of spontaneous bivouacs, which is accompanied by a strong impact on natural objects and ecosystems and causes significant disturbance of vegetation and soil cover, as well as affecting the living conditions of animals.

Description and results of the study

Recreational load was determined. The difference in its value depending on the time of day and day of the week (weekdays, weekends) was established. The maximum number of tourists, regardless of the day of the week is observed in the afternoon and after lunchtime and averages on weekdays 44 people / hour and on weekends 54 people / hour.

In our opinion, this is due to the fact that campers mainly come to the site for one day from nearby areas and the peak is in the daytime. However, a large number of visitors is also observed in the morning and evening hours. In the morning hours, this number is respectively 29 people / hour and 36 people / hour, in the period from 16 to 17 hours – 18 people / hour and 28 people / hour respectively (fig. 1).

Then we assessed the actual recreational load in relation to the existing norms. For broad-leaved forests its maximum permissible norm is 5 people / hour [4].

The calculations show that at the “Rock Zerkalo” there is a significant excess of allowable loads of 4–8 times, depending on the time of day and day of the week.

Figure 1. Number of visitors on weekdays and weekends in the protected area of the “Rock Zerkalo”

The soil cover on the study site “Rock Zerkalo” is represented by gray forest medium-loam soils. As evidenced by the results of the study presented above, the site is actively visited. It is reflected in the value of the recreational load.

A consequence of this is the formation of networks of trails, resulting in an impact on the water-physical, morphological characteristics of the soil, the activity of the development of exogenous processes (water erosion). The trail network at the study site occupies 1,4% of the total area.

We found a significant compaction of the top 10 cm layer of soil compared to the undisturbed area. Thus, the volume mass at the latter averaged 1,09 g/cm³ and 1,59 g/m³ directly on the trail, i.e., 1,46 times greater.

Figure 2. Volume weight of soil, g/m³ at the area “Rock Zerkalo”

The effects of the impact of tourists can also be seen in the area directly adjacent to the trail, at a distance of 0,7–1,0 m the soil density was 1,33 and exceeded this figure for undisturbed soil by 1,22 times, which is shown in (Fig. 2).

Conclusion

The study of the protected area “Rock Zerkalo” showed that the anthropogenic impact is most noticeable in the change in soil density on the network of trails and in the immediate vicinity of it. The process of soil compaction at this site is associated with the recreational load exceeding 6 times of the average norm.

Summing up, we note that the results and data obtained in the course of the study can be used in lectures and practical classes on ecology as a demonstration material.

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Zozulya A.A., Bolotin S.N., Semenova S.N.

Toxic Effect of Nanoparticles on Plant Resistance (on the example: Radish (*Raphanus sativa* L.), Lettuce (*Lactuca sativa* L.), Peas (*Pisum sativa* L.) and Coriander (*Coriandrum sativum*))

*Kuban State University
(Russia, Krasnodar)*

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Abstract

The given article is devoted to the study of the choice of test-objects due to the biotesting method. Analysis of the responses of the same level types of biological organization and their habitat to the effect of nanoparticles is carried out. Most resistant organisms to toxic effects of nanoparticle solutions were identified.

Keywords: biotesting, test-object, plants, ecology, nanoparticles, seeds, test-organisms.

Аннотация

Данная статья посвящена изучению выбора тест-объектов для проведения исследований методами биотестирования. Был проведен анализ ответных реакций представителей одного уровня биологической организации и среды обитания на воздействие наночастиц. При подведении итогов выявлены организмы, наиболее устойчивые к токсическим воздействиям растворов наночастиц.

Ключевые слова: биотестирование, тест-объект, растения, экология, наночастицы, семена, тест-организмы.

Introduction

At present, the determination of the level of contamination and toxicity of environmental objects, as well as materials, products and various types of waste cannot be established only on the basis of chemical research methods [6]. Biotesting enables to quickly obtain an integral assessment of toxicity at a particular point of time.