GROUNDWATER DEPENDENT TERRESTRIAL ECOSYSTEMS IN KAZU LEJA, GAUJA NATIONAL PARK, LATVIA

Agnese Priede (1)

(1) Nature Conservation Agency, Latvia (agnese.priede@daba.gov.lv)

Groundwater dependent terrestrial ecosystems (GDTEs) are ecosystems that rely upon groundwater, e.g. fens, spring flushes, swamp forests. According to EU Water Framework Directive, such ecosystems to be considered relevant for the assessment of groundwater bodies, need to be directly dependent on the groundwater body, i.e. where groundwater supplies the GDTE for a significant part or a significant period of the year.

In 2019, a study was carried out to identify GDTEs using vegetation as a proxy. A survey was conducted in Kazu leja valley (~112 ha), Gauja National Park (57°19`58, 25°20`28). Although nowadays there are almost no human activities in the valley, in the past large proportion of it was used for tufa mining (early 20th to mid-20th century) and peat extraction (1930s to 60s). The valley bottom has been affected by beaver.

The field work included inventory and mapping of spring-fed habitats, and classification of plant communities. The habitat types were determined according to the vegetation uniformity and abiotic conditions, their relevance to the Latvian national interpretation of the Annex I habitats listed in the EU Habitats Directive (Auniņš (ed.), 2013) was assessed. The vegetation was described in 50 x 50 cm squares, located in transects that were placed in spring-fed habitat patches (flushes, spring stream banks, fens) all across Kazu leja, each spring-fed patch was represented by at least three relevés. In total 99 spring-related sample plots were described. In each of them, all vascular plant and bryophyte species were identified, the cover (%) of each species estimated. Some other parameters were collected: water pH (measured in field), presence of flowing water, substrate moisture degree, shading, presence of dead wood, and later converted into numerical values. The data were analyzed using *Detrended Canonical Analysis*.

The protected habitat *7220* Petrifying spring with tufa formation* covers ~2.3 ha, in most cases occurring on forested valley slopes. Secondary tufa-forming habitats have developed also in the former tufa mining area. The vegetation (71 relevés) belongs to *Montio-Cardaminetea* class, *Montio-Caraminetalia* order, *Cratoneurion commutati* alliance. The vegetation of spring flushes hosted 76 taxa (50 vascular plant, 26 bryophyte taxa). Approximately half of taxa were frequent in the spring habitats of Kazu leja, while the rest were rare. The most common species were *Palustriella commutata*, *Plagiomnium* spp., *Brachytecium* spp., *Cardamine amara*, *Poa palustris*, *Myosotis palustris*, *Epilobium parviflorum*, *Geranium robertianum*, *Mycellis muralis*. The species richness was higher in forest openings, while shaded spring flushes were dominated by *Palustriella commutata*, often without other plant species. The species composition and richness may be influenced also by the steepness, i.e. stability of slopes (the steeper, the species poorer). Several typical species (e.g. *Palustriella commutata*, *Cardamine amara*) in the community are highly specialized and found only in such habitats with stable wet micro-climate and presence of flowing water. Observations in 2018 and 2019 suggest that extended drought periods may have considerable impact on small petrifying springs – it can cause decline or even (temporary) extinction of typical moss species cover and increase the cover of herbaceous species. In the particular area, trampling did not seem to have significantly effect on the species composition if there is continuous supply of flowing spring water and tufa precipitation. Presence of dead wood in flushes did not show positive correlation with species richness, though increase the micro-niche diversity.

The spring-fed fen (~5.2 ha) lies on the valley bottom. It did not qualify as protected habitat in Latvia, as the species composition did not meet the minimum criteria of protected spring or fen habitats. The

vegetation was poor in species (32 taxa, of them 29 vascular plant, 3 bryophyte taxa). Part of the valley fen (W part) was dominated by *Carex rostrata* and/or *Equisetum fluviatile* and *Epilobium palustre, Naumburgia thyrsiflora*, *Lycopus europaeus*. Some years ago, the E part of the fen had been inundated by beavers, thus in 2019 the vegetation was still unstable (the most common species were *Agrostis stolonifera*, *Carex diandra*, *Naumburgia thyrsiflora*). The bryophyte cover was sparse, with very few species (*Calliergonella cuspidata*, *Calliergon cordifolium*, *C. giganteum*). Most probably, due to its secondary origin (peat cutting in the mid-20th century) the phytosociological affiliation of this community is ambiguous; it is most similar to tall sedge *Potentillo-Caricetum rostratae* community (*Phragmito-Magnocaricetea* class, *Magnocaricion* alliance), occurring in base-rich sites.

Both petrifying springs and fen in Kazu leja are groundwater-fed, base rich habitats (pH 7.5–8 in the spring flushes, 7.3 –8.1 in the fen), thus by nature they are GDTEs.

The study was carried out within the project "Joint management of groundwater dependent ecosystems in transboundary Gauja-Koiva river basin (Est-Lat 62 – GroundEco). Thanks to Dr. Ligita Liepiņa for helping to identify bryophyte species.

Reference

Auniņš, A. (ed.), 2013. European Union Protected Habitats in Latvia. Interpretation Manual. LDF, VARAM, Riga.