



LITHUANIAN ACADEMY OF
SCIENCES
INTERNATIONAL CENTRE FOR
SCIENTIFIC CULTURE
- WORLD LABORATORY
LITHUANIAN BRANCH

ECOLOGICAL SUSTAINABILITY OF LITHUANIA

(ECOSLIT)

1995 Annual Report (abstract)

IV

Vilnius, 1996

**LITHUANIAN ACADEMY OF SCIENCES
INTERNATIONAL CENTRE FOR SCIENTIFIC CULTURE - WORLD
LABORATORY LITHUANIAN BRANCH**

State Scientific Project

**ECOLOGICAL SUSTAINABILITY OF LITHUANIA
(ECOLOGICAL SUSTAINABILITY OF REGIONAL
DEVELOPMENT IN A HISTORICAL PERSPECTIVE:
LITHUANIAN CASE STUDIES)**

ECOSLIT

Duration 1992-1997

1995 Annual Report

IV

Editorial board: L. Kairiūkštis, J. Požela, L. Raudienė, Z. Rudzikas, R. Volskis

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May, 1995

**LIETUVOS MOKSLŲ AKADEMIJA
TARPTAUTINIO MOKSLINĖS KULTŪROS CENTRO -
PASAULINĖS LABORATORIJOS LIETUVOS SKYRIUS**

Valstybinė mokslo programa

**REGIONO VYSTYMO SI EKOLOGINIS TVARUMAS
ISTORINIAME KONTEKSTE: LIETUVOS PAVYZDŽIU**

ECOSLIT

Trukmė 1992-1997

Metinė ataskaita (santrauka)
už 1995

IV

Redakcinė kolegija: L. Kairiūkštis, J. Požėla, L. Raudienė, Z. Rudzikas, R. Volskis

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1996, Gegužis

CONTENTS

1. INTRODUCTION: METHODOLOGICAL APPROACH	7
2. AIR OF ATMOSPHERE AND DEPOSITION	10
2.1. The variations of stratospheric ozone layer	10
2.2. Pollution of the atmosphere	13
2.3. Radioactive nuclides	20
2.4. Historical aspects and geographical distribution of pollutants in Lithuania	25
3. LAND USE AND SOIL POLLUTION	34
3.1. Soil erosion of agroecosystems and insurance of their ecological stability in the context of physical geographical conditions	34
3.2. Evaluation of the stability of land tenure during land reform period	35
3.3. The effect of agricultural systems on soils characteristics, transformation of agroecosystems and ecological estimation	35
3.4. Contamination of soil and agricultural crops	36
3.5. The response of soils and biota to technogenic pollution and the means to ensure their relative stability	38
3.6. Analysis and evaluation of integrated projects on nature protection	39
4. WATER ECOSYSTEMS, THEIR POLLUTION AND ECOLOGICAL SUSTAINABILITY	43
4.1. The inflow of nutrients and the self-purification of water	43
4.2. The eutrophication of lakes and the changes of fishes communities	45
5. THE BALANCE OF BIOMASS AND TRENDS OF ITS CHANGE IN LITHUANIA IN POST-GLACIAL PERIOD	47
5.1. Introduction	47
5.2. Accumulation of the biomass over this century depending upon land use	47
5.3. Variation in the balance of CO ₂ assimilation of a regional system in the past and the feasibility of atmospheric self-purification	51
6. HISTORICAL CHANGE OF CONDITIONAL SUSTAINABILITY OF SEVERAL MODEL SPECIES AND POPULATIONS IN LITHUANIA	53
7. RELATIVE USE OF CLIMATIC AND SOIL RESOURCES IN LITHUANIAN AGRICULTURE – HISTORICAL RETROSPECTIVE	59
8. TREES' RESPONSE TO ATMOSPHERIC POLLUTION AND CLIMATIC CHANGES	66
8.1. The quantity of proline and sulphur in pine and spruce needles in different pollution districts	66
8.2. A morphological expression of trees' response to environmental changes	68
8.3. The effect of environment pollution on the radial increment of trees	69
8.4. Crown defoliation in Lithuanian forests and its connection with neighbouring countries	70
9. GENOTOXICAL IMPACT OF POLLUTANTS ON HUMAN BEINGS AND ANIMALS	74
10. ALTERATIONS OF IMMUNOREGULARITY FUNCTIONS AND THE SPREAD OF VIRAL INFECTIONS IN CONTAMINATED ENVIRONMENT	80

