

**Daugavpils University  
Institute of Systematic Biology**

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# PARASITOLOGICAL SITUATION IN WILD GAME IN EAST LITHUANIA

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The aim of this study was to identify helminthes in the alimentary tract of Cervids in East Lithuania. Parasitological studies of Moose (*Alces alces*), Red Deer (*Cervus elaphus*) and Roe Deer (*Capreolus capreolus*) have been implemented in the areas of hunting research base of Vilnius University, on the area of Aukštaitija National Park. Additional material for coprological analyses of farmed Red Deer was collected. To examine faeces, the modified method of McMaster, methods of sedimentation and cultures of larvae were applied.

It has been established that in the study area, 100% of Cervidae were infected with the nematodes of the Strongylidae, Trichostrongylidae, Strongyloidae and Trichuridae families, as well as with the flatworms of the Paramphistomatidae and Fasciolidae families. It is determined that free ranging Red Deer were infected with seven nematode species, while farmed Red Deer were infected with three of them. The Moose were infected with six nematode species and Roe Deer were infected with four. Flatworm *P. cervi* was characteristic to all the examined wild game. *F. hepatica* has been determined in the Moose and the farmed Red Deer. It is stated that now the parasitological situation in wild game in East Lithuania is not bad (infection level in most cases was lower than 200 eggs per gram faeces).

In order to assess season ability of the infection and the extent of the helminthes invasion in wild game, it is very important to examine more Cervids during seasons of the year, also, to carry out the coproscopic analysis of animals of the different age ranges, and finally, to determine herb contamination with the nematode larvae.

# ASSESSMENT OF LANDSCAPE AESTHETIC RESOURCES IN LITHUANIA

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Under intensive development of Lithuanian State, the research and management of scenic landscape becomes more and more relevant. In Lithuania structural descriptive landscape inventory is used. Aesthetic resources of landscape are rated by the models of structural countable and comparative analysis. Structural countable analysis models were created by Eringis and Budriūnas, Stauskas, Purvinas, whereas comparative analysis models were worked out by Kavaliauskas and Daniulaitis, Bučas, Palys. The first ratings of landscape aesthetic resources were carried out by K. Eringis and A. R. Budriūnas in 1962. In 1968 their works were generalized in the first map of aesthetic resources of Lithuanian landscape and 1970 a Method for Aesthetic and Ecological Assessment of Landscape was published. In 1975, it was published in a monograph Landscape Ecology and Aesthetics, whereas in 2000, this edition was improved and a Method for Aesthetic and Recreational Assessment of Landscape was issued. The presented models are meant for scenery judgments from specially chosen observation spots. Basing on these models, in the period of 2001–2006, scenic assessment of 62 sceneries and their observation spots in protected areas of Vilnius city and its suburbs were performed. To predict the beauty of sceneries, phytocenotic research objects influencing scenic quality were chosen. The goal of the research was to investigate phytocenotic objects that should be preserved, revealed or restored for representation. It was found that 10 % of the sceneries were very picturesque (101–120 points), 53 % – picturesque (81–100 points) and 37 % – moderately picturesque (60–80 points). The highest ecoaesthetic quality is characteristic to the sceneries of Trakai Historical National Park. Assessment of observation spots showed that 11 % of them were very good quality (more than 60 points), 44 % – good (51–60 points), 33 % – moderate (41–50 points) and 12 % – poor quality observation spots (up to 40 points). The highest-rated observation spots were found in Verkiai Regional Park. High ecoaesthetic quality of many observation spots is subject to management of their environment. Recommendations for preservation, representation and improvement of landscape aesthetic resources in Pavilniai and Verkiai Regional Parks (2005) and Trakai Historical National Park (2006) were worked out basing on the obtained research data. According to these recommendations landscape formation cuttings on forest edges, protective zones along lakes, haying of meadows, restoration and management of green plantations on observation spots are carried out. That allows to preserve and reveal landscape diversity, restore violated landscape complexes and impoverished agrarian areas as well as increase the quality of landscape aesthetic resources.

# **SUMMER PHYTOPLANKTON AS INDICATOR OF WATER QUALITY IN THE LAKES LIELAIS AND MAZAIS BALTEZERS**

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During the last five years EU Water directive 2000/60/EC is being intensively initiated and this process changes all monitoring system. Based on law of ministry Nr.858, phytoplankton biomass and currency are one of the main indicators of ecological situation in lakes. Therefore the main aim of the work was to determine water quality and appraise current ecological situation using the structure of phytoplankton in the Lakes Lielais and Mazais Baltezers during the summer period 2002-2005.

During the period 2002-2005 structural analyse of phytoplankton shows very high concentration of biomass. Cyanobacteria are among dominant phytoplankton species in both lakes. Big amount of potentially toxic species appears in Mazais Baltezers, while in Lielais Baltezers cyanobacteria and diatoms are dominant. By dominant phytoplankton groups and composition, water quality in both lakes estimate as eutrofic – hipereutrofic. Other groups of algae show insignificant concentrations of phytoplankton biomass.

Coastal zone of Lielais and Mazais Baltezers characterizes with very intensive housing that increases anthropogenic load. This results in high concentration of total dissolved nitrogen and total dissolved phosphorus. Nutrients as well as temperature, conductivity, rainfall and velocity of wind are the most important environmental factors, affecting growth and development. Structural analyse of phytoplankton could be successfully used for determination of lake water quality.

# PHENOTYPIC DIVERSITY OF *FRAGARIA VESCA* AND *F. VIRIDIS* IN LITHUANIA

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Variation of nine phenotypic characters measured in a field collection was assessed among ten *Fragaria vesca* L. and five *Fragaria viridis* Weston accessions from diverse native populations across Lithuania. Analysis of variance (ANOVA) revealed significant differences for quantitative characters evaluated at both the accession and species levels. The phenotypic characters of plants (number of flowers per inflorescence, flower diameter, length of inflorescence and length of petiole) differed significantly between *F. vesca* and *F. viridis*. The differences in phenotypic characters among accessions were specified by the Scheffe test. Among *F. vesca* accessions, a high variation in the weight of 100 berries and petiole length was established. The accessions of *F. viridis* varied significantly in the majority of their phenotypic characters. The highest variations within accessions of both species were observed in the number of flowers per inflorescence and flower diameter.

# FIRST DATA ON MAMMALS AND AMPHIBIANS USING HIGHWAY UNDERPASSES IN LITHUANIA

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Subject to the road safety requirements of the EU, the first five highway underpasses were built in Lithuania in 2005–2006: three to the south-west of Vilnius (road A1), one to the south of Vilnius (road A16), and one to the north of Vilnius (road No. 102). Investigations into mammals and amphibians using highway underpasses were carried out in August–December 2006 (27 sessions). A survey of mammals was realized via registration of footprints and faeces on the sand, soil and snow; while that of amphibians, visually.

In total, 11 mammal species (58 individuals) were registered; most common were foxes (*Vulpes vulpes*), hares (*Lepus sp.*), raccoon dogs (*Nyctereutes procyonoides*), and martens (*Martes sp.*); a share of ungulates was about 10%. The number of amphibians registered was 39; out of 4 species, the most abundant was the common toad (*Bufo bufo*). Migration of amphibians ceased after September.

The effectiveness of underpasses for mammals lessened by ca. 75% due to construction failures; 43 individuals of 6 mammal species were able to cross highway avoiding underpasses. Ungulates comprised >50% of that number.

80 vehicle-animal collisions were reported for the zone of 3 underpasses in 2001–2006, involving 9 mammal species. The number of reported collisions lessened after 2004 along with the construction of underpasses, but only in 2006, compared to 2004, the decrease was statistically significant ( $p=0,01$ ;  $\chi^2=6,00$ ). Our data of 2006 show, that the actual number of killed mammals was much higher (38 individuals, 5 species – mainly hedgehogs). Small collisions were not reported.

An insufficient size of underpasses for the biggest game animals – moose (*Alces alces*) and red deer (*Cervus elaphus*) – was indicated in our study. Footprints of both species were found on the road and close to underpasses, but not inside them. According to preliminary data, underpasses are positive in reducing the number of animal-vehicle collisions, though further monitoring of animal migration is necessary.

Investigation was funded by the Ministry of Environment, Lithuania, No. AAR86-125.

# ANALYSIS OF PELLETS OF THE LESSER SPOTTED EAGLE (AQUILA POMARINA) USING TWO METHODS OF PREY IDENTIFICATION

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The population of the Lesser Spotted Eagle (*Aquila pomarina*) is possibly declining in Lithuania, though the number of breeding pairs is about 1500. Protection of the species is secured by Annex I of Bird Directive and the National Red Data Book. The diet is investigated insufficiently.

Material (30 samples of pellets from and under the nests) on feeding was collected in June–August, 2004–2005 in 10 administrative districts, except for South Lithuania. Nestlings and adult birds were identified visually. Habitats in 2 km radius around the nests were 25–90 percent afforested. The main forest type was wet mixed forest dominated by coniferous stands. Open areas were dominated by meadows and fallow land.

The pellet size was in the range of 5.5–6.5×2.5–3.1 cm, often with leaves and spruce needles. Identification of mammal species composition was done by means of two methods (visual osteological analysis and analysis of hair remains).

Prey remains consisted of mammals (ca 75.3%), birds (22%), and amphibians (2.7%), also insects. Nine mammal species were identified. The highest percentage of occurrence (90%) was found for voles of g. *Microtus* (3 species), 60% for the mole (*Talpa europaea*), 13.3% for the bank vole (*Clethrionomys glareolus*), 10% for the hedgehog (*Erinaceus concolor*). Preying on the water vole (*Arvicola terrestris*) and using carrion of Cervidae was confirmed only by hair analysis. Both methods complemented each other, as three vole species (*Microtus arvalis*, *M. agrestis* and *M. oeconomus*) and the yellow-necked mouse (*Apodemus flavicollis*) were identified only by osteological analysis.

In our sample, 28 out of 30 samples were young eagle pellets. Nestlings digest most of the bone material to fulfill calcium demand, thus, bones of prey were absent or highly destroyed. In case small mammal skulls were present, craniometrical analysis enabled prognosis of prey body weight and prey selectivity using original regression equations we obtained from the local material. It was found that the Lesser Spotted Eagle preyed on adult individuals of *M. arvalis* (average body weight 29.1 g), *M. agrestis* (30 g), *M. oeconomus* (38.6 g), *C. glareolus* (21.5 g), and *A. flavicollis* (33.4 g).

# DIET OF THE OTTER (*LUTRA LUTRA* L.) IN REGULATED RIVERS OF LITHUANIA

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Diet of otters was studied in 5 rivers in Central Lithuania: Armona, Juoda, Juosta, Važuoka and Vieđinta. In studied stretches, rivers are regulated, surrounded by pastures, meadows or arable land. The diet was investigated through scat analysis. The biomass consumed (BC) and frequency of occurrence (FO) were estimated. In the warm season, fish (24.4-62.5% BC, 28.3-82.8% FO), amphibians (19.0-69.1% BC, 34.5-65.4% FO), and mammals (4.4-25.4% BC, 9.2-37.9% FO) were the most important prey items in the diet. Insects were frequently consumed (up to 37.9% FO), still their biomass didn't reach higher values (up to 2.4% BC). Birds and crayfish made a minor part of the diet. In the cold season, two types of food – fish and amphibians – made the bulk of the diet (4.87-87.16 % BC, 12.9-91.67% FO and 4.87-93.53% BC, 20.83-96.77% FO, respectively). Food niche breadth was broader in the warm season (Levin's standardized niche breadth BA= 0.12-0.35) in comparison to the cold one (BA= 0.02-0.11). Importance of several food items varied also depending on the river. Index of Morisita (CH) was calculated for comparing similarity of otter diet in different rivers. In the warm season, otter's diet was most similar between rivers Juosta and Važuoka (CH = 0.99), Važuoka and Vieđinta (CH = 0.95), and Juosta and Vieđinta (CH = 0.94). The lowest similarity was found between otter's diet in rivers Armona and Juoda (CH = 0.59). In the cold season, diet was very similar in the rivers Juoda, Juosta, Važuoka and Vieđinta (CH=0.96-0.99). Meanwhile, the diet of otters in the River Armona differed significantly from all the rest rivers (CH=0.11-0.35).

# SOME ASPECTS OF IMPACT OF SHELTERWOOD CUTTINGS ON CONIFEROUS FOREST VEGETATION NEAR LARGE CITIES – VICINITY OF RĪGA AS AN EXAMPLE

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The aim of the study is to analyse forest vegetation after shelterwood cuttings in different forest types of Scotch pine and Norway spruce forests as well as birch stands forming succession stage of coniferous forests and to clarify impact of shelterwood cuttings on forest vegetation. Research was carried out in 2006 in permanent forest sample plots of shelterwood cuttings in Daugavas, Garkalnes, Olaines and Tīreļu forestry of Rīgas Forest Agency and Jelgavas scientific forest region of Forest research station. Altogether 67 vegetation descriptions were analysed using classification and ordination methods – TWINSpan and PCA and Ellenberg and Düll indicator values.

The impact of shelterwood cuttings on oligotrophic Scotch pine forests is rather insignificant. Different factors as forest basal area reduction in shelterwood cuttings, nitrogen pollution and frequent forest fires cause changes in forest vegetation, in this case increase of vegetation ground layer cover and decrease of bottom layer cover as well as intensive spreading of *Lerchenfeldia flexuosa*.

The vegetation of studied Norway spruce forests is widely influenced by men. Forest drainage has favoured increasing of soil fertility, but shelterwood cuttings arouse changes in ground vegetation. Light demanding species not typical for natural spruce forests were found.

Birch forests in rather poor soils are formed as succession stage of coniferous forests, and impact of stripe shelterwood cutting is similar as in coniferous forests here. Rapid natural regeneration of *Betula pendula* and *B. pubescens* change proportions between ground vegetation species, but floristic composition have no significant changes.

Ground and bottom layer of vegetation similarly reflect ecological parameters of habitat: light, moisture and soil reaction, but there are differences between layers in parameters of climate: temperature and continentality. Mosses typical for cooler and more continental climate predominate in bottom layer but herbs and dwarf shrubs characteristic for warmer and more oceanic conditions form ground layer.

Some invasive and fugitive ornamental species as *Sambucus racemosa*, *Padus serotina*, *Impatiens parviflora* and *Solidago canadensis* were recorded in small quantity. A spreading of some aggressive species as *Sambucus racemosa* and *Impatiens parviflora* is believable in the future.

The study is supported by Foundation of Forest development of Latvia, project 240206/c-63 „Elaboration of continuous cover forestry models”.

# JEWEL BEETLES OF THE GENUS *AGRILUS* CURT. (COLEOPTERA: BUPRESTIDAE) IN THE BALTIC STATES AND BELARUS

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Genus *Agrilus* Curtis, 1825 (Coleoptera: Buprestidae) is represented by 23 species in the Baltic States and Belarus. In Lithuania only 16 species of this genus can be distributed, in Latvia – 20 species, in Estonia – 17 species, but in Belarus – 15 species.

In Latvia hitherto 3 species of this genus: *A. convexicollis* Redt., *A. auricollis* Kiesenw. and *A. populneus* Schaef. have been found, for the time being they have not been found neither in other Baltic States nor in Belarus. In Estonia there is 1 such species *A. sinuatus* (Ol.) and in Belarus also there is only one species *A. obscuricollis* Kiesenw.

Fauna of the genus *Agrilus* Curt. has been still incompletely investigated in the Baltic States and Belarus. Many species are considered to be rare only regarding the fact that they have rather abstruse way of life. Information about situation of population of *Agrilus* Curt. species in the region is not available. Possibly some species are endangered and they should be taken in to state protection. Only in Estonian Red Data Book *A. ater* (L.) [category 3] and *A. mendax* Mann. [category 3] have been included. In Latvia *A. biguttatus* (F.) and *A. mendax* Mann. have been included in the list of indicator species of natural forest habitats.

In the lists of protected species in the Baltic States the following species of this genus should be included: *A. ater* (L.) (species of old aspen forests, occurs on sunlit aspen trunks, endangered owing to reduction of area of old aspen forests); *A. biguttatus* (F.) (expands in oak forests, local, rare species, endangered because of decrease of appropriate habitats); *A. mendax* Mann. (occurs on old rowan-trees *Sorbus*, very rare, endangered owing to decrease of appropriate habitats); *A. auricollis* Kiesenw. (occurs on *Ulmus*, rare, endangered species); *A. integerrimus* (Ratz.) (occurs on *Daphne*, endangered because of decrease of appropriate habitats); *A. paludicola* Krog. (endangered swamp species, expands on *Betula nana*; the impact of climate changes on its population should be investigated); *A. kaluganus* Obenb. (obscure East European species, expands in old hazel-trees, endangered because of decrease of appropriate habitats).

In the Baltic States and Belarus several new species of this genus can be traced during the analysis of fauna in the neighbouring countries. The investigations of ecology of species are required henceforth.

# TAXONOMY IN BALTIC: NEW CHALLENGES AFTER THE SYMPOSIUMS OF NETWORK OF EXCELLENCE - EDIT IN SMOLENICE

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At the moment in none of the Baltic States taxonomy is regarded as prior branch of biology. In many universities problems of taxonomy are touched superficially, the amount of hours is decreased, the length of field praxis is reduced for bachelor students, the bases of field praxis are eliminated and the modern equipment is being purchased for specialists of other branches of biology. As a result there has developed the situation when in the ecological researches the species are being defined inexactly, invalid names of taxons are being used; this leads to misunderstandings in legislation of nature protection and in practical protection of nature. In funds of museums a lot of unclassified and undefined materials are kept, between them are many taxons, which have not been described for science. It has happened due to derogation of significance of taxonomy and unbalanced politics of biology development, which are sometimes aggressive towards taxonomy, in many European (including Baltic) states.

Network of excellence - European Distributed Institute of Taxonomy (EDIT) is the collective answer of 27 leading European, North American and Russian institutions to a call of the European Commission, issued in 2004, for a network in « Taxonomy for Biodiversity and Ecosystem Research ». The EDIT objectives are to help to reduce the fragmentation in European taxonomic research and expertise and to coordinate the European contribution to the global taxonomic effort ([www.e-taxonomy.eu](http://www.e-taxonomy.eu)).

In EDIT symposiums, which took place in Smolenice (Slovak Republic, March 26-28 and 28-30, 2007), several issues were discussed: the problems of taxonomy in Europe, necessity to increase role of taxonomy, use new and modern research methods, to enhance importance of professional and amateur associations in development of taxonomy, attraction of new taxonomists and popularization of taxonomy.

In the Baltic States relatively few professional and amateur associations, which are supporting development of taxonomy, are acting, they do not have many active taxonomists. Universities and scientific institutes also have few active taxonomists. It is necessary to unite forces of region taxonomists. Bachelor programmes in systematic biology are needed; their students and teaching staff should be mobile and participate in international student and teaching staff exchange programmes. Joint Baltic region species lists, data basis, data basis of types from collections are needed. The following issues should be discussed: formation of Joint Network of Baltic Taxonomists, publication of "Baltic Fauna and Flora", searching for new forms of popularization of taxonomy, influence on politics of science and education; they would foster development and education of taxonomy, closer cooperation with EDIT. Certain effort in this field is made by Daugavpils University Institute of Systematic Biology – the only scientific research institute in the Baltic region, which majors in taxonomic researches and has commenced elaboration of Baltic region species list, data basis and taxonomic and faunistic e-library; it is equipped with modern research facilities and has involved in reorientation of Biology study programmes into the field of systematic biology. Our challenge – to team up and work so that Baltic become one of the regions of European taxonomy excellence!

# **USING OF ARTIFICIAL SHELTERS BY BATS (CHIROPTERA) IN SOUTHEAST LITHUANIA**

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One of the main threats in managed forests is a deficit of natural daytime roosts, mainly due to the removal of old, hollow trees. Various artificial roosts (bat boxes), being a substitute for tree holes, are used by foresters and conservationists. Bat boxes can be easily checked at day time to the presence of bats, so such artificial shelters are very suitable for investigations of bat ecology. The goal of our project was to investigate the occupancy rate of artificial shelters by bats in forested areas in summer and during autumn migration season. Our studies were carried out in 2006 in 14 localities of Southeast Lithuania. In the present study, standard wooden bat boxes were used. Totally were erected 255 bat boxes. The boxes were attached to trees at 4-6 metres above the the ground, in each case 3 boxes to one tree, respectively facing south, east and west. Bats found in boxes were captured, their species, sex and age were determined. Any damage of boxes by woodpeckers were also noted.

# THE DIVERSITY OF BENTHIC INVERTEBRATES IN THREE LITHUANIAN RIVERS

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Benthic invertebrates are very important part in aquatic ecosystems that is why investigations of water invertebrates can provide a lot of information about the state of water body. The aim of this work was to estimate differences in fauna, abundance and biomass of water invertebrates in three rivers and to elucidate some of the factors which can have an influence on the distribution of water invertebrates.

The studies of zoobenthos were performed in three rivers located in different regions of Lithuania – the Dubysa, the Merkys and the Dvantoji. The samples were collected every month from April to September in 2004, by kick-sampling method in three 0.1m<sup>2</sup> areas at each study site. The habitat of each study site was determined with respect to environmental factors: bottom structure, water temperature, depth, flow velocity. Amount of nitrites, nitrates, phosphates, oxygen dissolved in the water, water hardness, ph were investigated (Merck compact laboratory for water testing was used). The amount of organic matter was tested according to general accepted methods. More than 60 samples were collected and analyzed following standard hydrobiological methods. Composition of species, biomass (g/m<sup>2</sup>) and abundance (ind./m<sup>2</sup>) were determined for each sample. During the studies more than 150 species of Mollusca, Oligochaeta, Arachnida, Hirudinea, and Insecta (Trichoptera, Ephemeroptera, Plecoptera, Odonata, Coleoptera, Megaloptera, Heteroptera, Diptera) were registered in three investigated rivers.

Rivers were similar in discharge, amount of organic matter, velocity, ph. Rivers differed in water temperature, amount of oxygen dissolved in the water, in substratum. Dominant species of invertebrates were different in different rivers. The Merkys river was dominated by Ephemeroptera and Arachnida, the Dubysa river was dominated by Ephemeroptera, Trichoptera and Oligochaeta and the Dvantoji river was dominated by Mollusca. The time of the greatest biodiversity of water invertebrates differed in rivers. The greatest biodiversity was determined in spring in the Merkys and Dvantoji rivers and in autumn in the Dubysa river. The time when the greatest biomass was detected in the river was different in different rivers as well.

The factors which can have an influence on the fauna, abundance and biomass of water invertebrates are discussed in the paper.

# **HYDROCHEMICAL CHARACTERIZATION OF SPAWNING GROUNDS OF THE NATTERJACK TOAD (*BUFO CALAMITA LAURENTI*, 1768) IN AINAĀI, LATVIA**

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This poster summarizes data on the hydrochemical characteristics for the spawning grounds of the Natterjack Toad in the AinaĀi population. These characteristics are compared with corresponding data in different parts of the area.

In the AinaĀi population first time in Latvia and Baltic States was stated the spawning of the Natterjack Toads in brackish water along the seacoast. In this case the concentration of  $K^{++}$ ,  $Na^{+}$ ,  $Mg^{++}$ ,  $Cl^{-}$  ions is considerably higher than further away from the sea.

# THE RIVER FISH COMMUNITY'S STRUCTURE- RESULTS OF BIODIVERSITY MONITORING

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In 2006 62 stream sites in 32 different size rivers of Latvia were sampled using electrofishing. All of the sites were originally sampled as a part of state Biodiversity Monitoring Program. The sampling sites were chosen using 50\*50 km grid map to cover all country territory as far regular. In total 29 fish and 2 lamprey species were found.

Among this species 5 were occasional, with few sampled individuals in one or two sampling sites. Most of the sampling sites were presented with 5- 8 species, 4 of them- loach, minnow, roach and trout (sedentary and migratory forms) were largely distributed and made largest part (<60%) of the total catch.

Local species richness (LSR), number of fish and fish biomass is related mostly by local habitat conditions (bottom substrate, temperature and oxygen conditions, average depth) and stream spatial characteristics (watershed area, order).

Environmental variables explained a great part of the density and distribution patterns of the fish species. From the other side rough analysis of anthropogenic impact demonstrated that at least (%) of country territory with according rivers is inaccessible for migratory fish species. It means, fish community's structure and LSR would be affected by the far- away (out of the watershed) factors impact.

The data on fish community's structure, number of fish and standing stock biomass are the basis for elaboration of further rivers ecological classification system for the contribution of WFD requirements. At present the data of biodiversity monitoring uses for the Latvia report preparation regarding distribution and population dynamics (trends) characterization for the regulation 97/62/EK species.

