Biodiversity: structure, problems and conservation prospects

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Abstract. Conducting multi-year integrated monitoring research is important for biodiversity conservation. Results of such research are defined by not only discovery of wide range of rare or endangered plant species but also identification of locations with predominance of these species but not having conservation status. All these are necessary for clear organization of nature conservation system that intends to conserve biodiversity of the whole flora. The conduct of the work on identification of flora samples of different rarity category must be started in the specific locations and regions. Consolidation of the obtained results through the establishment of database will enable to see the whole problem that will relieve further measure development for specific species conservation, their population and will allow maintaining ecosystem balance on the whole.

1. Introduction
Nowadays the problem of rare plants conservation has come to the forefront. The significant direction in this area is the determination of ecological condition of relicts. The conduct of field monitoring is essential for the solution to the problem. Lipetsk region is one of the richest ones in floristic composition. The multi-year research on condition of the Red Book plant species in the range of the districts in Lipetsk region was held. Expedition floristic examinations in Lipetsk region aimed at performing the following tasks: 1) monitoring of rare plants; 2) renovation of the Red Book for plants; 3) the search of areas without anthropogenic impacts to designate conservation status for them.

2. Materials and methods
Expeditionary, monitoring, descriptive, geoinformational system methods were used in experimental work. The location and ecological characteristics of the number of rare plants populations brought in the Red Book were identified during multi-year observations. Revealed populations were photographed and ecological condition of them was assessed using test-systems of a portable mini-laboratory «Pchelka-U». Particularly, presence of heavy metal and nitrates in the soil was assessed, gas analysis of the air was held. On the basis of conducted expeditionary and monitoring research primary predictions of population development were made and conservative measures were suggested.

3. Results and discussion
During the research information review on existence, condition and a number of cenopopulation and rare vascular specimens that were found in some areas of Lipetsk region. The examinations were held in spring and summer seasons in 2014 and 2018 in the territory of Izmalkovsky, Yeletsky, Terbunsky districts. The described territory of the districts is situated in Central Russian Upland, therefore it has
broken ground. Steepness and slope of many gullies and banks of rivers prevent from mowing grassland vegetation clean and even from grazing livestock. Nevertheless, the slopes practically didn’t suffer from burning out. Therefore rare plant species that are actually unique survived here. They need long-term monitoring and protection.

As a result of the work new locations of rare plant species of Lipetsk region were found. This article is devoted to some parcels with the descriptions of discovered rare flora species.

Parcel № 1. The left bank of the Sosna river near the village of Denisovo (Izmalkovsky district). It is a recipitous, rubbly slope with steepness of 45-50%. The length of the area is several kilometres along the river. A number of rare plant species were found within the area. The cretaceous thyme (Thymus cretaceus) is an endangered species in the territory of Lipetsk region that entered the Red Book of the Russian Federation. The location is the middle part of the slope at the border of limestone bare rocks; phytocoenosis is thymic fescue; phenophase is blossom; abundance is 1 small population; vitality is good; 1 rarity category. The heavy metal content in the soil of the area doesn’t exceed the maximum permissible limit. Limitations for the species are the high level of anthropogenic burden, in particular mountaineering, especially in nature protection areas, collecting of the medical plants, developing of limestone deposits. In order to preserve the species it is necessary to limit uncontrolled mountaineering, specifically in nature protection areas, forbid to collect medical plants through the awareness of local people, the design of information leaflets and posters. The second species that was found within the described parcel is the leafless Iris (Iris aphilla L.). Location: the part of the slope above the border where the Thyme cretaceous is located. Phytocoenosis is thymic fescue; phenophase is blossom; abundance is 1 small population; vitality is good; 2 rarity category; associates with the Russian almond and the fruitscent cherry. Limitations for the species are collecting in bunches, grazing livestock. The establishment of the protected areas in the territory where the species grows, restrictions in grazing livestock and plant collecting are recommended to preserve it.