10.1 Introduction	80
10.2. Materials and methods	81
10.3. Results	82
10.4. Summary	89
10.5. Conclusions	90
11. ENVIRONMENT AND CANCER: PATTERNS AND TRENDS	93
11.1. Cancer relationships with geochemical factors	93
11.2. Cancer mortality and social factors	95
11.3 Social and economic aspects of years of potential life lost due to malignant tumors in Lithuania in 1965-1994	97
11.4 Conclusions	97
12. STRATEGY OF ECOLOGICAL COSTS MINIMISATION	100
12.1. The scheme of ecological cost formation and ecological resources evaluation	100
12.2. Practical evaluation of atmosphere pollution harm according to polluters and harm recipients	101
12.3. Problems of ecological costs' minimisation	103
12.4. Conclusions and recommendations	103
13. DATA RELIABILITY CONTROL AND SOFTWARE FOR MATHEMATICAL METHODS	105
14. GENERAL CONCLUSIONS	108

6. HISTORICAL CHANGE OF CONDITIONAL SUSTAINABILITY OF SEVERAL MODEL SPECIES AND POPULATIONS IN LITHUANIA

R. Volskis, J. Balevičienė, T. Bitvinskas, L. Lazauskienė, A. Mickus,
Z. Sinkevičienė, G. Vaitonis, V. Žiliukas

During the eutrophization of inner waters a number of oligotrophic lakes decreases. On the other hand, the acidity of environment and waters occurs. This is a common phenomenon in whole Europe. The acidity process in Lithuania is slower than in the Scandinavian countries because the peat-bogs and swamps partially neutralize the influence of acid precipitation. The enumerated processes determine the change of the specific gravity of populations (SGP %) of fauna and flora in the communities, e.g., in the Lithuanian inner waters a number of sturgeons, salmons, coregonides and other fish species is decreasing as they spawn only in the water bodies of oligotrophic type and are sensitive to eutrophization of environment. The change of eutrophization determined a rapid growth of SGP% of caprinide fish. The regular change of their parameters may be used when prognosticating the indication of the sustainability of environment.

The investigations of the change of the parameters of model species and the investigations of the dynamics of populations make an important part of the ECOSLIT programme. It has been found that each species of fauna and flora may live only in a certain level of eutrophization. E.g., pH of water for fish may fluctuate from 9.0 to 6.5. For each species this pH interval is more narrow. The consequence of the acidity of environment is the decrease of species sustainability.

The decreasing sustainability of biosphere differently touches the different types of biocoenosis and species. The abundance of some species and the SGP% in the communities is significantly reducing. The other species either disappear or increase [5,6].

Under the conditions of anthropogenic eutrophization the lakes and other water bodies overgrow with plants very quickly. In the most overgrown water bodies the intensive succession change is taking place. The diversity of species and communities is decreasing [9].

The species and communities of the vast ecologic amplitudes become predominant. The sustainability of these ecosystems is decreasing. The narrow ecological amplitudes and the rare species which locate at the boundary of the distribution area are disappearing. At present *Nitella batrachosperma*, *N. hyalina*, *N. tenuissima*, *N. translucens*, *Tolypella nidifica*, *Chara canescens*, *C. coronata*, *C. crassicaulis* can not be found. *Aldrovanda vesiculosa*, *Caldesia parnassifolia*, *Groenlandia densa*, *Hydrocotyle vulgaris*, *Topypella prolifera* have disappeared as well during the last decades. *Lobelia dortmanna*, *Nymphoides peltata* are disappearing very rapidly too. The state of other very rare species is unknown.

A lot of different species grow in marshes: 260 species belonging to 28 associations grow in marshes. The communities of 8 associations are very rare and of limited distribution. 19 species of marshes are recorded in the Lithuanian Red book. Some plants growing in marshes are in unfavourable conditions. Under the impact of intensive land-reclamation the ecosystem of marshes is almost destroyed [4].

The anthropogenic impact (land-reclamation, recreation, fires) evokes qualitative (disappearance of grass, growing of bushes and trees) and quantitative

changes. Impoverishment of floral composition is observed. During 10 years in the transformed ecotope 15-20 species survive out from the former 30-40 [7, 8].