# WHOOPE SWAN CYGNUS CYGNUS RINGING IN LATVIA USING NECK COLLARS

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Only two *C.cygnus* were ringed in Latvia till 2003. The first was ringed in 1987/88 winter near Riga. The second *C.cygnus* was ringed as pullus by metal ring with plasticine in 1990 near Kazdanga (western part of Latvia).

In the 2003 author with team caught and using blue neck collars ringed 2 moulting birds in Skrunda fish ponds, in the 2004 - 43 (3 breeding, 7 moulting, 33 cygnets), in the 2005 - 104 (4 breeding, 20 moulting, 80 cygnets).

We used blue neck collars with white codes 1C01-1C99, 2C00-2C50. Material: plastic. Size: height: 83 mm., symbol height (letter, number): 77 mm., beam: 3 mm., inner beam: 57 mm., weight: 71 g.

All together from August 2003 to October 2006 the author got 1333 resightings: 890 from Germany, 327 from Latvia, 70 from Poland, 17 from Estonia, 16 from Finland, 7 from Netherlands, 5 from Lithuania and 1 from Denmark.

# ECOLOGICAL CHARACTERIZATION OF ZOOPLANKTON GROUPS IN THE DEEPEST LAKES OF EAST LATVIA

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Drīdzis is the deepest lake in Latvia, its utmost depth reaches 65,1 meters. Lake Riča is the 8th deepest lake in Latvia – its utmost depth is 39,7 meters, but Lake Svantes is the 9th deepest lake in Latvia with uttermost depth of 38,0 meters ([www.ezeri.lv](http://www.ezeri.lv)). Investigating lakes Riča, Drīdzis and Svantes there have been recognized 3 groups of zooplankton organisms: Rotatoria, Cladocera and Copepoda. After analysis of literature sources (Cimdiņš, 2001) it can be concluded that qualitative composition of zooplankton in lakes Riča, Drīdzis and Svantes is similar to zooplankton composition of other eutrophic lakes in Latvia.

Analyzing physically chemical parameters of water in these lakes it can be concluded that each year these parameters do not change significantly. The temperature of lake's water changes according to the changes of depth. Stratification in metalimnium, which is in 4-8 m depth, is characteristic for lakes. The quantity of solute oxygen in lakes decreases when the depth increases. The high content of oxygen can appear exactly on the top layer of the water in the result of plants' photosynthesis or by waves flushing oxygen from the atmosphere. The greatest concentration of oxygen in Lakes Drīdzis and Svantes is at the 7m depth then the decrease of concentration is observed. It can be connected with mass reproduction of plankton algae and usage of oxygen in life processes. The quantity of solute oxygen mg/l in water is linked to chemical and biological processes. The changes in quantity of solute oxygen in Lake Riča are not so sharply marked. The quantity of solute is constant within all years, which is 0,2 g/l. After analysis of zooplankton samples levied the biggest variety of zooplankton species was observed in Lake Drīdzis. There were determined 27 species of zooplankton. The highest quantity of species is in Rotatoria group – 14 species. Among Rotatoria the most widespread are the following species: *Polyarthra remata*, *Keratella cochlearis*, *Kellicotia longispina*, *Conochilus hippocrepis*. There are 8 species in Cladocera group. Among Cladocera the most common species are *Bosmina crassicornis*, *Daphnia cucullata* and *Diaphanosoma brachyurum*, but the dominant among Copepoda are *Cyclops sp.*, *Eudiaptomus gracilis*, *Macrocyclops olbidus*, as well as a great number of small Cyclopes – Nauplii, Copepodite cyclopoid. There have been observed some changes in composition of species variety in Lake Drīdzis in years 2006, 2005 and 2004. If the number of species in samples levied in 2004 and 2005 is constant then it is 19 in 2006.

There have been determined 25 species of zooplankton in Lake Svantes. Here also the dominant is Rotatoria group with 12 species then come Cladocera group with 8 species and Copepoda with 3 species. Among Rotatoria the dominant are *Keratella cochlearis*, *Kellicotia longispina* and *Polyarthra remata*, but in Cladocera group the dominant species is *Bosmina crassicornis*. In Copepoda group as well as in Lake Drīdzis the dominant are *Cyclops sp.*, *Eudiaptomus gracilis*, *Macrocyclops olbidus*. In Lake Svantes there was also observed a great number of small Cyclopes – Nauplii and Copepodite cyclopoid. In its turn there have been defined 21 species of zooplankton in Lake Riča. Comparing the above mentioned lakes and Lake Riča, the dominant group of Lake Riča is also Rotatoria group with 10 species. The most common species are *Keratella cochlearis*, *Conochilus hippocrepis* and *Polyarthra remata*. The variety of species does not differ much in Lake Drīdzis, Lake Riča and Lake Svantes. After analysis of qualitative composition of zooplankton species it can be concluded that there is a sufficient quantity of solute oxygen in lakes Drīdzis, Riča and Svantes as there have been found such species of zooplankton as *Keratella cochlearis*, *Keratella quadrata*, *Filinia longiseta* that need a definite quantity of oxygen. In the case of oxygen deficit these species die within some hours. According to comparison of quantity indicators - Raikonen Index, similarity within 54% and 71% amidst these lakes can be seen. The greatest similarity according Raikonen Index is between lakes Riča and Drīdzis (70%). It testifies that they are alike in variety of species.

# **METHODS OF IDENTIFICATION BIRD SPECIES BY EGG SHELL MICROSTRUCTURE**

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We explored methods to identify species by examining microstructure of the egg shell. Our objective was to find tool for species identification from egg shell remains in cavities as well as to proof the identity of some egg collections deposited at the Museum of Zoology, University of Latvia. Trials included eggs of various species of the genii *Acanthis*, *Acrocephalus*, *Ficedula*, *Parus* and *Passer*. Egg shells were examined in the binocular and light microscope. Differences of inner surface of the eggshell: conic layer basal caps (mammillae) were detected in different bird species. Developing of the identification key of passerine species requires studies of more species.

# SOME DATA ABOUT THE AQUATIC ADEPHAGA BEETLES (INSECTA: COLEOPTERA) OF THE EASTERN LATVIA

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In the fauna of Latvia 144 species of aquatic beetle from suborder of Adephaga are known, that belong to four families: Gyrinidae (11 species), Haliplidae (15 species), Noteridae (2 species) and Dytiscidae (116 species).

The research of the aquatic adephagous beetles was carried out since 1999 till 2006 in eastern part of Latvia: in Daugavpils, Preiļi, Jēkabpils, Rēzekne, Balvi and Ludza districts. The various reservoirs (rivers, lakes, ponds, storage lake, rivulets, ditches and others) were investigated. In the Eastern part of Latvia Ludza, Balvi and Jekabpils districts are less studied. To these territories in our research is paid the most attention.

Beetles were collected assembled mainly using hydroentomological net. Other standard entomological methods also were used: collecting flying beetles to light traps and collecting in place of hibernation.

As a result of our research 617 specimens that belong to 62 species (43,1%) of aquatic Adephaga were collected: Gyrinidae – 7 species (63 specimens), Haliplidae - 5 species (17 specimens), Noteridae – 2 species (21 specimens) and Dytiscidae – 48 species (534 specimens). Two species from Noteridae were known for the all districts of the Eastern Latvia. One new species *Haliphus confinis* Stephens, 1829 from Silene Nature Park is recorded for the fauna of Daugavpils district; for Preiļi district – 2 new species, for Balvi district – 5 new species, for Rezekne district – 7 new species, for Jekabpils district – 12 new species and for Ludza district – 33 new species.

For the Eastern Latvia (for Latgale) the species *Nebrioporus assimilis* (Paykull, 1798) (Dytiscidae) is indicated firstly. One specimen of officially protected species *Dytiscus latissimus* Linnaeus, 1758 was recorded in Bedužu lake (Daugavpils district, Silene Nature Park).

*Hydroporus palustris* (Linnaeus, 1761), *Ilybius ater* (De Geer, 1774), *Ilybius fuliginosus* (Fabricius, 1792) (the species that are typical as for standing water as for flowing water), *Acilius sulcatus* (Linnaeus, 1758) and *Acilius canaliculatus* (Nicolai, 1822) (typical for standing water) are noticed as the most widespread and often occurred species from Dytisciformia in the Eastern Latvia.

The records will complete the information about Coleoptera species distribution in Latvia.

The study partly was supported by VPDI/ESF/PIAA/04/NP/3.2.3.1./0003/065 project.

# THE GROUND BEETLES OF SUBFAMILY BROSCINAE HOPE, 1838 (COLEOPTERA: CARABIDAE) IN THE BALTIC SEA REGION

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The species of Broscinae Hope, 1838 present a worldwide distribution in areas of temperate and subarctic conditions both north and south of the tropic, except for a genus *Rawlinsius* Davidson and Ball, 1998 from Mexico (northern part of Neotropical region). About 36 genera and more than 260 species are known. Most genera and species occur in the Southern Hemisphere, distributed in southern Australia plus Tasmania, New Zealand and southern South America. In Europe 10 species are known: *Brososoma* Rosenhauer, 1846 – 2 species, *Broscus* Panzer, 1813 – 7 species and *Miscodera* Eschscholz, 1830 – 1 species. Two genera are recorded from Baltic Sea Region – *Broscus* Panzer, 1813 and *Miscodera* Eschscholz, 1830, each with one species.

**Genus *Broscus* Panzer, 1813.** 24 species and 2 subspecies of genus *Broscus* Pz. inhabit the Western Palaearctic region. In Baltic Sea region and Middle Europe is known a single species – *B. cephalotes* Linnaeus, 1758. Eurosiberian species has the most vast distribution area among other representatives of genus. In the countries of the Baltic Sea region it is a usual species and widely distributed in suitable habitats. *B. cephalotes* L. is eurytop, thermophilic and meso-xerophilic species, which prefers various dry and open habitats with sandy soil, often with a strong admixture of loam, humus and peat. Preferred habitats: fields, meadows, edge of a forest, gravel-pits and sandpits, inland dunes and such habitat with scarce vegetation or least bald patches present. Typical species for agrocenosis with sandy soil. Also fond of lakeside and seashores. Active mainly at night-time. *B. cephalotes* L. is mixo-zoophagous species. They feed on mainly the food of animal origin. On occasion they can use the food of vegetable origin. Life cycle of *B. cephalotes* L. is polyvariant and combines one-year development with the hibernation larva of senior ages, and two year development with hibernation immature imago.

**Genus *Miscodera* Eschscholtz, 1830.** This is a monotypical genus. A single circumboreal, boreo-alpin species *Miscodera arctica* Pk. occur in forest zone of Eurasia and North America. In Palaearctic region from Great Britain through northern and northeastern part of Central Europe, Central Ural and South Siberia to northern part of Primorie (Russia) and to Japan. A rare relict in central Europe (Austrian and Swiss Alps), but widespread if local on mountains in northern England and the Scottish Highlands. In the countries of region of the Baltic Sea this eurytop and psamophilic species is quite rare. It inhabit different sandy or gravelly and dry habitats: moraines, edge of and pine forest, glade in pine forest, forest clearing, inland dunes, dry pine forest and other with thin vegetation. Meets on the marine sandy beaches and in coastal pine forest. Hidden under stone, moss and lichens of *Cladonia*, *Cladina*, *Empertum*. Active at night-time. Predatory on larvae of moss-feeding pill beetles (Byrrhidae: *Byrrhus* and *Cytillus*). *M. arctica* Pk. is specie with autumn breeder, hibernates on the stage of imago and has a two year cycle of development. Andersen J. (1968) is supposed that hibernation can pass also on the larval stage.

The study was supported by VPDI/ESF/PIAA/04/NP/3.2.3.1./0003/065 project.

Andersen J. 1968. The larva of *Miscodera arctica* Payk. (Carabidae). Norsk. Ent. Tidsskr., 15: 71 – 74.

# NATURAL ENEMIES AND BIOCONTROL OF GYPSY MOTH IN EAST GEORGIA

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Gypsy moths, *Lymantria dispar* L. (Lepidoptera: Lymantriidae), are pests of hardwood and other trees, and are capable of defoliating large wooded areas, causing economic, physiological, and aesthetic losses. The main objective of the strategy is to minimize the incidence of defoliation caused by gypsy moth.

A small outbreak of the gypsy moth were discovered the different site of foliage forest and orchards of East Georgia during 1996-2005. The heavy outbreak occurred in 1996 and 2004. Gypsy moth goes through one generation per year. The periodicity of outbreaks is 4-7 years and the area infested can very significantly. Growth loss in healthy trees will be roughly proportional to the amount of defoliation above 50%.

The role of natural enemies (parasitoids, predators, microorganisms) in the dynamics of gypsy moth is very important. Also, bioagents are considered such basis of biological control means. Frequency and abundance of pathogens, parasitoids and unknown mortality agents were observed during the last two larger outbreak periods. The nucleopolyhedrovirus (NPV) was discovered to be a cause for the natural collapse of gypsy moth populations after large outbreaks. Caterpillar mortality by this virus cause 47, 7-71% and 19, 8-24, 5%. To reveal entomopathogens of this pest by investigation gypsy moth caterpillar and pupae with symptoms of fungal pathology were detected. Cadaver producing abundant conidia, some of which remained attached to caterpillar hairs. The studying of morphological and physiological characters of fungus diseases isolated from the pest was shown the three species of fungi: *Penicillium chrisogenium*, *Botrytis cinerea*, *Paecilomyces farinosus*.

Materials were collected from different geographically distinct populations determine parasitoid complex attacking gypsy moth, revealed the presence following natural enemies: *Megatoma reideli* which parasitoids 70% of eggs, parasitoids *Apanteles melanoscelis* and *Apanteles porhetriae* -23-30%. The effect of the pheromone biosynthetic pathway for production of the sex pheromone disparlure, 2-methyl-7R,8S-epoxy-octadecane, on mating disruption gypsy moth populations was determined in field plots. There 145 pheromone trap were hung in threes of pest settlement. The total number of attracting and catching adult male were 5869 sample.

The new bacterial formulation of *Bacillus thuringiensis* var. Kurstak (Btk) - Agree-WG, Bio-Ti, Bitayon and Bt-CM were used against gypsy moth caterpillars (II-IV instars) in laboratory and natural condition. The concentration of this formulations were 0,1%, 0,5%, 1%. Calculates the letale concentration which were for Agree-WG LC50=45%; Bio-Ti- LC50=0, 41%, Bitayon- LC50=0, 40%, BT-CM- LC50=0, 38%. Biological effect of this formulation are 63,5-90,5%. Bacterial preparation on the base of Btk Dipel. Sonit-K, appeared to be effective- 90,5-92,7% towards gypsy moth caterpillars. The new formulation - Phytoverm (Aversectin -C), Russian production on the base Actinomicetes was tested for gypsy moth's caterpillar (II-IV instars) in laboratory and natural conditions in following concentrations 0,1%, 0,3% 0.6%. The suspension 0,6% of formulation by the high efficacy has differed. The caterpillar mortality after 7 days in laboratory was achieved 96%. The mortality concentration was LC50=0, 28%. The biological effectiveness achieved - 91.4%.

# THE HELMINTHS COMMUNITY STRUCTURE OF THE YELLOW – NECKED MOUSE (*APODEMUS FLAVICOLLIS*) IN THE SEASIDE REGIONAL PARK IN LITHUANIA

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The yellow necked mouse is the largest and the most spread mouse in natural habitats of Lithuania. It can be source of dangerous helminths. The infection of helminths changes depending on different geographical localities and environmental factors. The aim of this work is to investigate a structure of helminths community of yellow – necked mice in the Seaside Regional Park.

The yellow – necked mice were caught on October of 2004 – 2006 in three habitats: forests, bushed meadow and sandy meadow. There were caught 62 yellow – necked mice: 1 yellow – necked mouse was caught in sandy meadow in 2004, others were caught in forest. We used the method of total helminthological dissection of individual organs. The intestines, stomach and other internal organs were examined. The content of the intestines and stomach was studied by method of consistent flushing.

In the Seaside Regional Park yellow – necked mouse are parasitized by 7 species of helminths: 5 Nematoda (*Capillaria sp.*, *Syphacia sp.*, *Syphacia stroma*, *Longistriata sp.* and *Heligmosomoides polygyrus*), 1 Cestoda (*Hydatigera teniaeformis*) and 1 Trematoda (*Brachylaimus sp.*). In every years of investigation were found *Syphacia stroma* (abundance (X) varied from 0,11 to 2,56 and prevalence (E(%)) from 9,52 to 43,48), *Syphacia sp.* (X 2,11 ÷ 0,57, E(%) 16,67 ÷ 4,76), *Heligmosomoides polygyrus* (X 0,05 ÷ 1,22, E(%) 4,76 ÷ 34,78). *Longistriata sp.* was found in 2004 (X = 0,48, E (%) = 17,39) and in 2006 (X = 0,10, E (%) = 4,76). In 2004 – *Hydatigera teniaeformis* (X = 0,04, E(%) = 4,35). In 2005 – *Brachylaima sp.* (X = 0,11, E(%) = 11,11). In 2006 – *Capillaria sp.* (X = 1,14, E(%) = 28,57). In most cases helminths are overdispersed in the population of *A. flavicollis*.

# GENETIC DIVERSITY AND STRUCTURE OF THE PIKE PERCH (STIZOSTEDION LUCIOPERCA) IN THE CURONIAN LAGOON AND THE BALTIC SEA

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The subject of the present investigation is the pikeperch (*Stizostedion lucioperca*) and the aim set is by means of DNA markers specific to the species to assess the genetic diversity and the genetic structure of the population of the pikeperch caught in the Nemunas delta, the Curonian Lagoon and the coastal strip of the Baltic Sea. Having used microsatellite primers created for taxonomically close fish species (for the yellow perch – *Perca flavescens* and the blue pike perch – *Stizostedion vitreum*) 77 individuals were investigated and their genotypes in four polymorphic loci were determined. The number of individuals caught in different locations and in different years and used in the investigation ranged between 16 and 23. Biallelic locus Svi-L10 has been determined and four alleles have been detected in loci Svi-L8 and Pfla-L8, and three alleles were found in locus Pfla-L9. In the sample of Ventės ragas (2004) a specific fourth allele that was atypical of other samples was found in locus Pfla-L8. The value of heterozygosity ( $H_o$ ) observed in the pike perch populations was equal to 0.4578, and that of theoretical heterozygosity ( $H_e$ ) equalled 0.5597. The number of alleles in the loci in four pike perch samples hardly differed. Abundance of the alleles allowing the measure of the number of alleles between the samples of different size to be compared has been calculated. This value ranged from 2.7500 to 2.9277. The calculated value  $D_{st}$  of the genetic diversity between different samples was equal to 0.010. Parameters of the genetic diversity show very insignificant differences in genetic variability between investigated four samples of the pike perch. The value of the number of migrants per generation ( $N_m=11.3847$ ) calculated revealed intensive inter population exchanges between the crossbreeding individuals. During the investigation it was established that the structure of the pike perch population was mainly influenced by annual changes, as well as by salinity of water and the geographical distance.

# CHLORIDES ACCUMULATION IN THE SNOW, SOIL AND LIMES IN THE STREET GREENERY IN RIGA, LATVIA

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Greenery in cities is widely accepted as a major positive and cost-effective means to improve urban environmental quality. Especially in compact city environment with high building and traffic density, urban trees are subjected to a multiple stresses. One of the most serious causes of stress is chemical injury.

This study focused on the Cl<sup>-</sup> accumulation in snow, soil and limes of the street greenery in the central part of Riga to reveal Cl<sup>-</sup> influence on the ecological status of street trees (*Tilia x vulgaris*). Snow, soil, and leaf samples were collected from 27 study sites in the central part of Riga with high intensive traffic and from 3 control sites located in the park area. Significantly increased levels of Cl<sup>-</sup> in urban snow, soil and leaf samples were stated in comparison with the background values. There were close correlation between Cl<sup>-</sup> concentrations in the leaves and the extent of leaf and crown necrosis. The critical level in occurrence of visual symptoms of necrosis was 0.62 – 0.66 % Cl<sup>-</sup> in the dry mass of *Tilia x vulgaris* leaves.

# DIVERSITY AND ABUNDANCE OF SMALL MAMMALS IN WINTER SEASON IN NE LITHUANIA

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Winter data on small mammal communities in Lithuania are scarce. The only winter trapping data was collected in our previous work (Balčiauskas, Gudaitė, 2006). In current investigation, small mammals were snap trapped three winter seasons (from November to the end of April) of 2004–2007 in the North-east Lithuania, near lake Ilgelis, in the former farmstead territories. Study area was surrounded by fragmented forests and meadows. Standard snap trapping method was used (two trap lines of 25 snap-traps every 5 m in each line). Comparing these winter seasons, air temperature in winter of 2006–2007 was enormously high, so the trapping results were also different from the previous winter season. In 2006–2007 winter, 13 trapping sessions were worked out, and 404 small mammal individuals were trapped. Species composition: bank vole (*Clethrionomys glareolus*), which was dominant from November to December, comprising 36.8–48.9% of the total catch; common vole (*Microtus arvalis*), which become the dominant species in January - March, comprising 41.5–66.7% of the total catch; common shrew (*Sorex araneus*), yellow-necked mouse (*Apodemus flavicollis*) as sub-dominants, and pygmy shrew (*Sorex minutus*), striped field mouse (*Apodemus agrarius*), house mouse (*Mus musculus*), harvest mouse (*Micromys minutus*), caught in December and January, and brown rat (*Rattus norvegicus*), which were not numerous. Highest occurrence was found for the first two species (80%).

Recorded relative small mammal abundance was higher than may be expected in winter (and higher than that based on our previous data, see Balčiauskas, Gudaitė, 2006): 22.5 individuals per 100 trap days in November, 29 – in December, 30 – in January, 14 – in February and 7 individuals per 100 trap days in March. In November highest relative abundance was characteristic of yellow-necked and house mice, in December and February – that of bank vole and common vole, in January and March – common vole. Relative abundance of other trapped small mammal species was low.

# CONSERVATION OF PLANTS INCLUDED IN THE RED DATA BOOK OF LITHUANIA IN BOTANICAL GARDENS OF VILNIUS UNIVERSITY

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Genetic variation is maintained away from its original location. There are totaled, in Lithuania, about 1800 naturally growing plant species, their 1500 species belong to the vascular plant species. There are 339 plant species included in the Lithuanian Red Data Book (RDB). The 226 belong to angiospermous plants and 1 to gymnospermous. This is our national plant genetic resources (NPGR) and our great riches. There is a need to keep for the future generation.

Accumulation, investigation and preservation of NPGR were delegated by Ministry of Environment to the Plant Gene Bank and coordination centers of plant groups. The Ornamental Plants Coordination Centre located in Botanical Gardens of Vilnius University. 29 plants included in the Red Data Book of Lithuania are growing as living plant collections according to the permission of Lithuanian Red Book Committee and Ministry of Environment of the Republic of Lithuania: *Aster trifolium* L., *Betula nana* L., *Dianthus armeria* L., *Gentiana pneumonanthe* L., *Gratiola officinalis* L., *Hedera helix* L., *Hordelymus europaeus* (L.) Harz, *Schoenus ferrugineus* L. (Endangered); *Ajuga pyramidalis* L., *Bromopsis benekenii* (Lange) Holub, *Gladiolus imbricatus* L., *Iris sibirica* L., *Primula farinosa* L., *Prunus spinosa* L., *Ranunculus reptans* L. (Vulnerable); *Agrimonia procera* Wallr., *Allium angulosum* L., *Colchicum autumnale* L., *Cruciata laevipes* Opiz, *Koeleria delavignei* Czern. Ex Domin, *Lithospermum officinale* L., *Myrica gale* L., *Quercus petraea* L. ex Liebl., *Salvia pratensis* L., *Scabiosa columbaria* L., *Tanacetum corymbosum* (L.) Sch. Bip., *Trifolium rubens* L. (Rare); *Astragalus cicer* L. (Indeterminate) and *Lunaria rediviva* L. (Restored). Their seminal samples by approved list will be stored in Plant Gene Bank.

# ASSEMBLAGES OF BEETLES (COLEOPTERA) IN A PEAT BOG AND SURROUNDING PINE FOREST

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Peatbogs and other wetlands are very sensitive and endangered ecosystems in Europe. Some peatbogs have remained in a natural state, but most of them have been drained and became highly fragmented, isolated, or naturally overgrown by forests. Some small undisturbed peatbog fragments exist on the edges of large excavated peatlands.

At present, peatbogs and other wetland fragments are mainly surrounded by drier habitats such as forests or meadows. The aim of this research was to evaluate the relationship between beetle assemblages in a peatbog and the surrounding pine forest in the largest and the most natural mire complex of Lithuania.