Parcel № 2. The landscape unit of Korotish. It is one of the unique but still unprotected parts of Lipetsk region. Is is situated 3 km north-east from the village of Veseloe. The altitude is 185 m. These are slopes of creek flowing from the pond and into the Olym river to the right. One third of the way to the Olym river the creek flows through the underground karst cavity. The described slope has steepness of 45%, and it is totally overgrown with the blackthorn which provides for full plant protection from mowing and grazing. There is a spring coming out of limestone rubbly outcrops at the foot of the slope in the southern exposition. There is a small population of the leafless Iris (Iris aphilla L.; 2 rarity category, lowed Alpine flora) in the upper part of the slope in the southern exposition among the thickets of the blackthorn. 10 specimens of the wedged larkspur (Delphinium cuneatum Stev. ex DC; 2 rarity category, lowed Alpine flora) and 2 specimens of the Kuimanskaya rose (Rosa kujmanica Golitsin; 1 rarity category, endemic) were found in the lower part of the slope in the southern exposition in the little hollow among the thickets of the blackthorn. The species of lowed Alpine flora grow in the upper part of the both slopes free from bushes: the spring adonis (Adonis vernalis L.; 2 rarity category, a small population), the spreading pasque-flower (Pulsatilla patens (L.) Mill.; 2 rarity category, sporadic specimens), the Russian cornflower (Centarea ruthenica Lam; 2 rarity category, a small population), single specimens of the relict apple rose (Rosa pomifera Herrm.) as well as the Russian broom (Cytisus ruthenicus Fisch. ex Bess.; 3 rarity category). Limestone rubbly outcrops of the slope in the southern exposition are the locations for a small populations of rare regional species: the whitish hyacinth (Hyacinthella leucophaea (C. Koch) Schur; vulnerable species of 2 rarity category) and the feather grass (Stipa pennata L.; vulnerable species of 2 rarity category), and a small populations of the leafless Iris (Iris aphilla L.), the sumy cornflower (Centarea sumensis Kalen) and single specimens of the Unequal Onion (Allium inaequaele Janka; 2 rarity category) from lowed Alpine flora. The rare species for the region were found on the bottom of the creek near the water sporadically: the tiled gladiolus (Gladiolus imbricatus L.; vulnerable species of 2 rarity category) and the Lobel hellebore, or the white hellebore (Veratrum lobelianum Bernh). On the slope of northern exposition the following species from lowed Alpine flora were found: 15 specimens of the Caucasian pyrethrum, or corymbosus tansy (Pyretrum corymbosum (L.) Scop.), in the high motley grass among the bushes of the Russian broom there were
some specimens of the Phrigian cornflower (Centaurea phrygia L.; 1 rarity category), from relicts there was a specimen of the round-leaved shadberry (Amelanchier ovalis Medik), and on the even upper steppe part of the described northern slope there were 3 specimens of Armenian sagebrush (Artemisia armeniaca Lam; vulnerable species of 2 rarity category). The last one dissapeared close to the border of agricultural fields in the years during which herbicidal treatment was held.

Parcel №3. The right bank of the Olym river. The length of the landscape unit is 2.5 km. It is situated on the right opposite the village Veseloe bank of the Olym river (the tributary of the Bystraya Sysna). The slope with the steepness is 40-50%. The height of the bank above river level is 35-50 m. The altitude is 178 m. The bank is equally divided into parts by four short but deep ravines which stops with rocky benches to the river and which were formed from flowing melt water. The population of the frutescent cherry, or ground cherry (Cerasus fruticosa Pall.; rare regional species) grows in one of the ravines in the southern exposition of the slope. In the right bank of the Olym river in the middle of July the following species of lowed Alpine flora were recorded: the low scullcap (Scutellaria supine L.; 2 rarity category), the solitary clematis (Clematis integrifolia L.; 2 rarity category), the Italian aster (Aster amellus L.; 2 rarity category), the wedged larkspurn (Delphinium cuneatum Stev. ex DC), the Illyrian buttercup (Ranunculus illyricus L.; 3 rarity category), the titsan-leaf spirea (Spiraea hypericifolia L.), Donskaya bloodroot (Potentilla tanaictica V.J.Zinger), as well as a relict the Alunian cotoneaster (Cotoneaster alaunica Goltsin; 2 rarity category) connected to limestone aired outcrops in the lower part of the slope bank and in the deep short ravine running down to the bank. On the wet flood plain of the Olym river single specimens of the minimal gagea (Gagea pusilla (F W. Schmidt) Roemer et Schultes) were recorded though before the species had been considered to be extinct in the territory of Lipetsk region. The area №3 is the lower part of the dry gully of Dolgov Verch. The gully starts from the one of the ponds in the vicinity of the village of Krugloe in Livensky district of Oryol region. The lower riches of the gully are situated on the left bank of the Olym river, 500 m west from the village of Zarechnaya near the border with Oryol region. The altitude is 180 m. Here on the rocky slope of the southern exposition rare regional species grow: snowdrop anymone (Anemone silvestris L.; vulnerable species of 2 rarity category), whitesh hyacinthella (Hyacinthella leucophaea (C. Koch) Schur), perennial flax (Linum perenne L.; 2 rarity category), frutescent cherry (Cerasus fruticosa (Pall) and Russian almond (Amygdalus nana L.; 2 rarity category). Latter two were overextended within the population of the blackthorn. In the year of the research the following species of lowed Alpine flora were found in the landscape unit: leafless iris (Iris aphylla L.), low scullcap (Scutellaria supine L.) and Russian cornflower (Centaurea ruthenica Lam). In the year of the research in the Dolgorukovo district no one specimen of the drug centaury (Centaurium pulchellum (Sw.) Druce; 3 rarity category) was found, which had been last seen on the low wet flood plain of the Olym river near the water in July, 27 in 2005. The vulnerable species of 2 rarity category of Graffa feather grass (Stipa pulcherrima C. Koch), that had grown in the territory of the landscape unit of Korotish until 2006, disappeared. The presence of described species composition is a clear indication that plant formation has never suffered from anthropogenic impact. The number of some species (the spreading pasque-flower, the sumy cornflower, the tiled gladiolus, the Ilyrian buttercup, the tissan-leaf spirea, the wedged larkspurn) has remained within single specimens. Other species that have been mentioned before continue to grow on the territory without significant reduction in the number of the population. The importance of such first flowers for biocoenosis as the spreading pasque-flower, the spring adonis, thin-leaf peony, snowdrop anemone, the leafless Iris, the whitish hyacinth, the sumy cornflower can hardly be overestimated. The pollen of these plants which bloom early in spring is rich in protein and it serves as food for the larvae of predatory insects during their first days of the life when they are unable to catch prey. The population of the Russian broom has considerably grown in the territory for the last years.