The natural development of the communities is connected with a long-term fluctuation of water level and genesis. The fall of the level of ground waters evokes the irreversible endogenic changes in vegetation. This process which has started in yearly fluctuations (observed for 10-15 years already) in 50-60 years becomes a stable climax succession (Fig. 7.1).

Judging from the changes taking place it is possible to prognosticate that the biotops of the marshes will transform into the forest biotops. The communities of conifers will become predominant.

The introduced *Paramysis lacustris* and other species survived in new environment: a) the spawning started, their descendants survived; b) they made abundant populations and entered into the local biocoenosis using the food of a new water body.

Comparing the needs of the local as well as the introduced species of crustacea into the environment it is necessary to stress that the greater tolerance to the environment, greater fecundity and a number of generations are peculiar to acclimatized crustacea.

The process of the acclimatization of the higher Ponto-Caspian Crustacea took place by 5 stages and it lasted for 15-18 years. The acclimatization went on according to the general regularities of this process. Small deviations were conditioned by the local factors (Fig. 7.2). Acclimatizants increased the production of the crustacea complexes in the water bodies of Lithuania by 2.5-44.0 times. Now they make from 62.1 to 97.7% of the whole production of higher crustacea (excluding crawfish). In the water bodies inhabited by relict crustacea their production makes a significant part of the general production (11.0-37.7%) [2].

During 25 years with the increase of eutrophization of water level the tendency of the increase of the SGP% in the ichthyocoenosis of borealic species (roach, perch) is observed. These species are in the kernels of the fry fish of the biggest rivers.

On the basis of the data obtained it is possible to maintain that the species (of fauna or flora), its populations inhabiting the natural environment under the changing conditions "try" to keep the relative abundance of the population (SGP%) in communities characteristic to them. E.g. in the zone of the ecological optimum (ZEO) a rapid growth of fish, early maturity, relatively small heart and gill weight as well as the largest SGP per cent in the communities are characteristic to fish species. Moving to the north the growth speed is slowing consequently, the relative fecundity is decreasing, and the fish mature 2-3 years later.

The relative weight of the above mentioned organs is increasing because moving away from the ZEO more energy is used for adaptation and the SGP% of the populations of the species in the communities is decreasing. The individuals of the populations living southwards mature early but they are not so highly reproductive and their growth speed is slower than in the ZEO.

The relative weight of gills and heart is also increasing because more energy is used when adapting to the worst conditions of the environment, i.e., expenditures of energy for adaptation are increasing. SGP% of the populations of the species moving southwards from the ZEO is decreasing. The same phenomena are observed in the

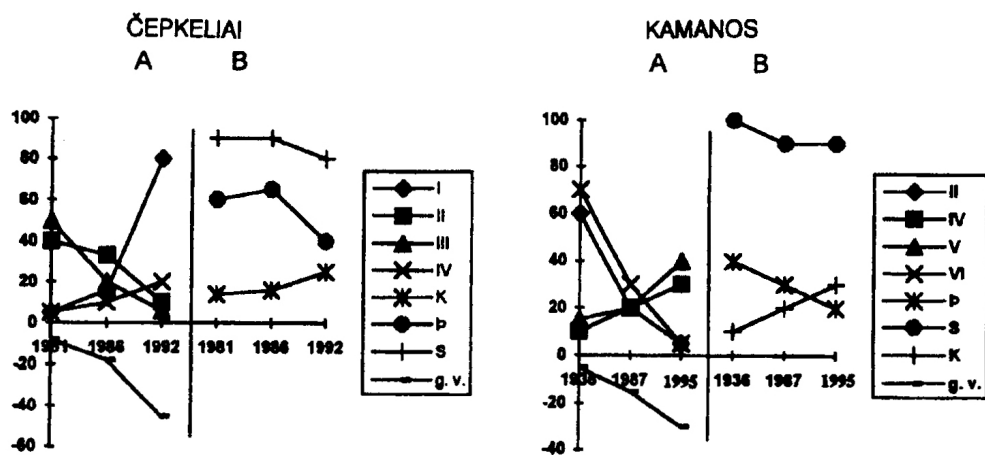


Fig. 7.1. The dynamics of the overgrowing of vegetation and ground water in the *Caricetum limosae* community.