The research of beetles was carried out in the northwestern part of the Čepkeliai State Strict Nature Reserve (54°00' N, 24°30' E). It is located in southern Lithuania, near the Belarus border. Čepkelių Raistas (5858 ha) is the largest mire complex in Lithuania. Pitfall traps were used for collecting the material.

The material collected comprised specimens of beetles representing 80 species belonging to 11 families (Carabidae, Leiodidae, Silphidae, Catopidae, Staphylinidae, Scarabaeidae, Cantharidae, Scirtidae, Melyridae, Chrysomelidae, Curculionidae). Of these, 33 species (565 specimens) were registered in the open bog; 41 species (450 specimens) in the pine bog, and 42 species (946 specimens) in the dry pine forest.

Pine bog and open bog had the most similar assemblages of beetles ( $P=64.8$ ). Relative abundances of seven species (*Agonum ericeti*, *Carabus arcensis*, *Pterostichus diligens*, *Drusilla canaliculata*, *Quedius molochinus*, *Ocypus fuscatus*, and *Agathidium atrum*) exceeded 1.0% of all individuals registered in each assemblage. *Agonum ericeti* and *Drusilla canaliculata* were the most abundant species in the open bog and pine bog. The similarity between pine forest and pine bog was very low ( $P=8.7$ ). There were only two species (*Carabus arcensis* and *Geotrupes stercorosus*) which abundances were higher than 1.0% in each assemblage of beetles. The lowest similarity was registered between pine forest and open bog ( $P=5.4$ ), where only *Carabus arcensis* reached the abundance of more than 1.0% of all individuals at the both sites (59.5% and 4.1%, respectively).

The results showed that the number of species registered in the studied habitats was quite similar, while the number of individuals was twice bigger in the pine forest in comparison to the pine bog or open bog's site. It was mainly influenced by *Carabus arcensis* that was very abundant in the pine

forest and dispersed to the bog only in low numbers. *Agonum ericeti* and *Drusilla canaliculata* were the most abundant species making up 67% of all individuals registered at the open bog's site and 50% in the pine bog.

High similarity of species composition in the assemblages of the open bog and pine bog was expected. The results showed that both sites shared the biggest amount of common species adapted to extreme microclimatic conditions. Some of them were not recorded from the dry pine forest at all (e.g. *Agonum ericeti*, *Drusilla canaliculata*, *Ocypus fuscatus*, *Cyphon variabilis*, *Cantharis pallida*).

Assemblage of beetles was quite different in the dry pine forest having some species that were not registered on bog, e.g. *Pterostichus oblongopunctatus*, *P. strenuus*, *Nothophilus palustris*, *Carabus hortensis*, *C. violaceus*, *Cychrus caraboides*, *Calathus micropterus*, *Amara brunnea*, *Stenus clavicornis*, *Xantholinus linearis*, *X. tricolor*, *Strophosomus capitatus*, etc. Some of these species were quite abundant and they influenced the results of the comparison of relative abundances with both bogs' sites.

The results showed that bogs have specific assemblages of beetles. Overgrowth of bogs with pines and other trees lead to the decline of abundances of some stenotopic species, e.g. *Agonum ericeti*. It is necessary to keep hydrological conditions in bogs and adjacent territories stable in order to preserve the proportion of open and closed habitats within bogs. Otherwise, some management activities in bogs should be used.

# ANT (FORMICIDAE) FAUNA IN NATURAL MEADOWS IN LATVIA

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The natural meadows are protected biotope in Latvia and Europe. Together with the protection of biotope there is also need to protect species and complexes of species that are characteristic to biotope.

Studies of ants were carried out in 2003 in the natural meadows at Vītiņi, natural reserve of Liepāja lake, Liepāja district and Diļļu meadows nature reserve, Kuldīga district. There were one transect in both places, every 100 m long, used in this study. Two methods that complement each other were used to do this study. A visual counting of ant nests on territory was made in 1000m<sup>2</sup> that allows identifying the density of the nests of ants in the territory. In addition there were ants taken from 30 pitfall traps. That allowed establish the presence of other species.

Nine ant species: *Formica pressilabris*, *Formica fusca*, *Formica sanguinea*, *Lasius niger*, *Lasius flavus*, *Harpagoxenus sublaevis*, *Myrmica rubra*, *Myrmica scabrinodis*, *Leptothorax acervorum* has been recorded in the studies at Diļļu meadow. Species *Formica pressilabris* were dominant species with 41 nests (93%) und 6695 individuals (89%).

Five ant species: *Myrmica scabrinodis*, *Myrmica rubra*, *Leptothorax acervorum*, *Lasius niger*, *Lasius flavus* has been recorded in the studies at Vītiņu meadow. Species *Lasius flavus* were dominant with 18 nests (62%) and species *Lasius niger* were dominant with 259 individuals (47%).

# ***GONYOSTOMUM SEMEN* (EHRB.) DIESING EXPANSION IN LATVIA'S LAKES**

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During last decades the large raphidophyte *Gonyostomum semen* invaded small, shallow brown water dystrophic, dyseutrophic lakes as well as ponds and man made pools originated by peat quarries. *G. semen* was found mainly in the lakes with soft brown water and high content of dissolved organic matter. Most of these lakes are located in the regions of ombrotrophic Bogs – Teichi Bog reserve, North Vidzeme Biosphaere Reserve. Last 5 years this species in high abundance was stated in the lakes of Riga surroundings, in very high abundance in the man made artificial reservoirs situated in Northern part of Latvia and in small dystrophic lakes of Eastern Latvia near by Daugavpils. Former data of Latvian algological literature shows that more than 15 years ago this species was rare for Latvia. Literature data from Estonia, Finland, Sweden shows that this nuisance raphidophyte *G. semen* fast expansion would be expressed in extension of the distribution to new areas, occupying new lake types within the distribution area, and achieving mass development in several lakes, by different actions in forestry and peat processing, by agricultural eutrophication, fish farming and wood processing industry, by more intensive investigation of small lakes.

# PROBLEMS OF INVENTARIZATION OF WILD-GROWING COTONEASTER SPECIES IN LATVIA

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Cotoneasters (*Cotoneaster* Medic.) is a polymorphic, systematically unclear and hard-to-determinate deciduous or evergreen arboreal genus. Different authors provide different number of species in this genus – from 50 in A. Rehder works up to 174 taxa in B. Hylmö publications. There are three taxa are usually mentioned in Latvia – *C. scandinavicus* B Hylmö (*C. integerrimus* Medic.), *C. niger* (Wahlb.) Fr. – species, which are mentioned in P. Lackschewitz and K. Kupfer works and collected in herbaria already in the end of the 19th century, as well as *C. orientalis* A. Kern. (*C. x matrensis* Domokos). R. Cinovskis, worked at analysis of *Cotoneaster* species for Red Data Book of Latvia, the 4th species – *C. canescens* Vestergr. Ex B Hylmö, is also mentioned for Latvia. *C. niger* and *C. scandinavicus* are included also in Republic of Latvia Cabinet Regulation No. 396 adopted in November 14, 2000 'List of especially protected species and partially available especially protected species'.

***C. scandinavicus.*** Scandinavian species. In Latvia species grow on southern border of their distribution area. Herbaria material, known till now, was collected in narrow seashore zone of wooded dunes in Ventspils district from Ventspils to Ovīši. During our investigations, species was found also to south from Ventspils – in territory of Ovīši nature restricted area, wooded dune, near Užavas lighthouse.

***C. niger.*** Natural distribution - Scandinavia, Eastern Europe and Western Siberia. It is very likely, that in Latvia species grow on the south-eastern border of its distribution area Distribution in Latvia - Daugava valley near Jēkabpils and Sēlpils, also on isles and peninsulas of Ežezers lake, and on Šķaune esker. During our studies species is abundantly found in Krāslava district Ezernieku municipality on isles and peninsulas of Ežezers lake – isle Šusta, isle Vilkastes, tiny isle between peninsula Pahatnieku and isle Kuļinovka, SE part of peninsula Pahatnieku,

***C. canescens.*** Species is naturally distributed in Sweden, Estonia and Latvia. Till nowadays herbaria material was collected near lake Feimaņi, on Madona esker, as well as Daugava valley near Oliņkalns. During inventory of all mentioned localities, the species was found in two places: Rēzekne district, Feimaņi municipality, E part of lake Feimaņi, in escarpment. Madona district, Lazdona municipality, Madona esker, Vadzole hill. I have to admit, that this species is morphologically and systematically unclear, and our collected herbaria materials rather belong to *C. orientalis*. Additional investigations of morphological boundaries for this Cotoneaster is necessary.

***C. orientalis.*** European mountain species. In Latvia this Cotoneaster is distributed mainly in Lielupe and Daugava valley. During our studies, species was found in Daugava valley: Aizkraukle district, Aizkraukle municipality, 200 m N from "Ceplī" farm, on the dolomite outcrop. Others previously known localities in Daugava valley, probable, perished after the creation of hydroelectric power station. Localities of Greblūkalns and Lielupe basin have not been inspected.

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# CONSERVATION OF GENETIC DIVERSITY IN THE LATVIAN GENE BANK OF CULTIVATED PLANTS

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The conservation of biodiversity can be achieved through in situ and ex situ conservation strategies. One method of long term ex situ conservation is the storage of seeds of generatively propagated plants under specific conditions. These techniques are well developed for crop plants by international organizations such as the International Plant Genetic Resources Institute (IPGRI), Food and Agricultural Organization of the United Nations (FAO), International Board of Plant Genetic Resources (IBPGR).

To preserve genetic diversity the Latvian Gene Bank of Cultivated Plants (LGB) was founded in 1998 within the framework of the Nordic-Baltic project. Initially, it was located at the Latvian University Institute of Biology, Plant Genetic Laboratory. The LGB has been located in the Latvian Forestry Research Institute „Silava” since 2006. The LGB works in collaboration with Latvian breeding and research institutions, and houses accessions (mainly of Latvian origin) according to internationally accepted standards.

Of the accessions held in the LGB, 68% are commercial varieties, advanced breeder lines and genetic stocks, 12% is material of wild relatives obtained in collecting missions and 20% is repatriated material from other institutions abroad. Altogether, 72 species are represented in the LGB. Species structure of the storage material is: cereals -58.8%, sugar beets and root crops – 6.3%, forages – 20.6%, fiber crops (flax) – 4.9%, legumes – 8%, vegetables – 1.3%, oil and aromatic crops – 0.1%.

The LGB is one of the newest in Europe. Seeds harvested in 1997 were first placed in long-term storage in 1999. At the beginning on 2007, after 8 year storage, the viability of initial seed accessions were monitored. Germination tests were carried out for 20 species first placed into long-term storage conditions. Results show that storage is successful and germination rate is similar to the pre-storage rate.

# **DEVELOPMENT OF DNA FINGERPRINTING PROTOCOLS FOR LATVIAN FOREST AND CROP SPECIES**

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The Genetic Resource Centre (GRC) was established last year with funding from the Latvian Ministry of Agriculture. It incorporates the Latvian Gene Bank, the Gene Bank database, and a molecular genetics laboratory. The Latvian Gene Bank holds seed collections of Latvian agricultural crops and their wild relatives, and there are plans to expand the collection to include seeds from forest tree species as well. The database contains information regarding these collections, as well as data about field collections held by various breeding institutes in Latvia. The molecular genetics laboratory is equipped with an ABI 3100 genetic analyser, and functions as a research facility as well as providing molecular marker support for breeding programs.

We have initiated a program of DNA fingerprinting for Latvian agricultural crops. SSR-based fingerprinting protocols were established for cherry, onion, melon, potato, barley, clover and wheat last year, and DNA fingerprinting of these crops will commence this year. Further SSR marker protocols are being developed for triticale, raspberry, blackcurrant, garlic, oats, rye and pea. Currently, we are concentrating on SSR markers, as these have been established for the crops listed above, they are robust, and data can be compared with results from other laboratories.

We are also closely collaborating with tree breeders, both in selection programs as well as genetic diversity surveys of Latvian forest populations. We have established SSR-based fingerprinting protocols for hybrid poplar clones that are being used in plantations here in Latvia. We are also in the process of undertaking a survey of the genetic diversity and population structure of Latvian forest tree species (pine, spruce and birch). As expected, little population differentiation was found in spruce and pine, and the birch diversity study is currently underway. The next step will be to investigate the use of chloroplast SSR markers in these forest species which may allow for better population differentiation and provenance identification. Another program is just starting that will look at developing species specific DNA markers for *Alnus* spp., which would aid in identifying hybrids of these species.

# FOREST LITTER ENTOMOFAUNA ON THE SURROUNDING STANDS OF *DENDROLIMUS PINI* L. OUTBREAK

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Litter arthropods were trapped by pitfall traps in outbreaks of *Dendrolimus pini* L. in 1998-2000 y. Beetles were the most abundant in the litter of the stand of outbreak, 62% of all collected Arthropods in 1998, 79% in 1999 and 74% in 2000. The dominating species of beetles was *Carabus arcensis* Hbst., which comprised 81,3% (in 2000) of all collected beetles. Forest litter insects (in 1999) included: entomophagous (91%), phytophagous (4%) and coprophagous (4%). Saprophagous, necrophagous and representatives of other groups did not exceed 1% of all collected Arthropods. Increased indices of insect species diversity (D), species evenness (E) and biocoenose diversity (H) as well as reduced domination indices (? and d) of insect species show, that in the strongly affected zone biocoenose is changing towards regeneration and stability.

# THE IMPACT OF COLONIAL SEA BIRDS ON THE VEGETATION COVER OF THE ISLANDS IN THE GULF OF FINLAND

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Most scientists, who worked on islands with large bird colonies, noticed very special flora and vegetation formed on the islands under the effect of activity of colonial seabirds. To specify the group of plants, which find the best conditions for their growth in or near the nesting sites of colonial birds and respond positively to the very special conditions of ornithogenic biotopes, chiefly to the richness of the substrate in nitrogen and phosphorus, a Scandinavian scientist R. Sernander (1912) offered the special term «ornithocoprophilous species». He distinguished this group from the group of coprophilous plants, because bird excreta (guano) consists of both faeces and urine and differs essentially from excrements of mammals. The bird dung contains considerably more uric acid and chlorides, which results in a difference in physiological effect on vegetation.

In foreign literature, studies devoted to the influence of colonial seabirds on the vegetation cover of islands are rather numerous. As concerns Russian islands of the Baltic Sea with seabird colonies, information on the flora and vegetation of most of them was not available until our works, which was due to the difficulty of access to many of the islands and impossibility of their free visiting because of a strict boundary regime.

We chose as «model» objects to characterize the influence of the birds on island vegetation cover, small-sized, the most remote from the mainland, peopleless islets with large seabird colonies. Most of them are almost devoid of arboreous vegetation and are a true heaven for the birds. About 20 islets, located in the northern part of the Gulf of Finland near the Russian – Finnish border (Doldyj Reef, the Bolshoy Fiskar Archipelago, Zubetz, etc.), and 14 minor islets included in the Berezovye Islands Archipelago were surveyed in 2002–2005.

The species of colonial seabirds do not all exert a considerable influence on the vegetation cover in their nesting sites, this resulting from peculiarities of their behaviour, and first of all depends on their excreting and trampling activity. According to our observations, a special ornithocoprophilous flora and vegetation in the Gulf of Finland islands are formed in the gull (mainly, herring gull – *Larus argentatus*) and cormorant (*Phalacrocorax carbo sinensis*) nesting sites.

The study of the mechanism of the vegetation cover changes on the islands under the influence of the activity of colonial birds was not a special aim of our research. However, the main agents are, obviously, the same as on many other «bird» islands, described by both foreign and Russian scientists: mechanical impact of the birds on the soil (trampling, scratching and digging the soil); changes of the soil chemical composition under the effect of a large amount of excrements and other organic substances (food remnants, nest material); transporting plant germs by the birds (by means of endo-, syn- and epiornithochory); mechanical damage of the plants by the birds (browsing, breaking, trampling the plants).

The influence of the cormorant colonies on the vegetation cover of islands is determined by the ecological and biological peculiarities of the species. The cormorants stay in their nesting sites longer than other seabirds, from May to the middle September. Their colonies are very dense, the nests quite often being located at 0.5–1 m from each other. The birds are rather large and produce large amount of dung. The colonies areas are poured by dung in plenty, and the surface around the nests is covered with its continuous layer. It

is remarkable, that at a distance of as little as several tens of meters many islands with large cormorant colonies look completely devoid of any vegetation. However, when landing to the island, one is astonished at the luxuriant and mosaic vegetation cover is formed there under the effect of bird colonies, though the total species number in the flora of «cormorant» islands is small, usually less than 100 species of vascular plants.

M. Grunlie (1948) has formulated the main peculiarity of the ornithocoprophilous flora in the best way: «If the vegetation be poor in species it is, on the other hand, all the more luxuriant». The income of excessive amount of the bird dung has a distinct selective effect on the vegetation. Some species die out, because excessive dung income kills them, others are able to exist, but in suppressed or underdeveloped state. On the other hand, a variety of plants prove to be resistant to the excessive income of organic substances, or this factor advantages their growth.

The most distinct destructive effect is exerted by the cormorants on arboreous vegetation. Most arboreous plants in their nesting areas die, and survived plants look stunted, and distinctly suffering from unfavourable effect of excessive dung income. The arboreous vegetation in the cormorant nesting areas suffers severely not only from the excessive income of bird excrements, but also from mechanical damages, because cormorants break pine and aspen branches to use them as a frame for building their big nests.

The areas occupied by large cormorant colonies demonstrate a clearly distinct zonation of the vegetation depending on the distance from a nest. In the immediate vicinity of the nests, the vegetation is almost lacking because of abundant dung income. A huge amount of organic detritus is accumulated around a nest and added every season, since cormorants rebuild their nests every year on the same place. These detritus is always wet and intensely manured with the bird dung during breeding season, and able to grow there is only *Tripleurospermum maritimum*, not only able to survive, but thrive even in the close vicinity to the nests. This typical ornithocoprophilous species, absolutely dominating in nesting areas of cormorants, forms huge thickets on the rock surface, or forms a continuous cover when the thickets join. As near as at several meters from the cormorant nests, there is a luxuriant vegetation of many ornithocoprophilous species (for example, *Tanacetum vulgare*, *Atriplex prostrata*, *Viola tricolor*, *Urtica dioica*, *Chenopodium album*, *Barbarea arcuata*, *Epilobium adenocaulon*, etc.), represented by vigorous, well developed plants. Some of these species were obviously introduced to the island by gulls by means of endo- or ornithochory, since cormorants are ichthyophagous, and usually pick up nest material nearby; therefore, they add nothing new to the flora.

The vegetation cover formed on islets bearing large gull colonies, has a number of peculiarities to differ it from that of the islands with the cormorant colonies. The gull colonies exert a significant effect on the vegetation cover of the islets, mainly by excessive manuring the soil with nitrogen and phosphorus, mechanical destroying soil cover and transporting plant seeds, including many alien species. In such conditions a peculiar ornithocoprophilous flora is formed, distinguished by its poverty in species (usually, less than 100 species), the luxuriant growth of many nitrophilous plants and presence of a number of weed species (for instance, *Stellaria media*, *Senecio vulgaris*, *Polygonum aviculare s.str.*, *Tripleurospermum inodorum*, *Potentilla norvegica*, *Chenopodium album*, *Capsella bursa-pastoris*, etc.). As distinct from the cormorants, the gulls produce less dung and spend less time in their nests, so many plant species grow in close touch with the nest. Dominating on the rocky «gull» islands, like cormorant colonies, is *Tripleurospermum maritimum*. This species especially thrives in hollows, depressions and rock fissures, where forms continuous band-shaped mats. Many species occurring in the areas of gull nesting have no special device for anemo- and hydrochory, and were brought to the island by ornithochory (mainly, by endoornithochory). They are these species which most often occur directly at the gull nests and feeding areas.

No doubt, ornithogenic influence is a strong factor to form a special ornithocoprophilous vegetation in nesting sites of colonial seabirds. Despite the characteristic composition and peculiar features of ornithogenic

vegetation of different islands, we can distinguish main features, typical of the ornithocrophilous vegetation of the islands of the Gulf of Finland as a whole:

- the poverty in species;
- the increase of alien species number in the vegetation cover;
- the decrease of abundance or elimination of many non-ornithocrophilous species (first of all, the destructive effect of the ornithogenic influence affects tree and dwarf shrub vegetation);
- biomorphological changes of the plant habit take place (gigantism, intense development of the vegetative, and in some instances generative plant organs).

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# THE COMBINING OF ENTOMOPATHOGENIC NEMATODES AND BACTERIAL PREPARATIONS AGAINST OPEROPHTHERA BRUMATA AND ERANNIS DEFOLIARIA

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The entomopathogenic nematodes (EPN) (Steinernematidae) are well suited for pest control of harmful insects because they attack a broad range of pests and can be easily applied with conventional spray equipment.

The intensive use of chemical insecticides has promoted rapid evolution of resistance, why alternative control measures are developed. Bacterial preparation Gomeline, Dendrobacilline, Lepidocide, Thuringin-2, Bitoxibacilline and etc. and entomopathogenic nematodes (EPN) have shown potential against different insect pests.

We therefore focused on the combined biological management for insect pests, in order to avoid resistance development and enhance the efficacy of the biological agents.

The experiments were carried out in the laboratory conditions. The experimental objects were forest and orchard harmful insects as *Operophtera brumata* and *Erannis defoliaria* (Lepidoptera: Geometridae).

The mentioned nematodes the IIIrd-IV instars staged pests were invaded first with EPN's (*Steinernema carpocapsae* and *Steinernema thesami*) then together with nematodes (the same dose) in combination with 0.3% bacteriological preparations Bitoxibacilline and Thuringin-2 solutions.

As result of researches it was proved that only *Steinernema carpocapsae* and *Steinernema thesami*-with nematodes' usage of *O. brumata* and *E. defoliaria* the average death of worms was 55.5 and 60.5% (per cents), and with combined usage of nematodes and bacteriological preparation the harmful insects death rate significantly increased: *O. brumata* larvae 88.5% and *E. defoliaria* larvae 94.5% died.

Proceeding from the carried out experiments we can conclude that nematodes suspension efficacy significantly increases (approximately 30-35%) together with bacteriological preparations used in combine form.

The results may offer a powerful and reliable tool for *Operophtera brumata* and *Erannis defoliaria*

# **FIBRE AND OIL CROPS FOR DIVERSIFICATION OF AGRICULTURE AND AS A SOURCE OF HIGH QUALITY RAW MATERIAL FOR INDUSTRY**

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Flax *Linum usitatissimum* L., hemp *Canabis sativa* L. and camelina *Camelina sativa* (L.) Crantz. are the oldest oil crops in Europe. Flax and hemp historically are used in Latvia for both oil and fibre production. Growing areas of those crops were reduced dramatically in the middle of the last century. The main reasons of this process were: absence of knowledge about favourable oil composition of flax, hemp and camelina oil, low price of rape oil and cotton. Nevertheless, last years flax, hemp and camelina attracted a great interest of scientists as well as fibre and oil processors as crops for diversification of agriculture and, in the same time, crops for producing high quality fibre for industry, high quantity oil for biofuel and high quality oil for feeding, food, and pharmacy (source of  $\gamma$ -linolenic acid, linoleic acid and vitamins). At present, flax and hemp are grown in Latvia in very small areas; camelina is not grown commercially in the country at all. Our goal was to explore the potential of flax crops for Latvia agriculture. Available genetic resources of mentioned crops were determined, for most perspective accessions field trials and laboratory investigations (oil content and composition) were carried out. We also looked for a possibility to use biotechnology methods for obtaining additional flax and camelina breeding source material: calli and anther cultures were applied in mentioned crops.

# SPATIAL SCALE DISTRIBUTION OF AQUATIC MACROPHYTES OF LATVIAN STREAMS

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The concept of spatial scale is at the research frontier in ecology. The organism groups proposed by the Water Framework Directive presumably indicate environmental change at different spatial and temporal scales. It is generally assumed that the scale at which different communities exhibit the greatest variation is the scale over which important physical/chemical gradients or biotic interactions control assemblage composition.

This study contributes to the understanding of the variability of macrophyte communities characterizing metrics at different spatial scales. For this purpose, high-quality reaches from medium-sized lowland streams of Latvia were sampled using a nested hierarchical sampling design: (river basin?stream?reach).

A number of different metrics were selected for indicating composition, tolerance and trophic status of macrophyte communities.

Among the macrophyte composition and diversity metrics the largest CV was for Shannon's diversity index, followed by evenness, domination and species number. This group of metrics was more variable in comparison with trophic and tolerance metrics (hemeroby index), except Simpson's diversity index, which was least variable of all calculated macrophyte metrics. The most variable of all metrics was cover of macrophytes.

