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Regional Databases within Invasive Plant Species Distribution Monitoring.

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ABSTRACT

In the hierarchical system of invasive species inventory the regional level is the basic one. The article is devoted to the use of regional databases at the organization of biological invasions monitoring. The accumulation of information in the database about the land cover at the regional level leads to the accumulation of data about the distribution of invasive species. The use of spatial modeling methods allow to create predictive maps of invasive species potential habitat in the region.

Keywords: invasive species, regional database, spatial modeling

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INTRODUCTION

Due to the increasing human impact on nature, including the impact on its plant component, the actual problem is the study of the natural vegetation synanthropization processes, synanthropic floras development and the formation of anthropogenic flora and the development of anthropogenic plant communities [1].

As the result of the powerful intercontinental relations and communications development the anthropogenically induced invasions became global ones and pose a serious environmental problem [2, 3].

A lot of attention is paid to the study of invasive species, the mechanisms of their implementation, the nature of migrations in almost all countries. The significance of these studies is enhanced due to the implementation of the Global Invasive Species Programme [4]. The international cooperation in this area is also expressed by the creation of databases that serve as the invasive species inventory to assess their impact on natural systems and human economy and the distribution forecast. Such databases are developed as on the global level (GISD - Global Invasive Species Database) [5], so as the European project (DAISIE - Delievering Alien Invasive Species Inventories for Europe) [6].

There is no national integrated program in Russia running on the accumulated information about invasive species. As the basis for such a program one may note the project of the Institute of Ecology and Evolution issues named after Severtsov (RAS) "Alien species on the territory of Russia" [7] and the work written by U.K. Vinogradova et al. [8]. The recent study states the issue of the regional blacklists development. The main task of such blacklists is the revealing of adventive species local invasions. These "Black Books" shall be also kept and at the regional level and become the basis of information support for the monitoring and the spread of living organisms invasive species like "Red Books". This hierarchical system of biological invasions monitoring will allow more effective decision-making to combat them.

METHODS

The "Flora" database developed at the Department of General Ecology, Kazan University was used as the materials for the study. The database contains information about specific types of findings and geobotanic plots on the territory of the Tatarstan Republic for the period from the end of the XIX century to the present. The database contains more than 220 thousand records and more than 7000 geographic locations in a separate GIS layer [9]. The information system contains tools for the vegetation cover species analysis. In the present study the analysis of flora taxonomic structure at the family level was used. We used the MapInfo software to develop the maps of invasive species distribution. We used the BioClim climatic data from the WorldClim database to develop the model of adventive species potential habitats [10, 11]. The model development was performed by using the QGIS (Quantum GIS) software [12].

MAIN PART

Here is the information about the flora specifics of human settlements (villages, towns), highways and railways, surveyed within 50 km from the city of Kazan. These settlements and highways are the centers of alien species distribution in the landscape, by the objects which to a large extent determine their modern fragmentation.

The taxonomic flora structure analysis (Table. 1) in the synanthropic habitats identified common trends. Two families, Asteraceae and Poaceae remain the leading ones in the range. Gramineae are not so spread as legumes along highways only. Rosaceae occupy a stable forth place. Brassicaceae, Caryophillaceae, Lamiaceae and Schrophulariaceae as well as in the spectra of individual landscape flora retain high positions.
Labiatae in the flora of settlements occupy the third place, which is ahead of Rosaceae. The increased portion of legumes indicates that favorable conditions for the southern flora species appear in synanthropic habitats. The share of adventive species in the flora of synanthropic habitats makes 31-38%. The Eurasian, Holarctic and European species dominate among adventive species. Cosmopolitans, Asian and North American species are presented widely enough here.
Table 1

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Flora range of commensal habitats

#	Settlements	Railways	Highways
1	Asteraceae	Asteraceae	Asteraceae
2	Poaceae	Poaceae	Fabacea
3	Lamiaceae	Fabaceae	Poacea
4	Rosaceae	Rosaceae	Rosacea
5	Brassicaceae	Caryophillaceae	Brassicaceae
6	Fabaceae	Lamiaceae	Caryophillaceae
7	Apiaceae	Brassicaceae	Lamiaceae
8	Scrophulariaceae	Scrophulariaceae	Scrophulariaceae

The distribution of invasive species in the Tatarstan Republic are registered by us along with the findings of other species and are stored in the "Flora" database [9]. These geobotanic plots also allow to store information about the species in communities exposed to invasion. Accurate geo-referencing of all findings allow us to develop maps of the alien species distribution and to analyze its spatial dynamics. Fig. 1 shows a map of the invasive *Conyza canadensis* distribution in Tatarstan Republic.

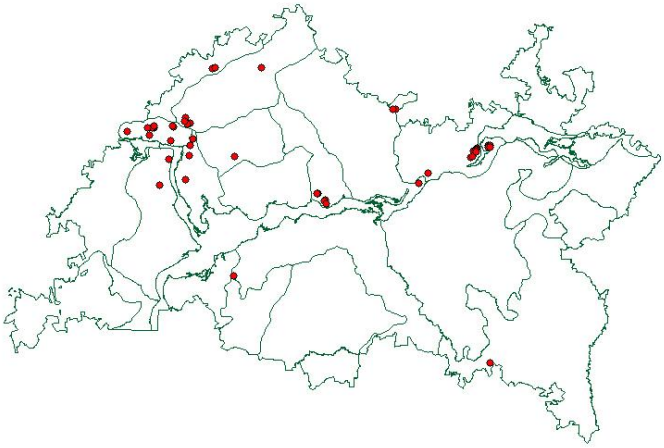

Figure 1: *Conyza canadensis* distribution in Tatarstan Republic

The spatial modeling may be used to determine the areas that could potentially be colonized by alien plant species. The development of invasive species models, which use the environmental variables as predictors was carried out by various authors [13- 15].

The example of the developed model taking into account the climatic parameters of the spatial pattern of habitat, which are the potential for the invasion of *Lupinus polyphyllus* is shown by Fig. 2.

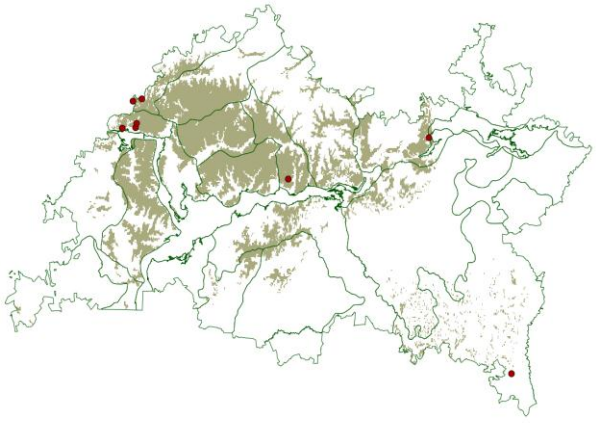

Figure 2: Spatial model of *Lupinus polyphyllus* Lindl. potential habitat

CONCLUSION

The use of the regional databases containing the floristic and geobotanic information showed the possibility of their application to assess the current state of communities, the spatial and temporal dynamics of the alien species introduction and the implementation of the invasion distribution prediction.

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