A-model species: I-*Sphagnum fallax*; II-*Carex limosa*; III-*S.angustifolium*; IV-*Andromeda polifolia*; V-*S.magellanicum*; VI-*S.cuspidatum*.

B-general; K-bushes; Ž-grass; S-moss (J. Balevicienė).

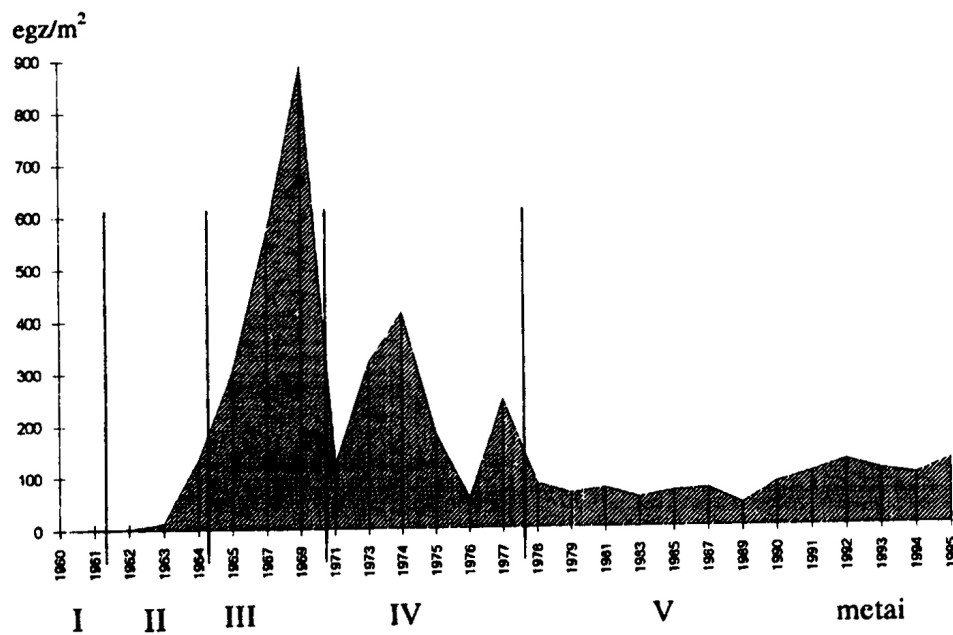


Fig. 7.2. The fluctuations of the abundance of acclimatized crustacea (units/m²) in the process of acclimatization I-V - phases. (L.Lazauskienė, G.Vaitonis).

populations of the same species living in different types of ecosystems in Lithuania. Though a roach and a perch are very tolerant for the worsening conditions of the environment, a roach still disappears the first when pH decreases. In an eutrophicated lake both species disappear. The data on the SGP% of these species in the ichthyocoenosis may be used for the indication of the sustainability of environment.

Beavers is one of the rare mammal species introduced in Lithuania. After the beavers have been introduced, their number is constantly increasing. The maximum was reached in 1987 - almost 15.000 animals. Now their distribution area covers the whole Lithuania. However, the successful results of the reacclimatization of beavers have also a negative side. Beavers are the only animals in Lithuania making a great impact on their surroundings and landscape. The investigations of the adaptation of beavers and the structure of population in different drainage systems have shown that the hydrotechnical works improve the living conditions of beavers because the additional suitable places occur for their living. New food resources become accessible in these areas. There is a favourable hydrologic regime and there are no such disturbing factors as shipping, fishing and others. Due to favourable living conditions a number of beavers is constantly growing in the drainage system. 21% of all beavers are hunted here [3].

The dendroscales of centuries formed separately from the rings of spruce and pine trees reflect these rhythms of woody species growth and the dynamics of different climatic factors. A pine tree gives the information on the ecological conditions of winters and springs of the previous centuries. The dendroscales of spruce give the information on summer and autumn periods. It enriches our understanding about the former climate and it enables us to prove the prognosis on the basis of dendroscales (Fig. 7.3).

From long-term and short-term dendroscales it is seen that the rings of trees in dry places at present are significantly narrower. A spruce survives better in more wet places. There are less pests hearths there actively attacking weak trees.