The groups of macrophyte trophic metrics, composition metrics and combined trophic and composition metrics indicated that there were usually no statistically significant differences among reaches, streams and river basins. Differences between samples occurred for composition metrics in two cases: one at the reach scale and one at the stream scale.

The comparison of species abundance in spatial scale resolution of streams shows that in the upper part dominance of bryophytes is higher than downstream. The dominance of vascular species increased with the distance from the source. In most cases, the number of species indicating higher trophic status is higher in lower reaches than upstream.

# HYDROLOGICAL CONNECTIVITY AND BIOLOGICAL DIVERSITY OF PHYTOPLANKTON COMMUNITIES OF FLOODPLAIN LAKES OF THE MIDDLE DAUGAVA

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Impact of hydrological connectivity on biological diversity of phytoplankton communities of 24 floodplain lakes of the Middle Daugava located in South-east Latvia has been assessed in summer 2004. There were no significant correlations between the degree of hydrological connectivity (long-term mean annual flooding frequency, amplitude of water level variation etc.) and total species richness. The highest average number of taxa (21-22) was observed in artificially isolated as well as in repeatedly flooded lakes. However, the highest biological diversity (the Shannon's index based on individual biomasses of all taxa) was stated in the repeatedly flooded lakes ( $H' = 1,92$ ). Such results could be explained by the long-term impact of the flooding on phytoplankton community composition and coincides with the Intermediate Disturbance Hypothesis in phytoplankton ecology (Connell 1978; Sommer et al. 1993; Reynolds 1993). It also demonstrates the crucial role of natural hydrological connectivity for maintaining high biological diversity in floodplain lakes of the Middle Daugava.

# **POPULATION NUMBERS AND DENSITY OF THE FERAL PIGEON (*COLUMBA LIVIA*) IN VARIOUS TYPES OF BUILDINGS IN GDYNIA, SOPOT AND GDAŃSK (N POLAND)**

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The feral pigeon is a common species in most large cities of all of the world's continents. It has superbly adapted to the urban environment, which provides it with favourable nesting conditions and a rich food base.

A study was conducted in 2006 on the distribution of feral pigeons in three neighbouring cities, Gdańsk, Sopot and Gdynia, which differ in terms of their area, age and architecture. Pigeons were counted in the fall-winter season at their foraging areas, which were searched in each type of district. The feral pigeon population in Gdańsk (area of 262 km<sup>2</sup>) was about 11,000, in Gdynia (area of 136 km<sup>2</sup>) 2,500 individuals, and in Sopot (area of 17 km<sup>2</sup>) 700 individuals. The average population densities were 42.0, 18.4 and 41.2 birds/km<sup>2</sup> respectively.

Feral pigeons most often used old buildings in city centres, where the highest densities of individuals and foraging areas were noted. Densities gradually decreased in the direction of the cities' outskirts and were lowest in villa districts and newly-constructed housing estates. Pigeons were not found in allotment gardens, industrial areas, farmland, and in a number of suburbs located furthest from city centres. Pigeon flocks reached a maximum of 350 individuals, and a minimum of several birds. Flocks of up to 50 individuals were observed most often. Foraging areas occurred most frequently by trash dumps, large shopping malls and recreational areas, for example – city parks.

# GENETIC DIVERSITY IN LATVIAN POPULATIONS OF HIGHLY ENDANGERED PLANT SEA HOLLY (*ERYNGIUM MARITIMUM* L.)

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Sea holly (*Eryngium maritimum* L.) is highly endangered species according to the Latvian legislation. It is found only at two locations in Western part of Latvia, on the Baltic coast, roughly corresponding to the northern margin of the species range. The two populations of the plant together contain less than 100 individuals found on short stretches of ca. 2 – 3 km of the coast. This study is part of a project aiming to characterize diversity of the species, its habitat and to develop recommendations for in situ and ex situ conservation in Latvia. We studied genetic diversity of the chloroplast and nuclear genomes of individual sea holly plants using molecular markers to identify population history of the species and to determine the connection between genetic and geographic distances, as well as to provide rationale for conservation measures. Since little information on molecular markers for *Eryngium* genus is available, several methods are being tested: (a) sequencing of the intron 1 from chloroplast rpl16 gene; (b) Inter Simple Sequence Repeat (ISSR) analyses of nuclear DNA; (c) sequence analysis of Internal Transcribed Spacer (ITS) and Intergenic Spacer (IGS) regions of ribosomal DNA gene cluster; (d) microsatellite analysis using *Eryngium alpinum* microsatellite primers. Of the four ISSR primers tested, only one identified polymorphic DNA fragments between individual plants suggesting low level of diversity in sea holly populations. No correlation was found between genetic and geographic distances, suggesting little differentiation between populations. Chloroplast, ITS and IGS sequence analyses and microsatellite analyses are currently under way. The methods adopted during this study are applicable to other plant species and can be used to study genetic diversity of Latvian flora.

# STATUS AND DISTRIBUTION OF *OSMODERMA EREMITA* AND *CUCUJUS CINNABERINUS* (COLEOPTERA) IN LITHUANIA

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*Osmoderma eremita* and *Cucujus cinnaberinus* are included in Habitat directive Annex II, Lithuanian Red Data book in II (vulnerable) category.

*Osmoderma eremita* in Lithuania are founded in 25 sites. The main localities surrounding Kaunas, Vilnius, Kaišiadorys, Krekenava. The main population of country are in Kaunas oak park and small oak groves in Kaunas area. In Lithuania the species was founded in oak stems (main cases), Acer and Populus (several cases). The best habitat of species are Kaunas oak park, where many of habitable trees, good insolation and no undergrowth bushes. The main protection problem in Lithuania are eliminating old hollow trees ant undergrowth stand.

*Cucujus cinnaberinus* in Lithuania are founded in 7 localities. The main localities are in surroundings of Kaunas in valley of Jiesia and Nemunas rivers. The Kamdã Botanical- zoological preserve are selected for species protection. In Lithuania larvae of *C. cinnaberinus* are founded under bark of *Populus tremula*, *Salix*, *Alnus*, *Ulmus*, *Quercus* and *Prunus*. The main treats for species are eliminating dead and fallen trees.

# **ALLOZYME VARIABILITY OF RED DEER (*CERVUS ELAPHUS*) IN LITHUANIA**

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We investigated tissue and liver of 25 red deers (*Cervus elaphus*). Samples for analysis were collected from 4 localities, 8 different forests, of Lithuania during 2004-2005 hunting seasons. The electrophoresis in polyacrylamid gel of seven isoenzyme systems: esterase (EST), malate dehydrogenase (MDH), malic enzyme (ME), glucozo-6- phosphate dehydrogenase (G6PGD), laktate dehydrogenase (LDH), ksantine dehydrogenase (XDH) and nonspecific protein (NSP) was applied to find out wich of them is the best sutible for genetical investigatios of red deer.

XDH isoenzyme system did not appeared suitable for population analysis. From six protein systems we detected 24 loci, five systems (EST, MDH, ME, G6PGD, NSP) were polymorphic and one (LDH) monomorphic.

The analysis of genotypes showed that the most common genotype in most populations on all loci was BB, the rarest – AF, BD and CF.

It was estimated that the biggest size of polymorphous loci were in two forests (Ažvinčių and Minčios) of Ignalina localities and in two forests (Kalnelio and Prievačkos) of Panevėžys localities (87.5%). The biggest mean allele per locus were in Kalnelio forest population ( $A=2.2$ ). In Ažvinčių, Minčios, Kalnelio, Prievačkos forests in some locus heterozygosis deficiency was detected.

According to our investigation polymorphic loci, the most genetically similar were Prievačkos and Kalnelio red deer populations; the most different were Birželių and Mantvilių populations.

# **DIURNAL FEEDING RHYTHM OF THE BLEAK (*ALBURNUS ALBURNUS* L.) FRY (0+)**

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The feeding peculiarities of Vajuonis Lake bleak (*Alburnus alburnus* L.) fry (0+) are discussed in the work: the quantitative (the intensity consumption of different diet components and feeding rate) and qualitative (the spectrum of diet, the choosing of prey by their size) aspects of diurnal feeding rhythm of the bleak fry are evaluated.

The 244 guts of this species and 36 zooplankton samples were analyzed. According to obtained results, it was defined, that 8 food components, assigned to rotifers, planktonic crustaceans and insects, compose the diet spectrum of the bleak. Also, the detritus was found in the guts. The preys of different size are found in the diet. Between the body size of the bleak and the body size of the prey, the weak statistically valid ( $r = 0,36$ ,  $p < 0,05$ ) correlation was defined. The consumption of certain zooplankton groups varies during the different diurnal period. Statistically valid close negative correlation was defined only between *Daphnia* genus crustaceans biomass in the environment and in the bleaks gut ( $r = -0.84$ ,  $p < 0.05$ ). When the consumption of water fleas grows, then their biomass in the environment decreases. The feeding of the bleak happens periodically with peaks of the intensity in the mornings and evenings.

# ROOT VOLE (*MICROTUS OECONOMUS*) IN SMALL MAMMAL COMMUNITY OF FLOODED MEADOW OF THE NEMUNAS DELTA

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Nemunas Delta Regional Park (W Lithuania) is characterized by exceptional habitat diversity. Flooded meadows in Rusnė Island are bordering with non-flooded meadows and separated by channels and polders. Birds are well known in the area, as site is enlisted as a habitat of European importance and RAMSAR site, but small mammals were scarcely investigated to date. Each year part of the meadows is flooded and re-colonized; migration is inevitable process in small mammal ecology. We also investigated other habitats outside the island, namely forest and grazed meadows.

In May-October 2006, 281 specimen was snap trapped in the area. Absolute dominant was root vole (*Microtus oeconomus*), with the share of 70.8% in the whole area. Two other most numerous species were common shrew (*Sorex araneus*) – 13.5% and striped field mouse (*Apodemus agrarius*) – 9.6%. Share of other species, pygmy shrew (*Sorex minutus*), common vole (*M. arvalis*), water vole (*Arvicola terrestris*), bank vole (*Clethrionomys glareolus*), and harvest mouse (*Micromys minutus*) was negligible. Species diversity was not high (Shannon's  $H=1.4$ ). *M. oeconomus* was even more dominating in the flooded meadows – 78.8% from total catch.

Relative abundance of *M. oeconomus* was highest in flooded meadows – up to 44 individuals per 100 trap days compared to 10–20 in other habitats. In May 2006, a month after spring flood, only 2 *M. oeconomus* individuals were live-trapped in flooded meadow, close to the flood-line. Using capture-mark-recapture methods (Petersen and Schnabel index), number of root voles in July was estimated as  $49.0 \pm 28.0$  individuals, in August –  $144 \pm 0.0$  and in October –  $139 \pm 0.0$  individuals (absolute abundance).

For the first time in Lithuania, data on breeding of *M. oeconomus* were collected (32 cases). We found litter size differences according to the season and habitat. Totally, litter size of *M. oeconomus* in flooded meadows was  $5.87 \pm 1.10$  (2–11), while that in non-flooded meadows –  $6.20 \pm 0.38$  (3–10) embryo. In May, litter size was higher in flooded meadows –  $10.0 \pm 1.0$  vs.  $7.75 \pm 0.63$  embryo. May is the start of migration to formerly flooded areas; thus, higher reproduction rates are in accordance with expansion to empty habitat. Breeders are over-wintered individuals with highest potential. Later on, in July, August and October, litter size was bigger in non-flooded meadow ( $5.90 \pm 0.41$  vs.  $4.50 \pm 0.85$  embryo). As area of the flooded meadows is limited, reaching near carrying capacity limit poses disturbances to breeding and diminishes litter size. In August, differences in litter size were statistically significant for the flooded and non-flooded meadows. The same conclusion is confirmed by corpora lutea count, which shows potential litter size; the difference with real number of embryo indicates, how many of the embryos remain not implanted.

# **SELF-PURIFICATION ABILITY OF THE SŁUPIA RIVER (POLAND); NUTRIENT DYNAMICS IN RIVER**

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The natural self-purification process in water is very complex and is consisting of various factors (physical, chemical and biological). the ability of water to remove the polluting levels of biogens play important role in the improvement of water quality.

The self-purification ability of Słupia River (Central Pomerania, Poland) has been investigated. In order to determine the changes of water quality, a fragment of the river (about 5 km length) was selected. The water samples were taken along the course of the river (6 points). Phosphorus (P-total, phosphates) and nitrogen forms (N-total, N-NO<sub>3</sub>; N-NH<sub>4</sub>), dissolved oxygen, electronic conductivity and temperature were measured. A significant differences of concentration has been observed for total phosphorus and dissolved oxygen concentration. Moreover the seasonal difference of the water quality changes were observed.

# THE SPATIAL ALLOCATION OF DRAGONFLIES (ODONATA) COMMUNITIES IN RAISED BOGS OF LATVIA

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The communities of different dragonfly species and their spatial allocation have been poorly studied in Latvia. Research in dragonflies 'communities' spatial allocations in bogs were undertaken in Sudas bog, (Cēsis district), Taures bog (Valka district) and Lielais Ķemeru tīrelis bog (Tukums and Rīga districts) in 2005 - 2006. Individual researches were taken also in other bogs of Latvia.

Research surveys included quantitative adult registration along 100 m long patches inspection. Sloughs registration in several habitats or groups of species has been done additionally. Different characteristic bog habitats were selected as patches for examination: large water pools complexes in open bog areas, lakes in the bogs inclusive lakes with woody coasts, lake with woody coasts located at the edge of bog, the watercourse at edge of bog, beavers over flooded watercourse in the dif of bog, complexes of water pools with woody edges and water pools in the middle of the wood.

26 dragonfly species were examined during current research: 20 species in Sudas bog, 6 species in Taures and 13 species in Lielais Ķemeru tīrelis bog. Major diversity of species has been registered near the watercourses with rich vegetation (14 species) and in large complexes of water pools (10 species). Lower diversity has been confirmed in bog lakes situated on open areas (7 species) and in open patches of the bog without water pools (3-4 species).

*Sympetrum danae* has been registered in all examined patches of Sudas bog, *Libellula quadrimaculata*, *Lestes sponsa* and *Enallagma ciathigerum* – in 80 % of examined patches of Sudas bog. Meanwhile, *Anax imperator* was found only in water pools, but *Pyrrhosoma nymphula* – along watercourses with grassy coasts. Due to sloughs research also *Aeshna subarctica* was registered but during adult registration this species was found only in Taures bog.

# DATA ON DISTRIBUTION, ECOLOGY AND CONSERVATION OF *BOROS SCHNEIDERI* (PANZER, 1796) (COLEOPTERA, BORIDAE) IN LITHUANIA

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*Boros schneideri* (Coleoptera, Boridae) is an endangered insect species listed in the Annex 2 of the European Union Habitat Directive. Earlier being inhabited all boreal and mixed forest zones, in ES *B. schneideri* has survived in Slovakia, Czech Republic, Poland, Lithuania, Latvia, Estonia, Finland and Sweden only. Nearly in all of these countries *B. schneideri* is characterized as a very rare and disappearing species.

Situation of *B. schneideri* in Lithuania at present is better. Fifty seven finding sites are reported since the first detection of this species in 1972: 13 in Jurbarkas, 4 in Tauragė, 15 in Varėna, 1 in Šalčininkai, 1 in Kaišiadorys, 15 in Švenčionys, 1 in Molėtai, 6 in Ignalina and 1 in Utena district. Population of *B. schneideri* in Lithuania is possibly the largest one in EU.

All specimens were found under the bark of died *Pinus sylvestris*. In 2006 the characteristics of 47 trees inhabited by *B. schneideri* larvae were analyzed. Suitable for larvae were dead standing trees with the trunk diameter exceeding 14 cm at breast level (as an exception 1 larvae was found on the trunk with diameter 8 cm), the bark getting easy to peel and damp layer under the bark. Fifteen percent of 47 trees inhabited by *B. schneideri* larvae were single trees left in clear-cuttings, 48 % were situated in *Vaccinio vitis-idea-Pinetum*, 11 % in *Vaccinio uliginosi-Pinetum* and young cultural forest, 7 % in *Ledo-Pinetum*, 4 % in *Cladonia-Pinetum* and *Vaccinio myrtilli-Pinetum* biotopes.

Since 1989 *B. schneideri* is listed in the Red Data Book of Lithuania. In 2005 four Natura 2000 localities are established in Čepkeliai (12 857 ha) and Viešvilė (5 693 ha) Strict Nature Reserves, Dzūkija national park (55 850 ha) and Labanoras regional park (52 976 ha) in order to conserve this species.

Consequently, *B. schneideri* is depended on short-term habitats under the bark of died trees. We are initiating the project to study the process of the formation of such habitats and the ability of *B. schneideri* to use them in various types of forests as well as impact of different forestry schemes. Colleagues from other countries are especially welcome to join this project.

# COMPARISON OF STATE ENVIRONMENTAL POLICY AND ENVIRONMENTAL AWARENESS OF LITHUANIAN PUBLIC

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Openness of policy, information rights, and formation of reasonably positive public opinion about state policy nowadays are topical aspects in the democratic society. Environmental policy is not an exception. In this study we tried to learn how effectively Lithuanian public was informed about its' environment (three components – air, water, forest and the last 15-year-long period were chosen), and what is public opinion. An interview method was used to collect the study material (320 respondents over 18 years were interviewed in different places of Lithuania).

Opinion of the respondents on increased pollution is opposite to the data of Statistic Department of Lithuania. This may mean that general public was not informed enough on the effectiveness of environmental protection activities, thereby the negative opinion was formed. The same opinion was expressed on the forest dynamics: 83,8% of respondents supposed that forest area declined during the last 15 years when statistical data clearly show its enlargement.

We tried to ascertain the public environmental awareness by finding their willingness to pay for environment improvement additionally than they pay in a form of taxes.

It is clear, that a number of respondents would agree to pay additionally for better quality of environment. We left some space near the answer “other” for comments. Not many of respondents used this possibility, but their comments were valuable. Almost all of respondents wrote they could pay more than listed sums, but they wanted to be sure about appropriate use of their money. Does this mean distrust of authorities? About one tenth of respondents did not want to pay at all.

Opinion on the importance of environment protection was revealed as a choice of most important policy fields. Respondents were asked to choose 3 most important out of 10 fields. Main concern areas were: health service (73,8%), environment protection (62,2%) and education (47,2%). Thus, environment protection was ranked as second important field.

Does the situation mean that environmental policy is wrong, or there is a lack of available popular information sources? We conclude, that better knowledge of environmental problems may help to form public opinion on the environmental policy.

# **WOLF SITUATION, CONSERVATION AND ACCEPTANCE: COMPARISON OF SOUTH EAST LITHUANIA AND NORTH EAST POLAND**

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The recent accession to the European Union by Poland and the Baltic States has been beneficial for large carnivore conservation. Across Poland and Lithuania a number of important wolf habitats were designated as Natura 2000 sites. The main differences in carnivore management politics are full wolf protection and damage compensation in Poland vs. unrestricted hunting in Lithuania. Two regions compared – SE Lithuania (SEL) and NE Poland, Suwalki (NEP) are comparable in social and cultural aspects, as in both regions national minorities are abundant. 431 respondents expressed their views on the natural environment and its management, wolf acceptance according their numbers, distances and predatory behavior. Questioning was done in 2003–2005. Distribution of the respondents according their age and residence was similar. Respondents from NEP were characterized by the higher level of education.

Concerning acceptable distances, 21% of the respondents from SEL would like to see wolves inhabiting areas further than 10 km from their residence, compared to 42.5% of the respondents from NEP (chi-square=22.7,  $p<0.001$ ). Previous analysis gives a background for suspicion of the NIMBY (Not In My Back Yard) syndrome, when people are accepting environment protection only in the case it occurs somewhere else. Data from the carnivore acceptance in Lithuania and Estonia showed, that urban dwellers are more positive than rural ones (Balčiauskas et al., 2005). Option to increase the number of wolves was acceptable to 26% of respondents from NEP (compared to 14% from SEL,  $p<0.002$ ). Option to decrease the number wolf number was a choice to 41% of respondents from SEL (compared to 21% from NEP,  $p<0.001$ ). In both countries existence of wildlife was highly valued, though acceptance of the animal rights was different. More SEL than NEP respondents agreed, that wildlife has got the same rights for the existence as humans (chi-square=21.2,  $p<0.001$ ). NEP respondents put human rights in the higher priority ( $p<0.001$ ).

We raise hypothesis that the differences in wolf acceptance between two compared regions are based on: (1) –higher quantity of the literature available in Poland; (2) – wolf damage compensation in Poland and (3) – differences in species protection (fully protected in Poland and hunted in Lithuania).

This study was partially supported from the project “Large carnivores in northern landscapes: an interdisciplinary approach to their regional conservation”.

# PARAMETERS OF VASOMOTION IN MESENTERIC ARTERIOLES IN DIFFERENT FUNCTIONAL STATES OF THE DIGESTIVE TRACT IN FROG (*RANA TEMPORARIA* L.)

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The investigation both in vitro and in vivo was done now in microcirculation and in arterioles of muscles of warm-blooded animals. However the cold-blooded animals are also interesting for investigation. Hypothesis of the work: if the bad of the vessel is hyperemated, the character of vasomotion is different from the one in case of lower blood flow. Intensity of blood flow to digestive tract depends on intensity of digestion process (). Therefore two experimental groups were made: first – frogs with full digestive tract, second – frogs with empty digestive tract. The aim of the work was to explore parameters of vasomotion in mesenteric arterioles in different functional states of the digestive tract in frog (*Rana temporaria* L.). Method: denervated *Rana temporaria* L. males (weight -  $35 \pm 2$  grams) were used for the studies in August and September. The object of experiment was mesenteric arterioles ( $\approx 75-125 \mu$ ). An intravital videomicroscopy method was used for the work. The video records were processed with “frame by frame” method, spectral analysis, correlation and two way analysis of variance. The results: vasomotions with bigger mean amplitude in % from blood vessels in which vasomotion was observed ( $3,01 \pm 0,16\%$ ) than in blood vessels with lower blood flow ( $1,98 \pm 0,21$ ) prevailate in hyperemated blood vessel bad. However vasomotions with smallest periods ( $T < 19s$ ) increase for hungry animals.

# IMPACT OF CHANGES IN AGRICULTURE ON THE CORNCRAKE *CREX CREX* (L.) POPULATION IN LATVIA

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Data on distribution of the Corncrake in Latvia were collected in 2000–2004 by using standardized atlas methods in 5X5 km square grid. Corncrake was observed in 1960 squares (70.4 % of the territory of the country). In comparison to data of 1980–1984 distribution has increased by 48.8 %. Corncrake numbers and agricultural land use were monitored in 69 freely chosen sample plots (0.63–45.05 km<sup>2</sup>; mean=8.39; SD=7.409) in Latvia 1984–2005. Annual TRIM index of Corncrake numbers in Latvia has increased significantly during the study period ( $r=0.67$ ;  $p<0.0008$ ), significantly increased also mean breeding density of the Corncrake in 6 long-term sample plots in 1990–1997 vs 1998–2005 ( $t=3.868$ ;  $n=14$ ;  $p<0.002$ ). During the study period the annual TRIM index of the area of all abandoned agricultural lands combined has increased significantly ( $r=0.77$ ;  $p<0.0006$ ) in the survey plots, increased as well has the area index of uncultivated meadows ( $r=0.55$ ;  $p<0.03$ ), but the area index of cultivated pastures ( $r=-0.60$ ;  $p<0.02$ ) and the area index of intertilled crops has decreased ( $r=-0.47$ ;  $p<0.07$ ). Habitat specific annual TRIM index of Corncrake numbers were positively correlated with TRIM index of the area of uncultivated meadows ( $r=0.78$ ;  $p<0.0004$ ), all meadows combined ( $r=0.66$ ;  $p<0.005$ ), abandoned agricultural lands ( $r=0.69$ ;  $p<0.003$ ) and uncultivated pastures ( $r=0.63$ ;  $p<0.04$ ), but negatively – with TRIM index of the area of intertilled crops ( $r=-0.28$ ;  $p<0.03$ ). Negative correlation between amount of pesticides used and Corncrake numbers was found in Snēpele sample plot ( $r=-0.48$ ;  $p<0.05$ ). Obtained data show tendency to observe more Corncrakes in Latvia in years, when there are high amount of precipitation during the Corncrake breeding season. The highest breeding density (on average – 3.05 males/sq.km) was observed in abandoned grasslands, followed by uncultivated meadows (2.85); abandoned arable lands (2.73); cultivated meadows (1.61); other (miscellaneous) habitats (1.60); uncultivated pastures (1.35); shrubland (1.27); winter crops (1.14); cultivated pastures (0.72); spring crops (0.70); intertilled crops (0.12). By analyzing 3300 Corncrake registrations, more Corncrakes than expected were observed in abandoned grasslands, uncultivated meadows and abandoned arable lands ( $p<0.001$ ), but Corncrake numbers were smaller in winter crops, cultivated pastures, spring crops and intertilled crops ( $p<0.001$ ). Population size of the Corncrake has increased in Latvia since 1996 and is estimated to be 48000–58000 calling males in 2004. Despite the recent increase of the Corncrake numbers in Latvia, projected long term dynamics since 1925 show significant decrease in numbers ( $r=-0.92$ ;  $p<0.00001$ ) due to decrease of area of meadows and pastures.

