

Long-term socio-ecological research platform (LTSER) as an instrument for assessment of integrated anthropogenic pressure on biodiversity

Viesturs Melecis*, **Maris Klavins****, **Zaiga Krisjane****, **Janis Viksne***,
Anda Medene*, **Maris Laivins***

* **Institute of Biology, University of Latvia (UL)**

** **Faculty of Geography and Earth Sciences, UL**

Since 2010 Latvia LTER works on a national project "Development of conceptual integrated model of socioeconomic biodiversity pressures, drivers and impacts for the long-term socioecological research platform of Latvia". The project is an implementation of the ILTER strategy in the National LTER programme of Latvia.

LTSER platform - drainage basin of Lake Engure covers 644 km². Lake Engure is a remnant of ancient Littorina Sea formed about 4,000 years ago. Its depth does not exceed 2 m and the bottom is muddy and covered by charophytes. As a result of economic activities the lake water level has changed essentially over the 20th century and at present its area is about 41 km². Large islands and coastal habitats of the lake are particularly favorable for water-bird nesting. Avifauna of the territory includes 186 species, 44 are recognized as highly threatened. Most of the lake surroundings are covered with pine forests, but there are also large areas of marshlands, meadows, and deciduous forests rich in species. Flora of vascular plants includes 844 species. Part of the unique wetlands of Lake Engure is protected by the state law and Ramsar convention.

The region has gone through at least three different economies during the last two centuries: (i) period of farmland agriculture until 50s; (ii) period of socialistic intensive agriculture 1950 - 1991; (iii) decrease in agricultural activities after privatization of lands since 1991 in independent Latvia. The region never had big industries and remained mostly as a rural landscape.

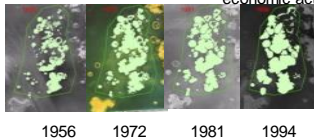


The Engure LTSEr site as a Lake drainage area can be subdivided at least into four zones which differ in relief, quaternary deposits, and geological age.

- I - the North Kurzeme Upland. This territory is subdivided from the Baltic Ice Lake plain by escarpment of the North Kurzeme and shoreline of the Baltic Ice Lake. The North Kurzeme Upland is characterized by well drained soils mostly used in agriculture while the
- II - Baltic Ice Lake plain represents lowland with sandy bedrock covered by peaty soils, wet pine forests and marshes.
- III - Littorina Sea Plain has the most heterogeneous landscape. It includes Lake Engure and is subdivided from the Baltic Ice Lake plain by the coastline of the Littorina Sea.
- IV - The narrow belt of parallel dunes of the Engure Spit with the coastal aquatory of the Riga Gulf forms functionally separate part of the LTSEr region.

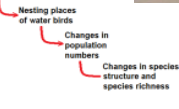
Natural factors have strong influence on community structure of the region, population density and economic activities.

Structure of landscape of the LTSEr region and intensity of human economic activities at different periods of time affect Lake ecosystem. This was demonstrated by the analysis of the Lake deposits.



Dynamics of emergent vegetation at one of slough areas on Lake Engure in 1956-1994

Chain of factors affecting biodiversity of Ramsar site as a core area of the LTSEr site



Biodiversity components investigated:

- Landscape biodiversity (fragmentation, structural changes)
- Vegetation (forests, seminatural grasslands, community structure, long term changes)
- Birds (species diversity, long term population dynamics)
- Invertebrates (grass dwelling insects, spiders, species diversity, long term dynamics)

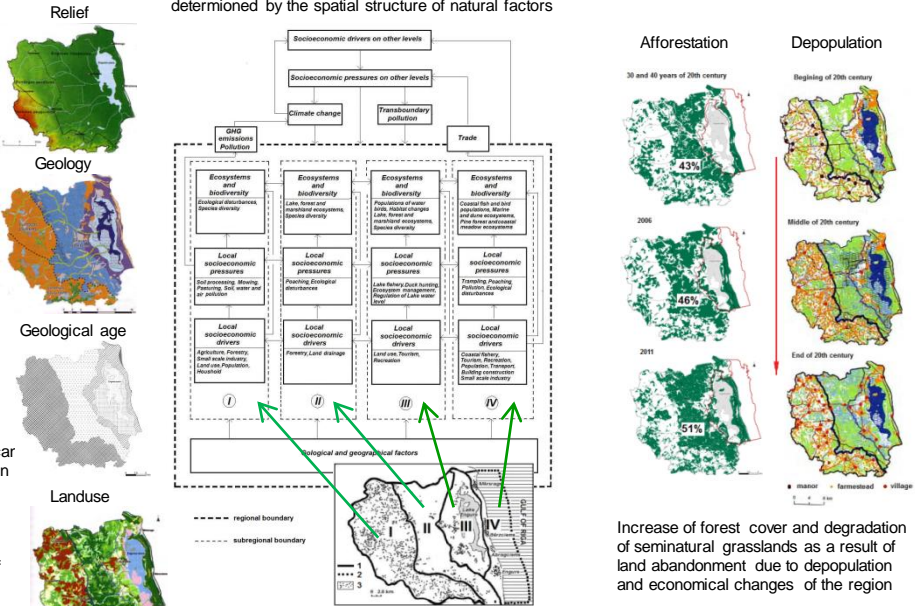
Natural factors:

- Geographical and geological factors (geological age of territory, relief, hydrology)
- Climate change

Anthropogenic factors:

- Land use
- Population
- Agriculture
- Forestry
- Changes in hydrology
- Environmental pollution

Conceptual integrated model of socioeconomic biodiversity pressures. At present human activities in the region are largely determined by the spatial structure of natural factors



Increase of forest cover and degradation of seminatural grasslands as a result of land abandonment due to depopulation and economical changes of the region

• Natural factors such a geological age of the territory, bedrock and relief still have a decisive role in the formation of community structure of the region

• On the background of natural factors extensive agriculture has positive effect on plant species diversity by increasing patchiness of the landscape. Single Area Payment System (SAPS) and payments for support of grassland biodiversity are the only factors which may slow down the degradation of grasslands

• The most striking effects of climate warming until now have been observed on bird species structure. Several northern species have stopped nesting while some southern species have begun nesting in the region

Northern species prevailing among those which have ceased nesting: Pintail - *Anas acuta*, Scaup - *Aythya marila*, Red-breasted Merganser - *Mergus merganser*, Hen Harrier - *Circus cyaneus*, Wood Sandpiper - *Tringa glareola*, Dunlin - *Calidris alpina*

Species of southern origin prevailing among newcomers: Greylag Goose - *Anser anser*, Gadwall - *Anas strepera*, Collared Dove - *Streptopelia decaocto*, Middle Spotted Woodpecker - *Picoides medius*, Bearded Tit - *Panurus biarmicus*, Savi's Warbler - *Locustella luscinioides*, Penduline Tit - *Remiz pendulinus*

• Long term studies of insect communities within various sites of the region showed an increase in species richness of flies (Diptera, Brachycera). However, most part of this increase could be attributed to the effects of soil eutrophication

Areas supported by SAPS



Indicator species of natural grasslands

