

Organization of Environmental Monitoring in Protected Areas

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Summary

Based on the literature analysis and our elaborations we suggest new principles of the environment state control as exemplified by the Middle Urals, Russia. We have chosen objects of studies and suggest for usage in protected areas a complex of standard methods for the laying sampling and discount sites, obligatory standard methods of observations, typical forms for the environment account based on the obtained results.

Keywords

monitoring, natural environment, bioindicators, plant communities

The Ural mountain system is 40 to 130 km broad and is stretched over 2000 km from the Karsk sea in the North to the middle stream of the Ural river in the South. It includes the main water-parting and several side ridges. The Urals are subdivided into the Polar, Subpolar, Northern, Middle and Southern Urals. Its foothills on the West and East are called the Preurals and Transurals, accordingly. The demarcation line between Europe and Asia is the eastern slope of the main water-parting ridge. The Urals are remarkable for their diverse natural conditions: goltsy barrens and tundras, various forests from pretundra to steppe kolkas, vast steppes.

In the Middle Urals (Sverdlovsk region, Russia) there are 5 vegetation complexes: 1- mountain tundra, 2- open woodland crooked forest, 3- mountain taiga (mild mountain complex), 4- foothill taiga (low mountain foothill complex), 5- valley taiga (foothill valley complex). The last three vegetation complexes predominating in the mountain landscapes are the most anthropogenously affected ones, therefore, they require a special attention to their state, assessment of changes, protection and recovery, if necessary.

The Middle Urals have a long (over 300 years) history of economic (primarily industrial) development; therefore monitoring effect on all their natural complexes is very important (BOLSHAKOV et al. 2009). To protect natural complexes in the Middle Urals a network of protected natural areas at various levels - from the UNESCO biosphere reserve "Visimsky" 335000 ha in area to small genetic reserves - landscape, mineralogical, hydrological, etc., natural parks, park forests.

The conception has been elaborated in the Institute of Plant & Animal Ecology (Russ. Acad. Sci. Branch), the project being ordered by the Ministry of Natural Resources and Ecology of Sverdlovsk region. According to this conception vast protected areas should be equally distributed in the region and be connected with each other by natural corridors, should include all ecosystems, unique natural features, cultural and historic sites; traditional nature management should be considered. Within the framework of this conception to preserve unique and typical natural complexes natural parks, forest parks, landscape, biological and hidrological reserves should be protected areas. The basic areas for the organization of the environment monitoring are natural parks "Olenji Ruchji" (23.200 ha), "The Chusovaya River" (77146 ha), "Bazhovskiy Mesta" (39938 ha) and the natural mineralogical park "Rezhevskiy" (32300 ha).

Presently natural areas of preferential protection of various levels occupy 1 367 377 666 ha, or 7.04% of the region area. Principles of monitoring the main ecosystem components in the protected areas are suggested, the choice of monitoring sites is substantiated, standard methods for discount site laying and observations are developed.

Usage of bioindicators for the assessment of the state of natural complexes has allowed to estimate long-term trends and the buffer ability of the biosystems to resist various disturbing factors most frequently affecting simultaneously. The state of three main blocks of biocoenotic components are monitored - producers, consumers and reducers - is observed, as each of them is equally responsible for the resistance of the biocoenosis to external factors. (KUZNETSOVA et al. 2012).

For plant communities, a special attention is paid to vascular plants: community composition, basic dynamic indices (projective cover degree, plant viability, presence of synanthropic species, etc.) on the stationary test sites are reported.

In conditions of strictly regulated moderate land use the state of the vegetation cover is stable. In case of increased anthropic load (including recreation) synanthropization increases. Its forms may be diverse: introduction of synanthropic species into the plant community, replacement of the natural plant communities with secondary or

synanthropic ones, decreased species diversity, structure simplification, lower productivity of plant communities (GORCHAKOVSKY 1984). Such negative changes in communities have been noticed in regularly visited places in protected areas. The man-made transformation is evaluated as strong or very strong: plant communities are suppressed, the total projective cover does not exceed 30%, in some cases – 20-25%, the rest is trampled down, the vegetation cover is low. The percentage of synanthropic species is up to 50% from the total number of species. Totally up to 50 species of vascular plants of 45 genera and 23 families are represented in the studied plant communities. The identified indicator species of synanthropization are *Amoria repens* (L.) C.Persl, *Poa anua* L., *Plantago major* L., *Polygonum aviculare* L.

In the kingdom of animals bioindicators are water invertebrates, hill ant of the genus *Formica*, ornitocomplex. Studies of the state of hill ants have revealed trends common for all investigated areas. In the control zones family and superfamily structures of ants reach maximum development. Conditions of moderate recreation are also favorable for ants.

The state of communities of wood destructing basidial fungi has also been investigated. Their high sensitivity to climate and man made changes is used as “a test system” of the tree stand state. To register climatic and weather peculiarities during the period of studies the main phenological indices are marked, the primary dendroclimatic analysis is made.

The ecological state of the investigated river sites is estimated from zoobentos indices widely used in hydrobiology.

As an indicator in monitoring ornitocomplex reveals the anthropic effect degree in a vast area – in the whole protected area, as the disturbed sites are usually small and the damage cannot be adequately estimated. Bird species composition and the relation between various species numbers is an adequate index of the biota state.

The results of studies have shown a satisfactory state of the nature complexes: disturbance caused by recreation load does not reach critical values. The vegetation cover suffers most of all: transformation degrees of sites affected by recreation are moderate to very strong.

Forest sites with a strong recreation load have a trend common for all protected areas: species number and diversity decrease, generative and competitive activities of forest-destructing fungi are suppressed.

In all protected areas rivers are not polluted as evidenced by the macrozoobentos state. The state of the indicator-hill ants- is stable in the investigated projected areas. The anthropic effect- thinning of the tree stand as a result of cutting- has provoked ant settling in new places. Ornitocomplexes are slightly disturbed communities in all investigated areas.

The obtained data and further investigations of the state of indicator objects and of the character and degree of changes at the early transformation stage caused by human activity will reveal natural dynamics in the state of undisturbed natural complexes, the character and degree of the anthropic effect on recreation sites in protected areas.

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