# THE DIVERSITY OF *LISTERIA MONOCYTOGENES* ISOLATES TAKEN FROM FIVE SALMON PROCESSING PLANTS IN NORWAY

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*L. monocytogenes* is regularly isolated from the fish processing industry in Norway. Post-process contamination of food with *L. monocytogenes* represents a serious problem because of its ability to survive and grow at refrigeration temperature. Cold-smoked fish products are foods of particular concern due to the lack of a heat inactivation step during processing. The European Commission has established a general limit of 100 cfu/g *L. monocytogenes* throughout the shelf-life for ready-to-eat foods able to support the growth of the bacterium. This recommendation is based on epidemiological data indicating that *L. monocytogenes* represents a very low risk for all population groups when the concentration is below 100 cfu/g.

Five salmon processing plants were investigated over a period of 8 months for the persistence of *Listeria monocytogenes*. A total of 226 strains of *L. monocytogenes* were subtyped with the automated DuPont Qualicon RiboPrinter® system. The 226 *L. monocytogenes* isolates could be divided into 16 DuPont ribotypes. Four subtypes were persistent in the five plants. DUP-1023C persisted in both plant A and B with 33 of 75 (44%) and 17 of 35 (49%) samples respectively. In plant C, DUP-1046A persisted with 39 of the 60 samples (65%). In plant D the DUP-1039C persisted with 17 of 31 samples (55%) and in plant E the DUP-1062B was persistent with 24 of the 25 samples (96%). In plant A and C, DUP 1053B and DUP 1062C were isolated regularly with 12 (16%) and 13 (22%) of the samples respectively. The remaining 10 ribotypes were found sporadically. Both DUP-1045B and the persistent subtype DUP-1039C were found in four of the plants. DUP-1038B, DUP-1039C, DUP-1045B and DUP-1046A are associated with human listeriosis in Norway the last 10 years with 22, 14, 7 and 1 case respectively. *Listeria* species have the ability to make biofilm and colonize the processing environment. The distribution of the DUP ribotypes indicated that specific subtypes of *Listeria monocytogenes* can exist in the processing environment for long periods. Four persisting strains were isolated in the plants, and two strains were found regularly. They have probably established themselves in specific niches of the plant and are not eliminated by the cleaning and sanitizing procedures used. It is likely that these strains play an important role in the formation of biofilm.

# ORGANIC CARBON FLOWS AND LOADING TO WATERS

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Dissolved organic carbon (DOC) is an important component of solutions in terrestrial and aquatic ecosystems as far as it is one of key elements in the carbon biogeochemical cycling and its influence on acidity and mobility of nutrients and contaminants. DOC contains a range of organic compounds, from simple sugars to complex fulvic and humic acids. Concentrations and composition of DOC change as a result of both biotic and abiotic processes when it moves through the ecosystem. Despite considerable information on various aspects of DOC cycling, little is known about the nitrogen fraction of DOC. DOC in streams fuels bacterial production, and the addition of labile DOC can stimulate the productivity of multiple trophic levels in streams. Natural DOC in streams ranges from labile forms, such as simple sugars and organic acids, to highly refractory forms, such as humic acids. The composition of the DOC pool is determined largely by DOC sources. Allochthonous sources of DOC in streams include soil leachates and the breakdown of particulate organic matter, and this DOC can vary widely in chemical characteristics. Autochthonous sources of DOC can also be substantial and often include labile forms of DOC that are readily used by heterotrophic bacteria. The dynamics and biogeochemistry of DOC is essential to understand the mechanisms regulating DOC export from catchments and so there is a need for an interdisciplinary approach, which combines (1) the identification of water flow paths through the catchment with (2) the analysis of the composition of stream water DOC as an indicator for the DOC origin. DOC flows in the same time largely depends on climatic factors.

# **DEVELOPMENT OF WATER BODIES AT THE PEAT EXTRACTION SITES IN THE SEDA MIRE**

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Seda mire is located in North Vidzeme, Valka district. The territory of the Seda mire is 7582 ha. It developed as a result of paludification of land after the Ice Age and partially overgrown lakes. The intensive peat extraction carried out until today has destroyed the original ecosystem of the territory. The aim of the study was to evaluate the development of water bodies at the peat extraction sites. During the study period analyses of water chemical composition, microbial organisms, phytoplankton, zooplankton, the benthic invertebrates and macrophyte composition from the different water bodies were carried out. Water bodies represented different patterns and development stages of wetland regeneration. The survey revealed that all studied lakes can not be considered as typical bog lakes regarding hydrochemical and hydrobiological features. In the nearest future, the recultivation aim – natural regeneration or managed activities – for cutaway peatland should be defined.

# **MONITORING OF THE POPULATION OF *BLUMERIA GRAMINIS* F.SP. *HORDEI* IN THE SOUTH-EASTERN PART OF LATVIA IN 2006**

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Monitoring of the population of *Blumeria graminis f.sp. hordei* in the South-Eastern part of Latvia in 2006 is a part of long-term observations of this population, which was done since 1995. In 2006, samples of the pathogen were collected both in sporulation and cleistothecia from commercial barley fields near the town Daugavpils. Barley leaves with well-developed pustules (phase of sporulation) or cleistothecia (phase of cleistothecia) were used only. For virulence detection the microinoculation technique was used. Frequencies of virulence genes, pathotypes and their complexity were calculated. Genes Va1, Va3 and Va13 were presented with medium-high frequencies and frequencies of Va6, Va7, Va9, Va12, Vk and VLa ranged from medium-high to high as well as last several years. Tendency to increasing of virulence frequencies for genes mentioned above observed in the phase of cleistothecia. Similar tendency of virulence increasing during the growing season were detected earlier, as well. Resistance factors from 'Steffi', 'Goldie' and 'Meltan' are still effective, corresponding virulence genes are presented with low-medium frequencies. Not any isolate with the correspondent virulence for S11 was detected in the pathogen population in 2006. Large number of pathotypes were detected what reflects wide genetic diversity in the pathogen population.

# **DIVERSITY DECREASES COMPETITION: AN EXAMPLE OF MIXED-SPECIES BIRD FLOCKS**

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Competition is a biological interaction between individuals or populations for a limiting resource, resulting in a reduced fitness of all parties involved. Several Parus species live in small, coherent winter flocks which are structured by intraspecific and interspecific competition. Ecological benefits of gregariousness have generally been coined in terms of either improved predator protection like "many eyes" hypothesis or improved efficiency at locating food such as local enhancement. Heterospecifics in such mixed-species groups are considered to substitute for conspecifics as predator protection at low competition cost. We present some new data showing less severe competition in multi-species groups vs groups consisting of individuals belonging to just one or two species.

# PECULIARITIES OF ORGANIC MATTER MINERALIZATION IN BOTTOM SEDIMENTS OF THE CURONIAN LAGOON (LITHUANIAN PART)

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The Curonian lagoon lies on the SE Baltic Sea coast of Lithuania and the Russia. The total area of the lagoon is approximately 1610 km<sup>2</sup> (Lithuanian part – 413 km<sup>2</sup>). It is a shallow (mean depth 3.7 m) water body, separated from the brackish Baltic Sea by the narrow (0.4-3.8 km) Curonian Spit. The southern and central parts of the lagoon contain freshwater due to discharge from the Nemunas River, while the salinity in the northern part varies from 0 to 8 PSU. It is very productive, complicated and unstable ecosystem, which changes due to Baltic Sea intrusion and river Nemunas inflow. High nutrient load from the land as well as human activity (recreation, fishery, navigation) in the Curonian lagoon causes anthropogenic stress and eutrophication. The dynamic of water masses, sedimentation rates, the relief of bottom, flow of different substances impacts the formation of bottom sediments structure as well as the peculiarities of organic matter mineralization and its intensity. Sediment organic matter can be a source of “recycled nutrients” for water column productivity (including algal bloom) when it degrades and may cause secondary eutrophication. Sulphate reduction also promotes the release of P from sediments because some iron oxyhydroxides that bind phosphate are converted to iron sulphides that cannot bind P (Roden, Edmonds, 1997).

In 2001, 2003 and 2006 during summer vegetation season investigations of organic matter mineralization processes (aerobic and anaerobic decomposition as well as terminal anaerobic – sulphate reduction) have been carried out in different types of bottom sediments located in various parts of the lagoon.

The major types of recent bottom sediments of the lagoon are medium and fine sands, coarse silt and fine silty mud. The fine sand occupies the largest part of the bottom. Silty mud is more characteristic to the western part of the lagoon in nearshore zones. Some areas of the bottom are covered with molluscs *Dreissena polymorpha* (Trimonis et al., 2003). The activity of benthic microorganisms, which took place in breakdown of organic matter, mainly depended on environment conditions in bottom sediments – temperature, pH, redox potential, as well as the amount and qualitative composition of organic matter. The amount of organic carbon in silty mud was rather high (10-11 % DW). Though in fine sand, coarse silt or bottom covered with molluscs the amount of C<sub>org</sub> was 2.5 - 16 times lower. Rates of total and anaerobic organic matter mineralization as well as sulphate reduction reach its highest values (in average accordingly up to 1.5 and >1 g C/m<sup>2</sup> d<sup>-1</sup> and > 1.5 mg S<sub>2</sub>-/dm<sup>3</sup> d<sup>-1</sup>) in silty mud as well. Anaerobic bacteria prevailed in this area. However, aerobic bacteria were more active in fine sand, where rates of aerobic mineralization were highest (in average >100 mg C/m<sup>2</sup> d<sup>-1</sup>). Sufficiently high rates of organic matter mineralization took place in coarse silt or covered with molluscs bottom sediments situated in eastern part of the lagoon. In this place both aerobic and anaerobic bacteria were active in mineralization process of organic matter.

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Trimonis E., Gulbinskas S., Kuzavinis M. 2003. The Curonian Lagoon bottom sediments in the Lithuanian water area. *Baltica*, ISSN 0067-3064, 16: 13-20.

# **CHANGE OF FOREST ECOSYSTEMS STRUCTURE OVER LAST 80 YEARS IN VIDZEME UPLAND (POSTER PRESENTATION)**

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Forest development analyses are carried out for last 80 years in study area located in Vidzeme upland, NE of Latvia. Applying GIS tools forestry management data are compared at stand level. Number of forest stands is increasing and age structure has become more diverse though area of old growth is reduced at a level of whole study area. Sites where low intensity forest use performed are more diverse in terms of tree species richness and number of age classes presented. Tree species' composition is changing, and spruce proportion is increasing though high proportion of deciduous species is still high in old growth stands. Relation between aspen and birch is changing, increasing proportion is observed to latter in stands unmanaged during the period. Parcels formerly used for agriculture are covered by forest now, and diversity of age classes is higher comparing to forest stands developed after clear felling. Areas established for conservation of biodiversity during Woodland Key Habitats inventory are coinciding with areas identified by our analyses as stands that are excluded out of intensive forest management.

# AN ASSESSMENT OF MOLLUSCS SPECIES DIVERSITY IN DRISVIATY LAKE REGION (BELARUS)

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This paper presents the results of the studies carried out at the transboundary wetland complex of international importance shared between Lithuania and Republic Belarus. The assessment of the molluscs' species richness was focused on samples from Drisviaty Lake, Richanka and Drisviata rivers (Western Dvina catchment basin). Our purpose was to complete of the existing data on molluscs species diversity available for this area. The basic state of aquatic animal investigation in the Drisviaty Lake has been studied in the late eighties. However the information available for malacofauna of the Belorussian part of the area proposed for including to Ramsar site list was not sufficient to the clarification of the mollusks species richness as one of the most diverse animal phylum. Taxonomic studies of this kind are significantly important for determination of the guidelines for conservation efforts and management.

Forty-five species of mollusca were recorded in the area of investigation. Three different and diverse molluscan groups were obtained in river system, from limnium habitats and from marshy woodland area. In the context of these notes it is essential that this region characterized by the high species diversity of freshwater mollusks.

It was recognized eleven species of freshwater sphaeriid bivalves, which it seems, appears one of a poorly known mollusks in Belarus. It is worth that sphaeriid clams (*Pisidium*) were more diverse in riverine ecosystem. In the Drisviaty Lake *Pisidium* was found only at littoral site.

There was revealed mollusk *Marstoniopsis scholtzi* for the first time for Belarus. At present occurrence of this species is known only from Drisviaty Lake and Richanka river.

The suggested list includes seven threatened molluscs' species having both nationally and across Europe protected status: *Anisus vorticulus*, *Gyraulus laevis*, *Gyraulus rossmaessleri*, *Pisidium pseudosphaerium*, *Pisidium hibernicum*, *Pisidium moitessierianum*, *Pisidium tenuilineatum*.

As a result the most of the information applied to the area investigated suggested that it is an important region for conservation and development of cross-border cooperation by management-oriented scientific research in Baltic Region. In this study the Lithuania-Belarus cross-border integrated research cooperation was realized under BALTIC SEA REGION INTERREG III B PRIORITY III A SOUTH NEIGHBOURHOOD PROGRAMME.

# **GEOGRAPHIC INFORMATION SYSTEMS (GIS) – EFFECTIVE SOLUTION IN LANDSCAPE ECOLOGICAL PLANNING**

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So far in Latvia, nature conservation policy and development of management plans for protected nature areas mostly have been based on the principle of protecting species and habitats. This approach usually ensures protection of individual ecosystem components, but does not guarantee the overall conservation of biological diversity. Landscape-level ecological planning is based on the analysis of the landscape, a structure of the ecosystem and its encompassed energy flows and interactions, and which considers to a large extent biotic, abiotic, socio-economic and cultural factors. Geographic information systems (GIS) provide effective Landscape planning considering variety of influenced factors and different scales. Research are based on experience from Landscape Ecological Plan prepare for the North Vidzeme Biosphere Reserve.

# COMPARISON OF NATIVE LATVIA WILLOW SPECIES AND BREEDED WILLOW CLONES IN SHORT ROTATION ENERGY PLANTATIONS

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Up to now, *Salix viminalis*, *Salix dasyclados* and *Salix purpurea* are successfully cultivated in plantations in Latvia. For producing fuel wood, also other quick-growing species and hybrids could be suitable, which easily take root and do not form too many shoots from one shrub, which makes the harvesting easier. In Sweden, in energy wood plantations, different *Salix viminalis* hybrids with *Salix triandra* clones are used, as well as *Salix dasyclados* hybrids with other species. The present study gives a comparison of suitability native Latvia willow species *Salix viminalis* x *Salix dasyclados*, *Salix burjatica*, *Salix triandra*, *Salix bicolor*, *Salix petandra*, *Salix phylicifolia*, *Salix fragilis* and willow clones Tora, Tornhild, Sven selected in Sweden for the arrangement of energy wood plantations in Latvia.

# ON HELMINTHS FAUNA OF MUSKRAT (*ONDATRA ZIBETHICUS*) IN LITHUANIA

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The muskrat (*Ondatra zibethicus*) is semi-aquatic rodent native for North America, in twentieth century it was introduced in Europe. The aim of the study was to examine helminths of muskrat in Lithuania.

37 muskrats were examined for helminths. We used the method of total helminthological dissection of individual organs. The intestines, stomach and other internal organs were examined. The content of the intestines and stomach was studied by method of consistent flushing.

According to the number of species trematodes specific to waterfowl, but also infecting mammals living in the same environment, dominate helminth fauna of muskrat.

# **RESISTANCE TO LOW TEMPERATURES OF RHODODENDRONS (RHODODENDRON) IN THE BOTANICAL GARDEN OF ĐAULIAI UNIVERSITY IN 2002-2006**

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Rhododendrons are not native to Lithuania, but are often cultivated in botanical gardens, various public and private green plantations. Resistance to low temperatures are among the most important criterion evaluated condition of rhododendrons collection in the Botanical Garden of ĐU. The research initiated at the ĐU Botanical Garden will help in selection and propagation of ornamental, tolerant to low temperatures representatives of species and cultivars, suitable for cultivation in northern Lithuania

# SEASONAL DYNAMICS OF HERBACEOUS VEGETATION IN DECIDUOUS FORESTS OF KAMĖA BOTANICAL – ZOOLOGICAL RESERVE

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The aim of this work was to determine seasonal dynamics of the 2006 year herbaceous vegetation in the deciduous forests in Kamėa botanical - zoological reserve. The object of the work is Kamėa zoological-botanical reserve situated near Kaunas. Investigations were done during vegetation period of 2006 year. The dates of phenological appearance and projection cover were recorded. The spectra of vegetation and flowering were made. It was determined, that projection cover of the plants changed during the vegetation period. The largest projection cover of the ephemeroïds *Anemone ranunculoides*, *A. nemorosa*, *Corydalis solida*, *Ficaria verna* was in spring. *Mercurialis perennis*, *Polygonatum multiflorum*, *Aegopodium podagraria*, *Pulmonaria obscura*, *Stachys sylvatica* had the largest projection cover in summer. The April of 2006 was cold, so plant species began flowering a week later than usually. The flowering of the herbaceous species in the forest depended on tree foliation. The most plant species flowered in spring, when trees were still without leaves. Only in this period vernal ephemeroïds are flowering of in the deciduous forests. The time and length of plant flowering and vegetation depended on the sum of active temperatures. In 2006 the sum of active temperatures in appropriate period (from the end of April till the middle of October) was higher than average, consequently, the development of plant species was faster and phenological phases was shorter.

# DISTRIBUTION, HABITATS AND NATURALISATION OF *EPILOBIUM CILIATUM* RAF. IN LITHUANIA

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*Epilobium ciliatum* Raf. (syn. *E. adenocaulon* Hausskn.) is in Europe an invader originating from North and South America (Haussknecht, 1884). The first sample in Europe was found in Great Britain in 1889. This species has speeded since this time in many European countries and occurs both in anthropogenic and in natural habitats (Strgulc Krajček et Nejc, 2004). *E. ciliatum* was found in Lithuania in 1926 (BILAS). According to the references, this species is diffusely speeded throughout the whole territory and occurs mostly in anthropogenic habitats, such as waste lands, ditches, road sides, forest cutting areas, railways (Gudþinskas, 1998). This author refers only to one type of natural habitats: banks of water bodies. However, there are references about spreading of *E. ciliatum* in Europe in many natural habitats (Smejkal, 1997). The aim of this work is to specify the character of *E. ciliatum* distribution in the territory of Lithuania and establish the spreading in natural plant communities.

The distribution of *E. ciliatum* was evaluated according to the data on revision of all specimen of the genus *Epilobium* in the herbaria of the Institute of Botany (BILAS), Vilnius University (WI) and the Station of Nature Investigations and Ecological Education of Marijampolė as well as 124 specimens of *E. ciliatum* collected by the author in different parts of Lithuania in 2003–2006. To characteristic plant communities, phytocoenological records were made applying Braun-Blanquet (1964) methodological guidelines.

It was established that *E. ciliatum* is found throughout the whole territory of Lithuania, but the number of localities in different parts of the country is not equal. It is determined by the objective and subjective causes. The most important objective causes are the different areas occupied by natural and anthropogenic habitats, irregular hydrographical network and different geomorphologic characteristics of river valleys in various parts of the country. *E. ciliatum* is especially frequent in the territories with abundance of wet habitats such as banks of water bodies and periodically flooded habitats. This species is especially frequent in flooded river valleys. Abundance of such habitats is typical for the eastern part of Lithuania. The main subjective causes are unequal investigation of the territories, habitats and plant communities. Distribution of *E. ciliatum* in arable fields has not been investigated in Lithuania yet. Bearing on the solitary specimens from the gardens and from virgin clayey soils we can suppose that this species may be found in many districts of Central and Northern Lithuania where clay and loam soils with setal vegetation prevail.

The most identified anthropogenic habitats of *E. ciliatum* are open. The most frequent habitat among them is forest cutting area. *E. ciliatum* is not widely distributed on road sides, in ditches, on virgin soils, railways, rarely found in exploited peatlands and urban territories, scrapheaps and fireplaces.

Natural habitats of *E. ciliatum* are both open and shaded, but in open habitats these plants are found more frequently and more abundantly. The most frequent open habitats are wet and alluvial meadows, banks of the rivers and lakes, wet surroundings of the lakes, flooded depressions. Some rarer the species is found in fens and springy habitats. In shaded habitats *E. ciliatum* occurs in primary swamp and wet deciduous or mixed forests, alluvial *Alnus glutinosa* stands, in secondary birch woods with *Picea abies* and in riverine shrub

thickets. Sometimes the species is found in shaded lags of the bogs.

Natural plant communities with *E. ciliatum* belong to 8 vegetation classes: *Isoeto-Nanojuncetea bufonii* Br.-Bl. et R. Tx. 1943, *Phragmito-Magnocaricetea* Klika in Klika et Novak 1941, *Montio-Cardaminetea* Br.-Bl. et R. Tx. 1943 ex Klika 1948, *Scheuchzerio-Caricetea nigrae* (Nordhagen 1936) R. Tx. 1937, *Molinio-Arrhenatheretea* R. Tx. 1937 em. R. Tx. 1970, *Alnetea glutinosae* Br.-Bl. et R. Tx. 1943, *Vaccinio-Piceetea* Br.-Bl. in Br.-Bl. et al. 1939, *Quercu-Fagetea* Br.-Bl. et Vlieger in Vlieger 1937. The most frequently and abundantly *E. ciliatum* occurs in the communities of *Calthion palustris* R. Rx. 1937 em. Lebrun et al. 1949 alliance, especially in *Deschampsietum cespitosae* Horvatić communities. Rather frequently but not very abundantle these plants grow in the communities of *Phragmition australis* W. Koch 1926 (Ass. *Glycerietum maximae* Hueck 1931, sometimes Ass. *Catabrosetum aquaticae* Rübel 1912) and *Magnocaricion elatae* W. Koch 1926 (Ass. *Caricetum paniculatae* Wangerin 1916 ex v. Rochov 1951, Ass. *Caricetum rostratae* Rübel 1912, Ass. *Caricetum vesicariae* Br.-Bl. et Denis 1926, Ass. *Phalaridetum arundinaceae* Libbert 1931) alliances.

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# SUCCESSION OF ORIBATID MITES IN LANDFILL SOILS REMEDIATED WITH SEWAGE SLUDGE

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One of the measures to convert landfill sites into usable soil is their amendment with sewage sludge. During sludge degradation, successive processes of zoocenoses are involved. Studies on separate soil invertebrate species and their complexes provide sufficient information about the processes occurring in soil. This paper analyses the tendencies of biological processes in landfill soils amended with municipal sewage sludge considering the changes in the structure of oribatid mite (Acari: Oribatida) complexes.

Studies were carried out in the Bukiškės and Nemenčinė landfills (Vilnius district) during the 1–2 and 5–6 years after their amendment with sewage sludge. Species composition and abundance of Oribatida, as well as physicochemical characteristics of the developing soil, were determined.

In the Bukiškės landfill site, following the first year of its amendment, the overall abundance of microarthropods was 916.2 thousands of ind./m<sup>2</sup>, with Acaridiae being dominant among them. Only single individuals of other microarthropod groups were found. In the second year, the abundance of Collembola (74.7%) increased in the landfill soil. Significant changes in the structure of microarthropod complexes were observed in the Nemenčinė landfill of domestic waste five years since the beginning of its amendment with sewage sludge. Oribatida among microarthropods made up 32.9%. During the sixth year, Oribatida dominated and accounted for 71.4% and 51.7% of all microarthropods in spring and autumn of 2003, respectively. The widely distributed euribiontic species *Tectocepheus velatus* dominated in the developing Oribatida community.

During the first and second years after landfill amendment, intensive processes of organic mineralisation take place, whereas during the fifth and sixth years, structural changes in the microarthropod complex towards the increase in Oribatida abundance reveal the beginning of soil development process.

# MICROMYCETES INFECTING LINDEN TREES (*TILIA* L.) IN VILNIUS CITY

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In green plantations of Lithuanian cities, three of linden trees (*Tilia* L.) genus are grow: small-leaved linden (*T. cordata* Mill.), large-leaved linden (*T. platyphyllos* Scop.) and common linden (*T. europaea* L.). Small-leaved linden (*T. cordata* Mill.) is the most widely grown tree that is self-spreading all over the Baltic region.