Parcel №4. The northern edge of the forest near the village of Baranovo in Izmalkovo district. The meadow is situated on the vast territory divided by the system of gullies and ravines. The steepness of the slop is 5-10%. Two rare for Lipetsk region species were discovered on the territory. The first one is the Russian broom (Cytisus ruthenicus Fisch. ex Bess.). The location is open drained meadow; phitocoenosis is gramineous cornflower; phenophase is blossom; abundance is 10 small populations;
vitality is good; 3 rarity category; associated with the meadow cornflower. The second species discovered within the parcel is the feather grass (Stipa pennata L.). The location is open drained meadow; phitoecoensis is gramineous cornflower; phenophase is blossom; abundance is one small population; vitality is good; vulnerable species of 2 rarity category; associated with the meadow cornflower.

Parcel №5. The right bank of the Yelchik river (Yelets district) is the western outskirts. It is a limestone brink of the river covered by maple light forest. The steepness of the slope is 50%. Several rare species were found there. Among them are Russian cornflower (Centaurea ruthenica Lam.). The location is the lower part of the slope; phitoecoensis is maple broom; phenophase is blossom; abundance is 3 specimens; vitality is tolerable; 2 rarity category; associated with the Tatarian maple and the Russian bloom. The Russian broom (Cytisus ruthenicus Fisch. ex Bess.) is the third one. The location is the lower part of the slope; phitoecoensis is maple broom; phenophase is blossom; abundance is one small population; vitality is good; 3 rarity category; associated with the Tatarian maple and the blackthorn. The leafless Iris (Iris aphilla L.) is the next. The location is the upper part of the slope; phitoecoensis is maple broom; phenophase is blossom; abundance is 5 specimens; vitality is tolerable; 2 rarity category; associated with the Russian broom and the blackthorn.

4. Conclusion
Monitoring of the rare plants makes it possible to identify the species that are vulnerable, relict and related to the lowed Alpine flora. Vulnerable species need recording, studing and protecting because they are wilderness indicators of places. Such places are specifically unique for environmental considerations. Some of these plants disappear if plant formation has been mowed, trampled or burnt only once. Others stop growing after the slightest contact with pesticides or after soil ploughing. The lowed Alpine flora is the plants which motherland is the Alpine meadows (The Caucaus, the Alps) but yet found on the territory of Lipetsk region (the Caucasian pyrethrum, the round-leaved shadberry). Relicts are the plants growing on the areas which land cover wasn’t damaged by the last glaciation and therefore they are the representatives of pre-glacial age (the Alaunian cotoneaster). Particular interest is rock relicts (the mountain houseleek, rock populations of the great stonecrop). Endemics are the plants growing only in specific places (the limestone thyme, the cretaceous hyssop, the Flyorov aconite, the Kuimanskaya rose). Specific flora forms near the creeks at the karsts when water flows partly on the land and partly on the underground cavities and cracks. Some species are just very rare for Lipetsk region and need clarification of their new area.

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