In the investigated field (1930-1990) 5 main extremums of spruce growth came to light reflecting the 11-12 years cycle. The minimums occurred in: 1985, 1986, 1974, 1969, 1970, 1955, 1940-1944, 1918-1922, 1890-1885, 1850-1852, 1842-1843. The maximal growth was observed in 1949-1952, 1925-1930, 1906-1907, 1899-1900, 1877-1881, 1855-1857. The data on the trees growing in different regions of Europe show that the same coincidence of maximums of 5 cycles was observed [1].

The duration of 11 years solar activity cycle fluctuates from 10.4 to 14 years. That is why the duration of longer cycles changes. Adjacent years to the 11 years cycles differ insignificantly. Among contiguous cycles of the duration of 50 years the greater differences are observed.

Most probably the sustainability of species in region may be different during different cycles. Besides, it changes in cycle phases. Estimating the sustainability of the ecosystems, it is necessary to consider the influence of the solar activity cycles of different durations on a certain species. The reduction of the abundance (SGP%) or disappearance of a certain species in Lithuania during the last decade may be a temporary phenomenon, conditioned by the impact of the phases of a cycle. During 20-30 years some of the species may spread again in our waters (e.g. *Chondrostoma nasus*, the Nemunas river basin is the northern limit of its distribution area).

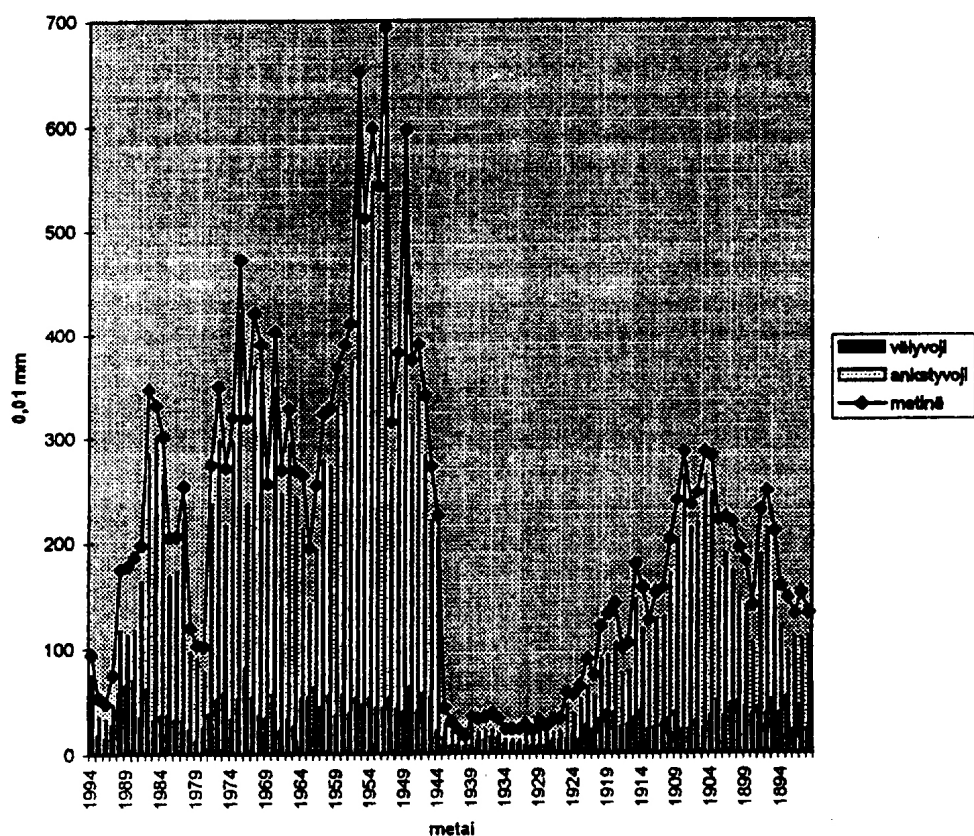


Fig. 7.3 The Ežerėlis forestry (82 district). The dynamics of the radial increase of fir-tree during the last 100 years. (T.Bitvinskas)

The sustainability of the whole regional system is periodically increasing and then diminishing. Its consequence for the species is the increase and reduction of their distribution area (moving either to the north or to the south). This phenomenon is approved by the regularity of the fluctuation of the SGP% of the species in the communities.

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