In Vilnius city linden trees are infected with different micro and macro fungi. Over 50 fungi taxous belonging to 55 genera were recorded on linden trees (*Tilia* L.) in green plantations of Vilnius city. Linden trees growing in urban areas are infected with the same fungal disease agents that are found in natural environment. In Vilnius city the most wide-spread linden micromycetes are: *Cercospora microsora* (*Mycosphaerella microsora*), *Discula umbrinella* (*Apiognomonium errabunda*), *Fumago tiliae*, *Cytospora* spp., *Stigmina compacta*, *Pseudomassaria chondrospora*. Seldom are found: *Lamproconium desmazieri*, *Robenhorstia tiliae*, *Corynespora olivacea*, *Exosporium tiliae*, *Asteroma* spp., *Septoria tiliae*, *Diplodia tiliae*, *Colletotrichum gloeosporioides*, *Microdiplodia tiliae*, *Phomopsis irregularis*.

Spreading of linden microfungi and manifestation of fungal diseases vary every year. It depends upon climatic conditions, pests and human activity impact. In cities, it is reasonable to grow linden trees that are more resistant to fungal diseases and pests. Yearly monitoring of linden trees is recommended.

# DEFINING PROBLEMS OF SPIKE, SPIKE-LIKE PANICLE AND PANICLE OF GRASSES (POACEAE)

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Title: Defining Problems of Spike, Spike-like Panicles and Panicles of Grasses (Poaceae Barnh.)  
In the description of the grass family species as one of the characteristics of spikelet clusters (complete inflorescences of grasses) three groups are separated - spikes, spike-like panicles and panicles. However, as it sometimes happens, some species (such as *Brachypodium*) fall in the cracks of description of these three groups, or sometimes they suite with more than one group (*Anthoxanthum*). Therefore it is necessary to review these description definitions, so that they become universal and suitable for all possible species. Author has designed several parameters for every kind of blossom, in order clearly separate them.

Spike: 1) spikelets seated directly (sessile) on the main axis 2) spikelets with very short and thick pedicels (stalks) (max 5 mm) on the main axis 3) spikelets along the main axis are placed in a regular pattern 4) the pedicels are only so long, as are spikelets  
Spike – like panicle: 1) spikelets are placed on the second and further- branching axis 2) branch internodes are very short – equal or shorter than spikelet length 3) branches around the main axis are placed densely and completely covering main axis  
In general spike-like panicle is a panicle, whose branches are very short and densely located around the main axis so fully covering it. As result it looks like spike.  
Panicle: 1) The length of branches and pedicels are very varying 2) dominates two and further-branching axis 3) sometimes there could be spikelets with sessile or with 1-stage, thin stalk.

# EPIPHYTIC BRYOPHYTES AND LICHENS ON *CARPINUS BETULUS* IN DUNIKA NATURE RESERVE, LATVIA

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Old-growth broad-leaved forests ensure suitable microclimate for epiphyte distribution. *Carpinus betulus* is specially protected in Latvia, where this broad-leaved tree species distributed in a margin of the northern-western distribution range. The studied forest stand dominated by *Carpinus betulus* was located in a south-west Latvia, Dunika Nature Reserve. The aim of the present study was to characterize epiphytic bryophyte flora and ecology. Epiphytic bryophyte vertical (until 0,5 m and 0,5-2 m) and horizontal (north, south, east, west) spatial distribution were estimated on 30 *Carpinus betulus* individuals. In total 39 (26 bryophyte and 13 lichen) epiphytic species were detected. Three specially protected epiphytic species (bryophytes *Neckera complanata* and *Antitrichia curtipendula*, lichen *Pertusaria pertusa*) were abundant in the studied territory. Multinomial linear logistic regression showed distribution of epiphytes affected significantly ( $p < 0.05$ ) by tree diameter, tree height, tree inclination and bark pH as well as height on the tree stem and north direction of exposure on tree. Composition of various factors ensure suitable conditions for epiphyte long-term persistence in studied territory.

## **Fin Necrosis in Baltic Salmon Parr**

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Fin necrosis is widely distributed salmon disease in Latvia. Several bacteria have been implicated in the etiology of the disease. To determine the cause of fin necrosis in the Baltic salmon, fish were randomly sampled at hatcheries. The degree of fin necrosis, fin necrosis progression phase and bacteria count were estimate by a standard method.

Representative colonies were isolated for identification. In experimental ponds were infected of salmon parr with isolate and were kept under observation. Each experimental infected fish were investigated of progress of the disease and presents of bacteria.

# VARIABILITY OF *SAXIFRAGA HIRCULUS* L. MORPHOLOGICAL FEATURES IN LITHUANIA

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*Saxifraga hirculus* L. (Rosidae, Saxifragaceae) is protected by international and national legal acts in numerous European states. In Lithuania, *S. hirculus* is a post-glacial relic, rapidly becoming extinct species. In the habitats of intermediate mires, situated near overgrowing lakes and on the banks of rivulets, which are characteristic of the similar hydrologic regime, research of variability of *S. hirculus* morphological features were accomplished in nine populations of Lithuania.

*S. hirculus* individuals were assessed by such criteria: 1) the height of floral shoots; 2) the number and length of runners; 3) the number of flowers and leaves; 4) the length and width of the longest leaf. The number of flowers was found to be the most unstable among the evaluated traits (the coefficient of variation being 53 %), then the leaf length followed (the coefficient of variation 36 %). The variations of the other traits were about 25 %. Variability of the same feature was different in the studied populations. The greatest variability of *S. hirculus* features was established in Laukagalis population. The height of shoots varied three times more than in other populations. Also the length and width of the leaves and number of flowers varied almost two times more than in other populations.

Correlation between different features of *S. hirculus* was estimated. Statistically reliable weak positive correlation ( $r=0.3$ ) was established between the height of shoots and the length of leaves; the height of shoots and the number of flowers; the height of shoots and the width of leaves; the length of leaves and the number of leaves. The most positive correlation ( $r=0.5$ ) was demonstrated between the length and width of leaves.

Comparative analysis of *S. hirculus* morphological features in all populations showed that it was not possible to distinguish one population where all studied individuals features would have the greatest values. Dispersal analysis (ANOVA) was stated that in various places of Lithuania studied populations of *S. hirculus* differed statistically reliable according to the main morphological features of structural elements.

# THE NEW POACEAE FAMILY PLANT EFFECTED BY CLAVICEPS PURPUREA (FR.) TUL. IN LITHUANIA

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The new Poaceae family plants species effected by fungus *Claviceps purpurea* (Fr.) Tul. that causes ergot was established in expeditionary conditions in Lithuania during the period 2002-2006 year. Plant species, affected by ergot were collected at plants seeds maturity stage, when ergot sclerotia showed at their inflorescences. Over four year period 8 new host plants species effected by *Claviceps purpurea* were collected: *Melica altissima* in Botanic Garden of Vilnius University and 7 species in Botanic Garden of Ėauliai University: *Bromus secalinus* L., *Deshampsia flexuosa* (L.) Trin., *Festuca pseudalmatica* K. 'Golubaja Korona', *Helictotrichon sempervirens* (Vill.) Pilg., *Phalaris paradoxa* L., *Secale montana* L., *Stipa turkestanica* K. The disease was found in 4 introduced plants, 1 cereal weed, 1 allien plant. Ergot sclerotia size was established. A total 88 ergot-affected wild and cultivated Poaceae family plant species in Lithuania are know.

# GENETIC AND MORPHOMETRIC DIFFERENTIATION OF SOME VENDACE (*COREGONUS ALBULA*) POPULATIONS IN LATVIA

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Vendace (*Coregonus albula*) is a widespread fish in waters of the Holarctic. The vendace forms exhibit a great variation in morphological characters, which reach the sub – species level. Since 1900 *Coregonus albula* has been artificially introduced from Peipus and Ladoga lakes to more than 30 Latvian lakes. *Coregonus albula* - vendace was registered in 30 Latvian lakes in the 30s of the last century. In the 90s of the last century vendace was registered only in 5 lakes.

The collecting of the material was carried out during years 2005 and 2006 from Dridzas and Raznas lakes in Latvia. Biochemical staining was to analyse and to estimate genetic variation of *Coregonus albula* in Latvia. For the morphological analysis ten morphological parameters of fishes (standard length and weight, body height, head length, head width, snout length, eye diameter, number of rays on the anal fin, number of scales along the lateral line, mean gillraker number), age and sex of fishes were used. A number of groups of male and female individuals of various ages were analysed.

Allozyme electrophoresis was used to study genetic variation and structure of population with and between populations from Dridzas and Raznas lakes in Latvia. Liver tissue homogenate was used for electrophoretic investigations on polyacrylamide gel. The eight enzyme system activities were studied (MDH, E.C. 1.1.1.37, ME, E.C. 1.1.1.40, EST, E.C. 3.1.1.-, G3PDH, E.C. 1.1.1.8, LDH, E.C. 1.1.1.27, AAT, E.C. 2.6.1.1, ADH, E.C. 1.1.1.1, SOD, E.C. 1.15.1.1). It was shown, that the distribution of genotypes in these isoenzyme systems was different. The number of loci in all investigated populations is analogical.

The results of investigations show that there is a passable level of heterozygosity in investigated *Coregonus albula* populations of Dridzas and Raznas lakes in Latvia. Mean of heterozygosity in different populations differs a little, but, in total, can show genetic stability in investigated populations.

# BREEDING BIRD FAUNA OF ISLAND MORICSALA – THE OLDEST NATURE RESERVE IN LATVIA

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With its broad-leaved and coniferous forests and the territory of 82 ha the island of Lake Usma has been under the state environmental protection since 1912. Any forest management activities have been prohibited there. The forest of Moricsala serves as a standard of and as a source of information about the fauna and flora of a forest ecosystem untouched in long term.

The fauna of the breeding birds was studied from 1986 till 1989 including the mapping of the birds during their nesting season. Additionally the census of the breeding birds was carried out using the Finnish line-transect method described by Jarvinen&Vaisanen (1975). The results of the census were used in the studies of the qualitative and quantitative structure of the bird communities. They were also used when characterizing the spatial distribution in connection with the research of the plant communities (Laivina, 1987). The data obtained was analysed using ArcGIS Spatial Analyst & ArcGIS 3D Analyst.

58 nesting bird species have been recognised on the island. The density of the breeding birds may reach 800 pairs on a square kilometre in separate years making it one of the highest figures obtained in the forest territories of Latvia. The dominant species are Chaffinch (*Fringilla coelebs*), Wood Warbler (*Phylloscopus sibilatrix*) and Robin (*Erithacus rubecula*), with a comparatively even territorial distribution in the forest biotopes of the island. The distribution of the other species is linked with suitable nesting biotopes and the placing of plant communities. Rare and protected bird species like Osprey (*Pandion haliaetos* (3-5 pairs!)), Black Kite (*Milvus migrans*), Red Kite (*Milvus milvus*), Middle Spotted Woodpecker (*Dendrocopos medius*), Brambling (*Fringilla montifringilla*) have been detected nesting on the island.

# **COMPARISON ZOOPLANKTON ABUNDANCE, BIOMASS AND COMMUNITY STRUCTURE IN THE RIVER DAUGAVA AND TWO RIVER DAUGAVA FLOODPLAIN LAKES WITHIN DIFFERENT HYDROLOGICAL CONDITIONS**

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Zooplankton densities and community's structure of the River Daugava, Latvia were studied from April to October in 2006. Zooplankton abundance, biomass and community structure was examined in the middle River Daugava and two largest floodplain lakes of the River Daugava. Hydrological regime in the middle Daugava and floodplains was characterised by greatly fluctuation. The two maximum of water level were observed. The first floods were observed in April (spring floods) and the second flush floods were observed in September 2006 due to greatly rainfall.

Evidently changes of structure, abundance and biomass of zooplankton communities were observed in period of the autumn flush flood maximum. Total zooplankton abundance and biomass of the River Daugava and floodplain was decreased while in the Lake Dvietes abundance of zooplankton was increased. Although total biomass was decreased nevertheless biomass of Rotifera in the floodplain lakes increased, mainly by *Sunchaeta oblonga*.

Compared lakes and the River Daugava with each other (Renkonen index) were observed more similarities between lakes. The highest similarity index between lakes Skuķu and Dvietes was 89% in the period of spring flood drainage phase and 81% in the maximum of autumn flush flood. The similarity index between lakes Skuķu, Dvietes and the River Daugava (River Berezovka source) was 63% and 70% in the period of spring flood drainage phase accordingly. The lakes and the River Daugava were again similarly during the autumn flush flood. These similarities was characterised by clearly expressed seasonality in flush flood period.

Results of statistics and regression analyses were showed that water level fluctuations are one of the significant factors for Cladocera biomass changes in the floodplains lakes.

# TERRESTRIAL GASTROPODS OF CHOSEN BALTIC COASTAL ZONE CITIES

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In 2000-2002 the investigations of terrestrial gastropods fauna in three cities of different area (Słupsk, Ustka, Hel) were performed. Material was collected at atleast 8 habitats in each city, representing different vegetation forms and anthropogenic impact characteristics. A total of 44 species of terrestrial gastropods representing 16 families were recorded. The most diverse gastropod fauna was observed in Hel (35 species), while lowest number of species (23 species) was noted in Słupsk. The most common were the species very popular in Europeae (23%) and Holarctic (21%) zone. With point of ecological view the most abundant was the group of forest species (27%). It was noted above 11 species representng very strong tendency towards synanthropisation. Three of them *Trichia hispida*, *Cepaea hortensis* and *Cepaea nemoralis* were most abundant.

# COMMUNITIES OF *QUERCUS PETRAEA* IN LITHUANIA

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The distribution area of *Quercus petraea* covers the major part of Europe and only in the northeastern Poland is the closest to Lithuania (Ozolinčius, 2003). In the sixth decade S. Tuminauskas (1957) published the data on a locality of naturally growing *Quercus petraea* in the area of 70 ha (Trakas forest, Lazdijai district). That forest was considered to be the locality behind the areal border. In Ažuolija (Utena distr.), Begėdžiai (Šilutė distr.) forests and Šešuoliai park (Ukmergė distr.) *Quercus petraea* is planted as alien species (Gelaževičius, 1973).

The origin of *Quercus petraea* locality in Lithuania is the question of discussion. There are three versions: first, *Quercus petraea* is imported from the neighbouring countries and planted in Lithuanian forests as alien plant; second, Trakas forest is the locality of natural spreading of the species; third, Trakas forest is the locality behind the distribution area (Ozolinčius, 2003). *Quercus petraea* and its hybrids with *Quercus robur* form forest communities in 8 quarters of Trakas forest (Baliuckas, 2000).

Syntaxonomic position of *Quercus petraea* forest communities in Lithuania has been interpreting different. J. Balevičienė (1984) ascribed these communities to as. *Pino-Quercetum* Kozłowska 1925, var. *Quercus petraea*. In floristic composition of polish communities of as. *Quercus robur-Pinetum* (W. Mat. 1981) J. Mat. 1988 (Cl. *Vaccinio-Piceetea*, All. *Dicrano-Pinion*) (Matuszkiewicz, 2001) some nemoral species of trees (*Quercus petraea*, *Quercus robur*, *Carpinus betulus*) shrubs and herbs (*Carex digitata*, *Corylus avellana*, *Euonymus verrucosus*, *Melampyrum nemorosum*, *Melica nutans*, *Viola reichenbachiana*) are found. Thus, there are a resemblance between as. *Quercus robur-Pinetum* and lithuanian *Quercus petraea* forest communities. Anyway, in chorological analysis of communities of the as. *Pino-Quercetum* Kozłowska 1925, J. Balevičienė (1984) distinguished two variants: var. *typicum* and var. *Quercus petraea*. In var. *Quercus petraea* is small number of boreotemperate species and a lot of temperate european species and in the later publication (Balevičienė, 1991) *Quercus petraea* forest communities were ascribed to the as. *Calamagrostio-Quercetum petraeae* (Cl. *Quercus-Fagetum*).

The communities of as. *Calamagrostio-Quercetum petraeae* are distributed in the southwestern part of Poland and its range area is quite far from Lithuania. In Poland in the communities of as. *Calamagrostio-Quercetum petraeae* dominate 7 species from the order of *Quercetalia roboris* (*Hieracium laevigatum*, *Hieracium umbellatum* ssp., *Hieracium sabaudum*, *Hieracium racemosum*, *Holcus mollis*, *Hypnum cupressiforme*, *Pseudoscleropodium purum*), in Lithuania – only 1 (*Hieracium umbellatum*). In the floristic composition of this association, a group of mesotrophic acidophilic species was found. In Polish communities 6 species are constant (*Calamagrostis arundinacea*, *Deschampsia flexuosa*, *Melampyrum pratense*, *Pteridium aquilinum*, *Solidago virgaurea*, *Majanthemum bifolium*), in Lithuanian – 3 species are found (*Majanthemum bifolium*, *Solidago virgaurea*, *Calamagrostis arundinacea*), but only 1 is constant. In the floristic composition of *Quercus petraea* forest communities in Lithuania, species from the *Quercus-Fagetum* class (total number 39) dominate, in Polish communities – only 3 species are found (*Coryllus avellana*, *Melica nutans*, *Viola reichenbachiana*).

A great distance of distribution area of as. *Calamagrostio-Quercetum petraeae* from Lithuania and differences in the floristic composition of communities allow to draw a conclusion that Lithuanian *Quercus petraea*

forest communities do not belong to the association *Calamagrostio-Quercetum petraeae*. A large number of nemoral species and only few species from the *Vaccinio-Piceetea* class, leads to a conclusion that these communities belong not to the *Vaccinio-Piceetea* class, but to the *Quercu-Fagetea* class, the *Carpinion betuli* alliance, the *Tilio-Carpinetum betuli* Traczyk 1962 association, the calamagrostetosum subassociation. The communities of *Tilio-Carpinetum calamagrostetosum* are found on a slightly acidified soils, the floristic composition of these communities includes a small amount of species from the *Vaccinio-Piceetea* class (*Pinus sylvestris*, *Picea abies*, *Vaccinium myrtillus*, *Trientalis europaea*) and a group of acidophilic mesotrophic species (*Calamagrostis arundinacea*, *Majanthemum bifolium*, *Solidago virgaurea*).

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# RESEARCHES ON MOLECULAR ECOLOGY IN LITHUANIA

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The application of molecular markers to the study of animals has provided new insights into their population structures, conservations biology and taxonomic relationships. Organisms have been studied at individual, population and species level. Different methods, like allozymes analysis, random amplified polymorphic DNA (RAPD), single strand conformation polymorphism (SSCP) analysis, microsatellites, sequences have been used to study. Molecular ecology investigations of animals in Lithuania are perform to studing a) taxonomy (differentiation of sibling species), b) ecology - test-object of genotoxical impurity (small rodents); genetic variability in different biotopes; c) differentiation of reintroduced and introduced species and population; d) gene pool estimation of rare and endangered species; e) biodiversity of animal genetic resources. Basic studied species are rodents: *Apodemus agrarius*, *A. flavicollis*, *A. uralensis*, *Cletrionomys glareolus*, *Microtus agrestis*, *M. arvalis*, *M. rossiaemeridionalis*, *M. oeconomus*, *Ondatra zibethicus* and *Castor fiber*. Differentiation of reintroduced species and population was estimated using non-metric and metric parameters of scul, proteins and genomic DNA polymorphism (PCR, RAPD, Microsatelit, Sequences). Biodiversity of *Apodemus agrarius*, *A. flavicollis*, *A. uralensis*, *Cletrionomys glareolus*, *Microtus agrestis*, *M. arvalis*, *M. rossiaemeridionalis*, *M. oeconomus*, *Sciurus vulgaris*, *Castor fiber* and *Talpa europaea* from different localities of Lithuania were analyzed using allozyme PAG electrophoresis, restriction fragment length polymorphism (RFLP) and RAPD. The genetic diversity was estimated using allelic distribution and polymorphism, assessed by the number of alleles per locus. Molecular data suggest that several vole species like *Cletrionomys glareolus*, *Microtus arvalis*, *M. oeconomus* and *M. rossiaemeridionalis* fall into two geographic lineages (eastern and western) according to mtDNA haplotypes found in Lithuania.

RAPD markers were used to measure the genetic diversity of *Ixodes ricinus* ticks collected from Lithuania and Norway. The samples were analysed within and also between the populations.

Since the year 1980 molecular ecological investigations of wildfowl have been performed in Lithuania and various breeding sites in the Northern Palearctic. The research was done of 20 wildfowl species from Anatini, Aythyini, Mergini, Somaterini and Anserini tribes. It was found that the same species migrating from different wintering sites differed considerably not only by frequency of alleles of isoenzymes and common proteins, but also by frequency of random DNA fragments. Genetic diversity of seaducks wintering in the Baltic Sea was determined, and the scope of inter-specific similarity and genetic distances between these species. Significant genetic differences were also identified among migratory and sedentary populations of Mallard (*Anas platyrhynchos*) in different sites of the eastern Baltic region.

# **DNA ANALYSIS OF THREE *ELACHISTA* (LEPIDOPTERA: ELACHISTIDAE: ELACHISTINAE) SPECIES**

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Previously, the group - Elachistidae (Insecta: Lepidoptera) was analysed only with the help of traditional research methods and the molecular techniques was never applied. In the present study *Elachista argentella*, *E. maculicerusella* and *E. pollinariella* species were examined using both, traditional entomological methods (such as identifying of species, making of morphological preparations, documenting of important for taxonomy morphological structures) and molecular methods. DNA was extracted according V.Tkach with modifications. Two specific and one random primers were used for polymerase chain reaction. Only one pair of specific primers which amplified mitochondrial DNA sequences of the COI gene was chosen for further analysis. The polymorphism of sequenced mtDNA segments of the COI gene in *E. argentella*, *E. maculicerusella* and *E. pollinariella* was assessed on species and population level.

# **PUBLISHING FOR BIODIVERSITY – A PRESENTATION OF PENSOFT**

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In the last decade, Pensoft published more than 300 titles in various branches of natural history and has become a leading publisher of books on world biodiversity. The rationale behind this activity is well expressed by the motto of Pensoft – "Active scientists publish for other active scientists!". Recently, Pensoft was intensively involved in several EU FP5 and FP6 projects, such as BIOFORUM, ALARM, MACIS, COCONUT and others. The cooperation with leading EU institutions resulted in launching of some new serials, such as "Invertebrate Ecology and Conservation Monographs", "Advances in Biodiversity Risk Assessment", and "Aquatic Biodiversity of Latin America". Pensoft Series Faunistica, with its 68 volumes published so far, has long become an authoritative forum for everyone who wants to publish taxonomic revisions, catalogues or biodiversity inventories. The presentation outlines some perspectives in "hot-topic" biodiversity publishing.

# TERRESTRIAL SNAIL FAUNA IN GREY DUNES IN LATVIA

**Digna Pilāte**

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In Latvia the study of terrestrial snail fauna in grey dunes for the first time was carried out during 2001-2004. The study plots were established along the Latvian western sea coast nearby Ziemupe, Pape, Užava, Lielirbe, Pāvilosta and Pērkone. Altogether 14 terrestrial snail species were found: *Columella aspera* Walden, 1966, *Cochlicopa lubrica* (O.F. Müller, 1774), *Cochlicopa lubricella* (Porro, 1838), *Discus ruderratus* (Ferussac, 1821), *Euconulus fulvus* (O.F. Müller, 1774), *Nesovitrea hammonis* (Ström, 1765), *Punctum pygmaeum* (Draparnaud, 1801), *Pupilla muscorum* (Linnaeus, 1758), *Vallonia costata* (O.F. Müller, 1774), *Vallonia excentrica* Sterki, 1892, *Vallonia pulchella* (O.F. Müller, 1774), *Vertigo lilljeborgi* (Westerlund, 1871), *Vertigo pygmaea* (Draparnaud, 1801) and *Vitrina pellucida* (O.F. Müller, 1774). The terrestrial snail fauna in each area studied was different. Dominating species found in most areas were *Pupilla muscorum*, *Vallonia excentrica* and *Cochlicopa lubricella*. The mean density of molluscs was 24,7 specimens per m<sup>2</sup>.

## **Monitoring of woodland meadow management using epiphytic lichens**

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The research was conducted in Fennoscandinavian woodland meadows (6530\*) in a specially protected nature territory - Protected Landscape Area "Northern Gauja". Old, scattered broad-leaved trees are significant structural elements of this habitat. Part of the woodland meadows are overgrowing with shrubs and trees shading the old broad-leaved trees. Restoration of woodland meadows in the protected landscape area "Northern Gauja" was started in the year 2004 (removal of bushes, grazing, mowing).

Monitoring of the effects of grassland management efficiency was started in 2005. using epiphytic lichens as indicators. In a preliminary studies the selected method was tested and data was collected on lichen species composition and projective cover in four plots on each of 30 oaks (*Quercus robur* L.). On the investigated oaks 48 lichen species were recorded, two of them (*Sclerophora amabilis* (Tibell) Tibell and *Sclerophora peronella* (Ach.) Tibell) for the first time in territory of Latvia. Two monitoring parameters were chosen: diversity of epiphytic lichens (number of species) and relative proportion of epiphytic species societies typical for the habitat. Continuing preliminary research is planned to include an additional 60 oaks to obtain more precise values of the monitoring parameters.

# EPHEMEROPTERA FAUNA AS ECOLOGICAL INDICATORS OF ENVIRONMENT QUALITY IN LATVIA'S INLAND WATERS

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Aim of the study was to detect Ephemeroptera species characteristic for different ecological conditions in Latvia's inland waters.

Rhitron community is characterised by Ephemeroptera species typical for running, oxygen rich waters. *Baetis vernus*, *Caenis horaria*, *Ephemerella ignita*, *Ephemerella mucronata*, *Heptagenia sulphurea*, *Heptagenia lateralis*, *Ecdyonurus venosus* are common. As occurrence of Ephemeroptera indicates high or very high quality of investigated small streams

Potamon community is characterised by potamophyl species *Caenis rivulorum*, *Cloeon dipterum*, *Baetis rhodani* which always are stated in high abundance and biomass on the silt bottom and on the littoral part of the potamal stretches.

Due river regulation in Latvias small streams ecological conditions were changed: reduced flow, mean temperature of water – a major factor controlling the distribution, abundance and life cycles of aquatic insects became warmer. Changes in substrate composition through sedimentation alter species composition and community structure. Species typical for lentic waters - *Cloeon dipterum*, *Caenis horaria*, *Caenis moesta*, *Baetis niger* became dominated species in the dammed reservoirs.

Most of investigated Latvia's lakes are characterised as shallow, eutrophic and by leaking waters via the lake. These lakes were characterized by medium high biological diversity of Ephemeroptera fauna.

The highest abundance and biomass of Ephemeroptera are stated in riverine part of Lakes. The same situation are observed in man made reservoirs where species of Ephemeroptera characteristic for running waters such as *Ephemerella ignita*, *Heptogenia flava* and *Heptogenia sulphurea* are stated in the riverine part.

Dystrophic lakes are characteristic by minor species of Ephemeroptera – only 3 species – *Cloeon dipterum*, *Baetis rhodani*, *Leptophlebia vespertina*. Humic substances in bog lakes and acid waters caused simplification of Ephemeroptera fauna.

# ZOOBENTHOSS AS A CRITERION OF ENVIRONMENTAL STATE OF STREAM FOR SUSTAINABLE SURVIVE OF *MARGARITIFERA MARGARITIFERA* (LINNAEUS 1758)

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To provide further survive and successful reproduction of *Margaritifera margaritifera* (Linnaeus 1758) in summer period of 2006 were performed ecological investigations with aim to clear up current status of zoobenthoss communities and *Margaritifera margaritifera* in in two small Latvia's streams – Rauza and Ēpka.

Rauza and Ēpka – typical rhitral type streams where river bottom is covered by sand, gravel, pebbles and cobbles.

Physiological status of *Margaritifera margaritifera* colonies, agedness, numbers of individuals and biodiversity of zoobenthoss communities as well as quantitative and qualitative parameters of macrozoobenthoss were observed. Typical complexes of invertebrate species characteristic for rhitral stretches as well as for potamal were found on substrates formed by cobbles, pebbles, rough gravel and *Fontinalis sp.* Rhitral stretches were dominated by Ephemeroptera – especially by mass of *Agapetus sp.* These stretches were characteristic by high numbers of *Ancylus fluviatilis*. Biomasses of macrozoobenthoss were high - (69,5 – 142 g/m<sup>2</sup>). Therefore zoobenthoss could provide salmonide fishes with ration which is formed mainly by Chironomidae, Ephemeroptera, Trichoptera and Mollusca. Dominated species are *Heptogenia sulphurea*, *Baetis rhodoni*, *Hydropsyche angustipennis* and *Ancylis fluviatilis*. Structure of *Unio crassus* population shows usual (normal) processes of rejuvenescence but age structure of *Margaritifera margaritifera* gives evidence that this population is getting old. There are no observations of new individuals. On average old and old individuals of *Margaritifera margaritifera* are dominated in the rivers.

As a result of anthropogenic impact - (impact from pig farm) and dams erected by beavers caused to be worse ecological status of rivers: depletion of quantitative and qualitative structure of macrozoobenthoss communities. Indicators of very low environment quality such as microorganisms *Sphaerotilus natans* were stated in high abundance below pig farm. Due to destructive activities of beavers ( building of dams, cutting of macrophytes, reduction velocity of stream flow, turn down of oxygen amount in water, mixing of bottom upper layer) leads to depletion of quantitative and qualitative indicators of macrozoobenthoss communities. More over all these negative impacts influenced macrozoobenthoss communities which provides food for salmonide fishes. It would decrease potential possibility for further survive and reproduction of *Unio crassus* and *Margaritifera margaritifera*.

# EXPANSION OF INVASIVE NON-NATIVE GOLDENRODS (*SOLIDAGO SPP.*) IN LATVIA

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Non-native goldenrods *Solidago canadensis* L. and *S. gigantea* Ait. (Compositae) are considered as the “black list” invasive species in most of temperate Europe. Therefore there is a need for assessment on their current distribution and potential dynamics, habitat preferences, phytosociology and ecological impacts in Latvia.

Canadian goldenrod *Solidago canadensis* L. is one of the common non-native plant species spread throughout Latvia. The species was introduced as an ornamental in the beginning of 19th c. Over several decades it had been spreading outside cultivation. Although it is well-known as a common naturalized garden ornamental, there is still little knowledge on its current distribution in Latvia. There are few data available on the actual distribution of another congener, giant goldenrod *S. gigantea*. It is not known whether it is still a rare non-native species or, more possibly, we do not have sufficient information yet.

Both species are spreading by underground rhizomes (within a short distance). Seed dissemination by wind helps the species to establish in new localities further away from the parent plants. Roads and railways play a major role as corridors in the spreading of goldenrods. Seeds may be attached to vehicles, and transported by air movements. The situation in Latvia shows that semi-natural treeless areas, such as old fields and grasslands, are suitable for quick establishment of vast *Solidago* populations. Abandoned lands, poorly managed areas in the vicinity of transportation roads and railways, and heavily disturbed habitats are the most susceptible to *Solidago* invasions.

In Europe and Latvia, *Solidago* species are characterized by ruderal strategy and are more associated with local ruderal plant communities where they tend to form dense, monodominant stands replacing the native species. *S. canadensis* invade dry and disturbed habitats, while *S. gigantea* prefers mostly wet and more natural habitats. It is not known whether the expansion of *Solidago* species cause any significant changes in ecosystem structure and functions. The main threats for local plant communities may occur if *Solidago* species establish themselves in natural or semi-natural meadows, wetlands or nutrient-poor natural grasslands that may cause irreversible changes in resource availability, soil conditions, and community structure and composition.

# DISTRIBUTION AND BIOTOPES OF *BOMBINA BOMBINA* IN LATVIA

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*Bombina bombina* L. is a rare Latvian amphibian living on the northern border of the area. In 2006 it was known only 4 really existing or confirmed populations of *Bombina bombina* in Latvia (Bauskas, Ainavas, Ilgas, Demenes (found in 2006)). Necessity of acceptance of urgent measures on preservation of *Bombina bombina* in Latvian fauna does the researches of ecology of a species, distribution and number, actual.

During the research were carried out the searches of new biotopes of *Bombina bombina* in Latvia, monitoring of *Bombina bombina* number, the description of existing populations? biotopes. Number of a species was defined by calculation of quantity of vocalizing males in known populations, research of biotopes was carried out using standard metodes.

As the result of the given research, it is confirmed stable existence of 3 out of 4 known populations of *Bombina bombina* in Latvia in 2006. Distribution: Bauskas area: the "Bauskas" population (7 males); Daugavpils area: populations "Ilgas" (9 males), "Demenes" (~70 males), "Ainavas" (0 males). While inspecting biotopes in Latvia it was ascertain that *Bombina bombina* take the whole biotope, if it answers the needs of a species or certain microbiotopes or zones of greater biotopes. These microbiotopes differ from the whole biotope and from other neighbor biotopes not occupied by *Bombina bombina* that mostly have the certain intervals of temperature and light regime of microbiotope, small depth, clay ground, water and floating vegetation. The biotopes of *Bombina bombina* in Latvia in 2006 were home ponds (10 males), meliorative channels flooding by *Castor fiber* (45 males), temporary reservoir (1 male), fish-breeding ponds (30 males). In the research it is ascertained that ~46 % of all Latvian *Bombina bombina* biotopes were zoogenous biotopes forming by activity of *Castor fiber*. Also noted the expressed usefulness of shallow overgrown zones of fish-breeding ponds as biotopes of *Bombina bombina* populations in Latvia, despite of presence of predatory fishes there (2 biotopes the "Demenes" population). In case of dwelling in large deep-water ponds *Bombina bombina* take microbiotopes: shallow, overgrown with floating and above water vegetation, coastal zones where is formed optimum for them (biotopes of the localizations "Lauru d?ls 1,2", "Gravu d?ls", the "Demanes" population). If the biotope of dwellings is overgrown ameliorative channel, *Bombina bombina* take the shined places where is formed the separate microbiotope. More overgrown places of the ameliorative channel in that case serve as ways of migration between optimum microbiotopes for *Bombina bombina* (the localization "Meliorat?vais kan?ls", "Ilgas" population).

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# THE DATA ON DAMAGE TO POND TURTLES *EMYS ORBICULARIS* L. BY PREDATORS IN LATVIA

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European pond turtle *Emys orbicularis* L. is a rare and protected species in Latvia and Europe, living on the northern border of his area. It is known nothing about any stable population of *Emys orbicularis* in Latvia. In connection with that research of ecology of *Emys orbicularis* in Latvia and especially influence of limiting factors on Latvian population of *Emys orbicularis* is actual. One of the limiting factors is influence of predators on a population. Such dangerous predators for adult *Emys orbicularis*, as in Latvia, as well as in other European countries, can be foxes, badgers, wild boars, otters, rats, dogs, also introduced to Latvia invasive species *Nyctereutes procyonoides*, widely widespread in places of *Emys orbicularis* observation (Madona area, Dobeles area, Kraslava area, Daugavpils area) etc.

There was organized the research of zoogenous damages of legs, tail, carapax and plastron, of all known *Emys orbicularis* caught in Latvian nature and containing in zooculture of Latgale Zoo, carried out for an estimation of influence of predators on a population of *Emys orbicularis* in Latvia. There were surveyed 22 adult *Emys orbicularis* individuals in total. Zoogenous appearance of traumas was established by an expert estimation, modeling method and comparison with the turtles that have received damages, as a result of occasionally observed attack of a predator (dog) (M.Pupins, pers.obs.).

There have been ascertained zoogenous traumas of carapax, plastron, legs and tail of Latvian *Emys orbicularis*, as a result of the research. The majority of carapax and plastron traumas of *Emys orbicularis* had characteristic places of localization. Different degree zoogenous damages of an carapax and plastron had 8 (36,4 %) animals, 1 animal had amputated leg (4,5 %), amputating damages of a tail had 4 animals (18,2 %) out of all 22 surveyed *Emys orbicularis*. The degree of damages differed. The ascertained traumas have been regenerated in part. Also has been ascertained one irreversible trauma: amputated forward leg with a part of carapax and plastron of an adult *Emys orbicularis* female. Carapax and plastron were traumed in 61,5 %, legs in 7,7 %, tail in 30,8 % of all traumas. The part of traumatized *Emys orbicularis* out of all surveyed animals is 59,1%. Analyzing the results of research, it is possible to approve, that predators play a significant role, as the negative factor for *Emys orbicularis* in Latvia. Undoubtedly also, that the given research considered only those turtles that have survived after an attack of a predator. Therefore, the general negative influence of predators on population of *Emys orbicularis* in Latvia will be higher. Actions on preservation and restoration of *Emys orbicularis* in Latvian fauna should consider the influence of predators on a population.

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# THE EFFECT OF DISSOLVED ORGANIC MATTER ON SUMMER BACTERIOPLANKTON AND PHYTOPLANKTON COMMUNITY FROM THE GULF OF RIGA AND OPEN BALTIC SEA

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The global increase in the occurrence of algal blooms has initiated interest to identify factors controlling the plankton population dynamics. The possible role of dissolved organic matter (DOM) from land origin has been suggested. The effect of riverine DOM on development of natural phytoplankton and bacterioplankton communities was studied in experimental treatment series, as well as the contribution of heterotrophic bacteria in biodegradation of DOM was investigated.

Experiment was processed twice (in early and in late summer) in subsequent treatments: no enrichment (Control); natural plankton community with DOM additions (+DOM); bacterial filtrate with DOM addition (Bact+DOM). Seawater was collected in the Central part of the Gulf of Riga and in the Open Baltic Sea. DOM was extracted from the Parnu River with a method of tangential ultrafiltration. The development of phytoplankton was favourably influenced by DOM during early summer, when addition of DOM to water from the Central part of the Gulf of Riga and to the Open Baltic evoked increase of total phytoplankton biomass for 790 and 670mkg m<sup>3</sup>, respectively. Initial phytoplankton community was co-dominated by cyanobacteria and chlorophytes, dinoflagellates. Addition of DOM resulted in an increase of the phytoplankton biomass mostly due to the growth of dinoflagellates. During late summer initial phytoplankton assemblage of the Gulf of Riga was dominated by euglenophytes and cryptophytes. The addition of DOM increased relative importance of cyanobacteria in seawater from the Open Baltic by 490mkg m<sup>3</sup>. Nitrogen fixing cyanobacteria contributed on average for 69% from the total phytoplankton biomass.

Against all expectations the addition of DOM reduced production of bacteria proving inhibition effect of riverine DOM added on formation of new marine bacterial cells and biomass. Contrary to that in a presence of whole plankton the increase of bacterial cell concentration, production and biomass was marked. These results promote us to think that bacterioplankton from the Central part of the Gulf of Riga and Open Baltic Sea was much better adapted to the biological use of autochthonic dissolved organic matter produced by phytoplankton and zooplankton excretion or by cell lysis as that brought with Parnu River.

In this case we could not corroborate the opinion that in marine environments river derived dissolved organic matter is exposed to elevated hydrolysis and enhanced turnover promoting growth of bacterioplankton, however the development of phytoplankton was favourably influenced by DOM. In our case DOM used was composed from compounds resistant to microbial degradation. The enhanced bacterial productivity in a presence of another plankton organisms indicate to the increased role of autochthonic products and whole plankton community.

# DIVERSITY AND CONSERVATION STATUS OF *CYNOSURION* GRASSLANDS IN LATVIA

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Semi-natural grassland vegetation of the order *Cynosurion* R.Tx. 1947 is widespread in the planar and colline belt of Europe. Although only the association *Anthoxantho-Agrostietum tenuis* Sill. 1933 em. Jurko 1969 represents *Cynosurion* grasslands in Latvia, inner community heterogeneity is quite high. Three subassociations (typicum, holcetosum lanati, and nardetosum) with seven variants were described. Community diversity can be described using gradient length of the detrended correspondence analysis ordination (in standard deviations). In the present research ordination of the *Anthoxantho-Agrostietum* relevés (in total, 290) showed that  $\beta$ -diversity of this association was 4.2 standard deviations (SD). If compared to other most common grassland communities (for example, *Centaureo-Fragarietum* 3.2 SD (114 relevés), *Filipendulo-Helictotrichetum* 4 SD (231 relevé), *Festucetum pratensis* 4.1 SD (86 relevés)) it can be concluded that grasslands of the ass. *Anthoxantho-Agrostietum* are among the most diverse grasslands in terms of  $\beta$ -diversity.

Vascular plant species richness varied among subassociations. Mean number of species per relevé (size varied from 4 to 25 m<sup>2</sup>) was 30-39 for the subass. *typicum*, 29 species for the subass. *holcetosum* and 26 species for the subass. *nardetosum*. The highest number of vascular plant species recorded per relevé (4 m<sup>2</sup>) was 48 species in a relevé of the var. *typicum*, subass. *typicum* in managed grassland of Drusku hill fort in northern Latvia and 47 species in a relevé of the var. *Carex panicea*, subass. *typicum* in managed grassland in town Tukums.

The most species rich *Cynosurion* grasslands are included in the list of the protected habitats of European Union (EU Habitats Directive, habitat code 6270). In Latvia, communities of the ass. *Anthoxantho-Agrostietum* cover approximately 4000 ha, but only one third of all grasslands corresponds to the criteria of protected habitat type 6270. Others are either too young succession phases of fallow-lands or too impoverished in typical species composition because of abandonment or improvement. To assess conservation status of the habitat type, favorable reference range and area in the country should be known, as well as condition of specific structures and functions should be evaluated. Although *Cynosurion* grasslands are the most common grassland type in Latvia and they have been investigated starting with 1950ies, assessment of their conservation status can not be done readily. Problems associated with the data availability and quality for this purpose will be discussed.

# DIVERSITY OF *BORRELIA BURGDORFERI S.L.* IN LITHUANIA

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Lyme borreliosis (LB), caused by spirochetes *Borrelia burgdorferi* sensu lato complex, is the most common tickborne zoonotic disease in the northern hemisphere. Up to now, 12 species of *B. burgdorferi s. l.* complex have been identified. The three main pathogenic species *B. burgdorferi* sensu stricto, *B. garinii*, and *B. afzelare* are undoubtedly involved in clinical cases of LB and known to cause different clinical manifestation in humans. Different reservoir hosts seem to harbor different genospecies of *B. burgdorferi* sensu lato.

The purpose of the present study was to determine diversity of *B. burgdorferi s.l* in different vectors and reservoir hosts in Lithuania: in *Ixodes ricinus* ticks collected from vegetation and from rodents, and in different rodent species.

*I. ricinus*, the main vector of *B. burgdorferi s.l.* in Europe, is a widely distributed tick in Lithuania. During 2003–6, 1686 unfed *I. ricinus* ticks (151 nymphs, 845 females, 690 males) were collected from the lower vegetation by flagging in 20 locations of Lithuania. A total of 248 rodents belonging to 8 species were collected in 7 locations. Collected rodent harbored 428 immature *I. ricinus* ticks.

The overall prevalence of *B. burgdorferi s.l.* infection in ticks collected from vegetation was 14% (range 1.1–31.9% in different locations). *B. afzelii* genospecies was found in 74%, *B. garinii* in 10%, and *B. burgdorferi s.s.* in 7% of ticks. Double infections were observed in 1% of the infected ticks, 7% of the *Borrelia spp.* was not typed.

The small rodents like *Clethrionomys glareolus*, *Microtus arvalis*, *Apodemus flavicollis*, and *A. agrarius* were detected as reservoirs of *B. burgdorferi s.l.* All infected rodents were hosted *B. afzelii* genospecies. The prevalence of *B. afzelii* infection was higher in *M. arvalis* (range 33.3–54.1% in different sampling sites) and in *C. glareolus* (range 6.7–71.4%) than in *A. flavicollis* (range 5.6–50%) and in *A. agrarius* (range 0–20%).

In 11, 5 % of all ticks collected on rodents were detected only *B. afzelii* genospecies. According to results of the present study *B. afzelii* was the predominant genospecies in *I. ricinus* ticks and rodents collected from various locations in Lithuania.

# **SOME DATA ON FUNGUS GNATS OF GAUJA NATIONAL PARK (LATVIA)**

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The fungus gnats (Diptera, Mycetophilidae) were collected in 3 localities (Zvartes rock, Krimulda, Cirulisi) of Gauja national park (Latvia) in 21-24. 09. 2005. Adult fungus gnats were caught with an entomological net. The collection material is deposited at the Institute of Ecology of Vilnius University. The greatest number of fungus gnats specimens was established in Cirulisi surroundings. We found species of genus *Boletina*, *Mycetophila*, *Allodia* in studying sites mostly. The species composition was different in studying sites.

# **SIMILARITY OF CAMPYLOBACTER LARI AMONG HUMAN, POULTRY, DUCK, PIG AND WATER ISOLATES**

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## **Introduction**

Reliable and powerful typing methods for *Campylobacter* are necessary in order to gain more insight into infection routes. Traditionally, phenotyping methods such as serotyping and biotyping have been used. The drawbacks of these methods are their restricted resolutions, the lack of specific reagents for serotyping, and a large portion of untypable strains. The purpose of this study was to characterize and compare *C. lari* isolated from humans, poultry, pigs and water by using the automated PstI ribotyping method to provide evidence of genetic relatedness among isolates. We used a highly standardized method coupled with a computer-based pattern analysis in order to compare the strains. Ribotype profiles of *C. lari* in the DuPont library identification system (DUP-ID) could then be compared.

## **Ribotyping**

Ribotyping was performed using the DuPont Qualicon RiboPrinter® as previously described. Single colonies from a 24-h culture on blood agar plates were suspended in a sample buffer and heated at 80°C for 15 min. After addition of lytic enzymes, the samples were transferred to the RiboPrinter®. Further analysis, including PstI enzyme (20.000U/ML, New England Biolabs) restriction of DNA, was carried out automatically. The riboprint profiles were aligned according to the position of a molecular size standard. The identification of an isolate was predicted when the corresponding patterns matched one of the patterns of the DuPont Identification library of the RiboPrinter® with a similarity  $\geq 0.85$ . The PstI ribotype patterns were automatically assigned a DuPont identification number (e.g. DUP-PST1-1010) by the RiboPrinter®, which was confirmed by visual inspection. The profiles were transferred to and analyzed with the GelComparII software (Bio Numerics, Applied Maths Inc.) using the Pearson correlation for genetic similarity and unweighted pair group method with average (UPGMA) clustering to determine profile relation.

## **Results**

All 49 isolates were classified as *Campylobacter lari* according to biochemical tests and genotyping. Thirty-four isolates (71.4 %) were given a DUP-ID automatically from the RiboPrinter® library. The strains isolated from water and animals show a high grade of similarity and were grouped in DUP-PST1-1010, DUP-PST1-1166, DUP-PST1-1178 and DUP-PST1-1081. The isolates DUP-PST1-2021 and DUP-PST1-1184 were found only among the human isolates. The isolates could be generated in three main clusters. One of these contained the human clinical isolates DUP-PST1-2021, DUP-PST1-1184, and DUP-PST1-1081, found in both the human and duck isolates.

The second cluster generated DUP-PST1-1010, found in both the human and poultry isolates, and a single strain, DUP-PST1-1079, isolated from poultry. The third cluster consists of DUP-PST1-1066 and DUP-PST1-1078 isolated from humans, animals, and water. Three human strains and two poultry strains were diverse and formed their own clusters and could not produce a DUP-ID.

## **SUMMARY**

A total of 48 isolates of *Campylobacter lari* from humans, poultry, pigs, and water were genetically characterized. The species were identified by using biotyping and multiplex PCR. Automatic riboprints were performed by PstI enzyme and RiboPrinter®. The identification of the isolates was predicted when the corresponding pattern matched one of the patterns of the DuPont Identification library and was then assigned an identification number. Thirty-four (70.8%) of the isolates were given a DUP-ID. The isolates from water and animals show a high grade of similarity with the human strains and were grouped as DUP-PST1-1010, DUP-PST1-1166, DUP-PST1-1178 and DUP-PST1-1081. The isolates DUP-PST1-2021 and DUP-PST1-1184 were only found among the human isolates. The isolates could be generated in three main clusters. One of these contained DUP-PST1-2021, DUP-PST1-1184, and DUP-PST1-1081, found in both humans and ducks. The second cluster generated DUP-PST1-1010, found in both human and poultry, and the isolated strain DUP-PST1-1079, found in water. The third cluster consists of two strains, DUP-PST1-1066 and DUP-PST1-1078, originating in humans, animals, and water. Three human strains and two poultry strains were diverse and formed their own clusters and could not be given a DUP-ID. Because of the similarity of *C. lari* isolated from humans, poultry, ducks, pigs, and water, as well as the limited knowledge of the strains and their virulence factors, special hygienic precautions should be taken to avoid the risk of transmitting campylobacteriosis.

# REVISION OF GENUS *LATHYRUS* L. IN THE FLORA OF LATVIA

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The first records about genus *Lathyrus* L. in the flora of Latvia date back from the end of the 18th century (Fischer, 1778, 1784, 1791). Main investigations on this genus have been carried out in the 20th century. In „Flora of Latvian SSR” (Līvena, 1957) 8 wild species have been mentioned of genus *Lathyrus* – *L. maritimus* (L.) Bigelow, *L. montanus* Bernh., *L. niger* (L.) Bernh., *L. palustris* L., *L. pratensis* L., *L. sylvestris* L., *L. tuberosus* L., *L. vernus* (L.) Bernh. and 1 cultivated species – *L. odoratus* L. The view on genus size has changed due to floristic investigations of the Latvian geobotanical districts in the 60-80-ties of the 20th century, as well as due to critical investigation of herbarium. In the review of the flora of Latvia 4 new species were added to genus: *L. aphaca* L., *L. hirsutus* L., *L. pisiformis* L., *L. pannonicus* (Jacq.) Garke. In the latest list of taxa in „Flora of Latvian Vascular Plants” (Gavrilova, V. A. Ģulcs, 1999) 3 more species were added to genus: *L. sativus* L., *L. tingitanus* L. and *L. venetus* (Mill.) Walf. Comparison of the last revisions of genus with previously mentioned led to the following conclusions:

1. There are no *L. pannonicus* (Jacq.) Garke in Latvia. The specimen was misidentified.
2. Until now there is no evidence of *L. venetus* (Mill.) Walf. presence in the flora of Latvia.

At this stage of investigation the following list of species of genus is accepted in the flora of Latvia: *L. aphaca* [1972]\*, *L. hirsutus* [1972], *L. linifolius* (Reichard) Bässler [1839], *L. maritimus* [1839], *L. niger* [1791], *L. pallescens* (M. Bieb.) K. Koch (*L. pannonicus* auct., non (Jacq.) Garke), *L. palustris* [1784], *L. pisiformis* [1839], *L. pratensis* [1778], *L. sativus* [1980], *L. sylvestris* [1803], *L. tingitanus* [1999], *L. tuberosus* [1778], *L. vernus* [1791].

\*The year in square brackets behind taxa refers to the year when the taxon was first mentioned in the flora of Latvia.

# DEVELOPMENT OF DNA FINGERPRINTING PROTOCOLS FOR LATVIAN FOREST AND CROP SPECIES

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The Genetic Resource Centre (GRC) was established last year with funding from the Latvian Ministry of Agriculture. It incorporates the Latvian Gene Bank, the Gene Bank database, and a molecular genetics laboratory. The Latvian Gene Bank holds seed collections of Latvian agricultural crops and their wild relatives, and there are plans to expand the collection to include seeds from forest tree species as well. The database contains information regarding these collections, as well as data about field collections held by various breeding institutes in Latvia. The molecular genetics laboratory is equipped with an ABI 3100 genetic analyser, and functions as a research facility as well as providing molecular marker support for breeding programs.

We have initiated a program of DNA fingerprinting for Latvian agricultural crops. SSR-based fingerprinting protocols were established for cherry, onion, melon, potato, barley, clover and wheat last year, and DNA fingerprinting of these crops will commence this year. Further SSR marker protocols are being developed for triticale, raspberry, blackcurrant, garlic, oats, rye and pea. Currently, we are concentrating on SSR markers, as these have been established for the crops listed above, they are robust, and data can be compared with results from other laboratories.

We are also closely collaborating with tree breeders, both in selection programs as well as genetic diversity surveys of Latvian forest populations. We have established SSR-based fingerprinting protocols for hybrid poplar clones that are being used in plantations here in Latvia. We are also in the process of undertaking a survey of the genetic diversity and population structure of Latvian forest tree species (pine, spruce and birch). As expected, little population differentiation was found in spruce and pine, and the birch diversity study is currently underway. The next step will be to investigate the use of chloroplast SSR markers in these forest species which may allow for better population differentiation and provenance identification. Another program is just starting that will look at developing species specific DNA markers for *Alnus spp.*, which would aid in identifying hybrids of these species.

# CHANGES IN DUNES PLANT COMMUNITIES UNDER ALIEN SPECIES *GYPSOPHILA PANICULATA* INFLUENCE IN LATVIAN SEACOAST

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Several territories of seacoast in Latvia and Lithuania were investigated during four-year studies to describe the population dynamics and spatial structure of *G. paniculata*, and impact of this plant on plant communities and biodiversity of dunes.

Baby breath *Gypsophila paniculata* L. is one of exotic species in the dunes of Latvia. This plant is invasive and nonnative in North America and Lithuania, but it is included in the Red Data Book of Latvia. *G. paniculata* established in the territory of Latvia during the 20th century and nowadays it grows in ruderal areas, near railways and in the dunes of Baltic Sea seacoast.

There were described 531 sample plots for analysis of plant communities, and 6 permanent plots were established to describe the population dynamics and spatial structure of *G. paniculata*. The biotopes where *G. paniculata* occurs were investigated, describing changes on *G. paniculata* cover and occupied territories.

Plant communities on investigated territories are represented by the class Koelerio-Corynephoretea Klika in Klika et Nowak and class *Ammophiletea arenariae* Br.-Bl. et R.Tx. The new, no-officially registered taxa of plant communities class *Ammophiletea arenariae* Br.-Bl. et R.Tx that is typical for disturbed grey dunes and dune grasslands, is described. The dominant species of taxa are *G. paniculata*, *Tortula ruralis*, *Artemisia campestris*, *Carex arenaria*, *Sedum acre*, *Leymus arenarius*.

*G. paniculata* has advantages in competition compared with other typical plants of dunes, and the only limitation factor for promoting the spread of *G. paniculata* is a stable degradational successional stage of plant communities. It is necessary to take in account that *G. paniculata* can endanger the biodiversity of dunes and change the structure of typical plant communities, besides growing number of occupied territories with *G. paniculata* indicates about increasing anthropogenic stochasticity.

# PRELIMINARY NOTES ON PYRENOAMYCETES (ASCOMYCOTA) FROM ALLUVIAL FOREST WITH *ALNUS GLUTINOSA* (SOUTH-EASTERN LITHUANIA)

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31 herbarium specimen, including 41 sample of pyrenomycetes, were collected during 2001 and 2005 in alluvial forest with *Alnus glutinosa*, situated in Varėna district (southeastern Lithuania). One twig, one branch, one leaf, a part of stem or stump is called a sample. The diameter of lignicolous substrate was measured.

On *Alnus glutinosa*, *Corylus avellana*, *Frangula alnus*, *Pinus sylvestris*, and *Rhamnus cathartica* 16 species of pyrenomycetes, belonging to 4 orders, were identified. Among these orders representatives of Diaporthales predominate according to the number of species (7) and samples that make up more than half of collected material. Order Xylariales is represented by 6 species. Samples with species of Xylariales make up more than one third of all material.

*Eutypella extensa* (Fr. : Fr.) Sacc. is reported for the first time in Lithuania.

Ascocarps of the vast majority of pyrenomycetes were found in bark of twigs and branches. Only ascocarps of *Bertia moriformis* were on wood of branch. In general the diameter of twigs and branches, inhabited by studied fungi, was 0.4–14 cm. Species of Diaporthales were registered on twigs and branches with the diameter from 0.4 up to 1.6 cm. Species of Xylariales were found on twigs and branches with the diameter from 0.7 up to 3.2 cm.

# **LICHENOINDICATION, CONTENT OF HEAVY METALS AND PH OF PINE BARK AS AIR POLLUTION INDICATOR: CASE STUDY IN DAUGAVPILS**

**Santa Rutkovska**

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In the article the results of the research of environmental quality in Daugavpils are summed up. The bioindicators – pine bark and epiphytic lichens, were used as the absorbents of atmospheric pollution. The amount of 11 chemical elements (Na, Mg, K, Ca, Mn, Fe, Ni, Cu, Zn, Cd, Pb) was determined in the pine bark, pH of the bark was determined in KCl extract as well. In parallel, the author also used the method of lichenoidication. The obtained results show that in the town the most polluted places and the worst environmental condition in common are near chemical and metal-working enterprises. In this case the factor influencing accumulation of atmospheric pollution is the prevalent wind of the NW and SW directions.

# MYCORRHIZAL STATUS OF SCOTS PINE SEEDLINGS AND IDENTIFICATION OF MYCORRHIZA FUNGI BY TRADITIONAL AND MOLECULAR METHODS

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The influence of different nursery substrata (pine and oak stands litters) on mycorrhiza spreading at age of 2 of Scots pine seedlings in bare-roots nursery was investigated. The morphological classification of the mycorrhiza morphotypes was accomplished by the traditional morphotyping and verified aid by the PCR-RFLP molecular markers. Identifications of fungal symbionts were based on PCR amplification of the ITS using ITS-1 and ITS-4 as primers. The studied influence of different nursery substrata on mycorrhiza spreading differs. The ascertained highest spreading of *Suillus* sp. ectomycorrhizal fungi in pine stand litter (80.6%) with the least ectendomycorrhiza (10.5%) formed by *Wilcoxina* sp. mycorrhizal fungi in the mentioned substratum and provided optimal conditions to sustain genotypic diversity of the most growing Labanoras provenance under transferred conditions. Ectomycorrhiza formed by the ectomycorrhizal fungi (*Suillus luteus*, *Suillus variegatus*, *Tuber* sp., *Cenococcum geophilum*, *Amphinema byssoides*) decreases the probability of for formation of ectendomycorrhiza formed by mycorrhizal fungi *Wilcoxina mikolae*.

# STRUCTURE OF HELMINTH COMMUNITIES OF THE AMPHIBIA IN KALOTE LAKE

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Only several researchers have studied the parasites of amphibia in Lithuania and the last data in this field are 13 years old. The purpose of this research is to explore the structure of the helminth communities in amphibia from Kalote Lake. The research material was collected near Kalote Lake, which belongs to the Seaside Regional Park, in September, October 2004, September 2005 and April 2006. Amphibia were dissected and examined for their helminth parasites.

40 specimens of *Rana temporaria* and 30 specimens of *Bufo bufo* were examined for helminths. As a result of this helminthological study, a total of 7 species of helminths, belonging to 4 classes, 7 families and 7 genera were determined. *Rana temporaria* is the host of 7 helminth species: *Rhabdias bufonis*, *Oswaldocruzia filiformis*, *Cosmocerca ornata*, *Opisthioglyphe ranae*, *Gorgoderia cygnoides*, *Polystoma integerrimum*, *Acanthocephalus ranae*. *Bufo bufo* is the host of 4 helminth species: *Rhabdias bufonis*, *Oswaldocruzia filiformis*, *Cosmocerca ornata*, *Acanthocephalus ranae*.

There are 57,14 % of helminth species generic to both species of hosts. The host's age and season influence the infection intensity of helminths. There are statistically significant synergistic interaction by helminths species abundance between nematodes *O. filiformis* and *R. bufonis* adults. The species composition and infection parameters of parasites of different amphibia depend on their way of life. *R. temporaria* which lives in water and on land has the same possibility to be infected with trematodes and nematodes as well. *B. bufo* enters into the water only for spawning after metamorphosis, that's why nematodes prevail in the helminth fauna of the Common Toad. *B. bufo* is more infected with nematodes than *R. temporaria*. There are statistically significant differences between infection intensities of *R. bufonis* and *C. ornata*.

# SOME MOLECULAR MECHANISMS OF OXIDATIVE STRESS IN PLANT CELLS OF WHEAT SEEDLINGS

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The role of oxygen in plant life is very significant. Reactive oxygen species inactivate enzymes and damage important cellular components. The increased production of toxic oxygen derivatives is considered to be common feature of stress conditions. Plant and other organisms have some mechanisms (antioxidant defence system) to contend with this problem.

SODs (EC 1.15.1.1.) are a family of metallo-enzymes whose presence has been demonstrated in the cytosol and different cell organelles, its physiological significance in protecting cells from reactive oxygen species. When these defences are overwhelmed, as occurs during both biotic and abiotic stress, the mitochondria are damaged by oxidative stress.

The influence of antioxidants (ionol, ascorbic acid) and inhibitor of the mammalian permeability transition pore (cyclosporin A) on the activity of superoxide dismutase (SOD) were studied in wheat (*Triticum aestivum* L.) seedlings and different seedlings part over a 7-day period. SOD profiles were examined by native polyacrylamide gel electrophoresis in different organs of wheat seedlings.

The enzymes are present in the leaves and coleoptiles of wheat germ. It was found that production of superoxide is crucial for normal morphogenesis of etiolated wheat seedlings at the early stages and senescence at late stages of plant development. The development of etiolated wheat seedlings was shown to be accompanied with cyclic changes in the rate of superoxide production both in a whole intact seedling and in its different organs (leaf, coleoptile). It was shown, that cyclic change of rate of superoxide production in seedlings development correlates with changes of nuclear DNA synthesis and apoptotic fragmentation in cells of some development and senescence separated organs (leaf, coleoptile) of this plants. It was found, that antioxidant defense system superoxide dismutase is activated in apoptotic cells of senescence organs. It was found, that cyclosporin A inhibits of peroxide formation and nuclear DNA apoptotic fragmentation.

# THE STATUS OF LITHUANIAN NATURAL AND SEMI-NATURAL MEADOW COMMUNITIES AND THEIR PRESERVATION POSSIBILITIES

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Under temperate climatic conditions meadow ecosystems have formed as a result of centuries-long traditions of land use, which facilitated the formation of meadow communities characterized by high diversity of vascular plant species. At the end of the 20th century, after restoration of private land property rights in Lithuania, the economic value of meadows declined, which had an ecological effect on landscape stability and allowed botanical diversity restoration to increase.

After Lithuania's integration into EU, new possibilities to preserve biodiversity in the remaining natural and restoring semi-natural meadows have emerged. The financial assistance that is now available to farmers encourages them to maintain meadows and prevent succession to scrubland or woodland. Changes in land-use and farming traditions have stimulated naturalization of abandoned agricultural lands allowing increase in their biodiversity, and also caused rapid degradation of abandoned natural meadows. Investigations on the status of natural and semi-natural meadow communities were carried out in 2000–2005 on different geographical regions of Lithuania. The aboveground phytomass (1st harvest; dry weight, g/m<sup>2</sup>) and economic value (points) of meadow communities included into 4 systematic classes were ascertained: *Festuco-Brometalia erecti*, *Trifolio-Geranietea sanguinei*, *Molinio-Arrhenatheretea elatiori* (large variation of phytomass and economic value is conditioned by habitat and taxonomic diversity of communities) and *Nardetea strictae*.

A complex of growth conditions and management of grasslands in separate study sites determined quite large diversity of meadow productivity (especially of the communities of *Molinio-Arrhenatheretea elatioris* class): from 240 g/m<sup>2</sup> (Ass. *Anthoxantho-Agrostietum tenuis*) to 1660 g/m<sup>2</sup> (Ass. *Deschampsietum cespitosae*) of dry weight aboveground phytomass. Fodder demand in Lithuania has currently decreased, therefore, a threat of extinction of natural and semi-natural meadow communities has occurred. Instead of abandoned meadows, areas overgrown with shrubs or trees can gradually form. Meadow communities (Ass. *Alopecuretum pratensis*, Ass. *Festucetum pratensis*) with rather productive and economically valuable grassland (6.1–10.0 points) have more chances to survive. Nevertheless, to preserve biodiversity, meadows producing small amount of vascular plant phytomass (Ass. *Molinietum caeruleae*, Ass. *Anthoxantho-Agrostietum tenuis*, All. *Mesobromion erecti*, Ass. *Polygalo-Nardetum strictae*) or those of low economic value (up to 6.0 points; Ass. *Cirsietum rivularis*, Ass. *Deschampsietum cespitosae*, Ass. *Molinietum caeruleae*, Ass. *Trifolio-Agrimonetum eupatoriae*, Ass. *Polygalo-Nardetum strictae*) are also important. Therefore, it is necessary to observe and evaluate the status of natural and semi-natural meadow communities, leave the areas for preservation of biodiversity as well as select a proper way of their management.

# **CARABIDS DIVERSITY ALONG ANTHROPOGENIC GRADIENT – FROM PRIMEVAL BIALOWIEZA FOREST TO OPEN AREA**

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The indicator taxon selected for study was the family Carabidae, which has been thoroughly studied in Europe with respect to both its taxonomy and ecological requirements. The field work was carried out in Bialowieza Primeval Forests, the last extant primeval forest in Europe, characteristic of the Central European Lowlands. Bialowieza Primeval Forest was legally protected as late 1920. At present only part of it remains a protected area and the rest is variously managed with minor or large-scale felling, changes in the composition of the foreststand resulting on pine-only and spruce-only stands felling make way to paths and roads, clear-cutting of stands to build settlements or timber stockpiles or years agricultural management of the soil following clear-cutting. The hypothesis was put forward that a decrease in forest species with an increase share of non-forest species accompanies increasing disturbance of the primeval forest. The hypothesis was proved true with additional observation that there is often an increase in the number of carabid beetles in communities inhabiting managed stands, accompanied by an increase in the Margalef index. These changes are due to the appearance in managed stands of generalists species, which prevail numerically over forest specialist among Polish Carabidae.

# THE SPATIAL DISTRIBUTION OF THE CADDISFLY TRICHOPTERA COMMUNITIES IN THE MICROHABITATS OF TUMSUPE STREAM IN LATVIA

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The aim of the study was to determine the spatial distribution of Trichoptera species in the different type of microhabitats in relation to the abiotic factors.

The sampling was conducted in the May 27 of 2005 along 50-meter long reach of the stream. 8 types of microhabitat were investigated: akal (>2mm to 2cm), microlithal (>2cm to 6cm), microlithal (6cm to 20cm), mesolithal (20cm to 40cm) and mesolithal with water moss *Fontinalis* sp. cover, FPOM (fine particulate organic matter), CPOM (coarse particulate organic matter), and macrophytes. In the each microhabitat 5 replicates were taken with the Surber sampler (frame size 0.25 x 0.25m). The physiography for the investigated stream stretch was characterised.

In total 36 caddisfly taxa were found. Microhabitats differ in the abundance and the species diversity of Trichoptera taxa.

The highest mean abundance was found in the mesolithal (20cm to 40cm), macrophyte and mesolithal with *Fontinalis* sp. cover microhabitats (from 90 to 118 individuals per 0.0625 m<sup>2</sup>) but the lowest, in the akal and FPOM microhabitats (from 12 to 17 individuals per 0.0625 m<sup>2</sup>).

The highest species diversity was found in the mesolithal with *Fontinalis* sp. cover (in total 18 taxa) and macrophyte microhabitats (in total 15 taxa). The lowest species diversity was found in the akal (in total 5 taxa) and FPOM microhabitat (in total 6 taxa).

The PCA biplot shows three distinct groups of Trichoptera taxa in Tumsupe stream. The first one make the FPOM, CPOM and akal microhabitat species (the most characteristic are Limnephilidae Gen. sp. and *Anabolia laevis*), the second one make the microlithal (>2cm to 6cm), microlithal (6cm to 20cm), mesolithal (20cm to 40cm) microhabitat species (the most characteristic are *Agapetus ochripes* and *Psychomyia pusilla*), but the third – macrophyte and mesolithal with *Fontinalis* sp. cover microhabitat species (the most characteristic are *Ithytrichia lamellaris*, *Hydropsyche instabilis* and *Hydropsyche* sp.). The results show that the Axis 2 of PCA displays the species preference to the current velocity.

The spatial distribution of Trichoptera taxa is related to a complex of abiotic factors but the most important is the current velocity, which influence the formation and structure of microhabitats.

# **EROSION LANDFORMS AND SPATIAL DISTRIBUTION OF RARE VASCULAR PLANT AND MOSS SPECIES AND HABITATS: CASE STUDY IN PROTECTED NATURE AREAS IN SE LATVIA**

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Erosion landforms are widespread geomorphological features and elements of landscape throughout the world. However most of studies hitherto focus on fluvial erosion processes and formation of stream and gully network as an environmental problem (Valentin et al., 2005) or negative phenomenon (Poesen et al., 2003), which causes soil erosion, losses of soil fertility, arable land degradation, silting-up of small rivers and brooklets etc.

Despite the negative effects, it is necessary to highlight the positive results of fluvial erosion like diversification of the landscape, formation of different habitats and increasing of biodiversity. In this context, less study (Soms 2004; 2005) have reported to erosion landforms as factor controlling spatial distribution of plant species and geospatial relationships of biodiversity, though assessing the habitat suitability indices is the objective of many researches in Europe.

Field studies of rare vascular plant and moss species (e.g. *Carex pilosa* Scop., *Circaea lutetiana* L., *Dicranum viride* (Sull. & Lesq.) Lindb., *Neckera pennata* L., *Bazzania trilobata* (L.) Gray, *Geocalyx graveolens* (Schrad.) Nees., *Lophozia incisa* (Schrad.) Dum., *Anomodon attenuatus* (Hedw.) Hüb. etc.) realised by authors of this paper in protected nature areas in south-eastern Latvia, as well as GIS analysis of their spatial distribution, show direct interconnectedness between their location and patterns of erosion network. Actually, the big part of rare vascular plant and moss species growing places, as well as habitats of international and EU importance are located exactly within erosion-formed valleys and gullies.

Analysis of data shows that this fact can be explained as result of interaction of indirect and direct controlling factors. On the one hand, preservation of rare vascular plant and moss species within erosion forms is a result of preservation of forest habitats unsuitable for human economic activities (soil cultivation, grazing, forestry etc.) due to steep slopes (indirect controlling factor), whilst forests in territories adjacent to valleys and gullies were totally cleared off. On the other hand, changes of natural factors (topography, slope aspect, slope gradient, soil properties, amount of solar radiation, distribution of precipitation and moisture regime, air humidity and temperature etc.) and their spatial distribution due to formation of erosion landforms within landscape causes modification of existing ecosystems and formation of environment favourable for existence of rare vascular plant and moss species. Respectively, changes of landscape pattern caused by erosion and formation of gully network have changed complex of geographical and ecological factors. Its also prevents this sites from further intense use for agricultural needs, making them “unusable” from man’s view point.

Taking into account facts mentioned above, we can conclude that erosion processes determines spatial distribution of plant species and their biodiversity to a high degree. Recognition of that leads to necessity to study the habitat requirements of rare vascular plant and moss species, taking into account also spatial distribution of erosion landforms and topography of territory under study.

# EVALUATION OF TERATOGENIC ACTIVITY OF THE SMOKE OF BURNING PLASTIC INFLUENCING THE *DROSOPHILA MELANOGASTER*

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The city environment suffers from the aggressive influence of the burning litter in the outskirts of the city. Synthetic packaging, plastic bottles, etc. are among the burning mass. Smoke of the burning plastic is characterised by a mutagenic, cancerogenic and teratogenic activity.

Combustion of organic compounds, including polymers is a complex physical-chemical process in course of which, first, original substances are destructed, which results in the appearance of less complex products (CO<sub>2</sub>, CO, HCl, COCl<sub>2</sub>, etc.) that can possess both low and high degree of toxicity. Second, the process of burning is accompanied by a number of free radical reactions in course of which such dangerous ecotoxicants as polyaromatic hydrocarbons (Harvey 1977) are synthesised in a thermo-chemical way, e.g. benzopyrenes that are strong cancerogenes (Dachs, Eisenreich 2000). If the burning substance contains halogens, the likelihood of the appearance of halogenated alkanes and halogenated aromatic compounds, dioxins, dibenzofurans, etc. is very high (O'Neil 1993; Karosek, Dickson 1987). Many of these substances have a distinct mutagenic, cancerogenic and teratogenic activity determined by their ability to form during metabolism active metabolites interacting with nucleic acids. In so doing they damage the structure and functioning of the latter.

The given work presents the experiments in which larvae and pupae of *Drosophila melanogaster* of various ages were influenced by different doses of the smoke produced by the burning plastic with the aim of evaluating its teratogenic activity at various stages of postembryonic development. The experiment results demonstrate that the frequency of imago with abnormal tergites (morphoses) grows with increasing doses of the smoke of burning plastic, namely polyethyleneterephthalane (PET) and polystyrene (PS); it also depends on the age of larvae and pupae at the moment of the influence.

Larvae of younger age (24-32 hrs after the eggs are laid) and pupae of younger age (120-136 hrs after the eggs are laid) proved to be most sensitive to different doses of the teratogenic influence of the smoke of burning plastic (PET and PS). At these ontogenesis stages abdominal germline cells from which tergites develop, are actively mitotically dividing (Nothinger 1972). The conclusion arrived at is that the dividing cells are more sensitive.

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# FAUNA AND ECOLOGY OF BUGS (HETEROPTERA) IN THE COASTAL DUNE HABITATS IN THE ZIEMUPE NATURE RESERVE, LATVIA

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Epigeic arthropods, including bugs were investigated in the coastal dune habitats in the Ziemupe Nature Reserve near Akmensrags in 2006. The dunes covered narrow, up to 100 m wide coastal zone. The foredune was narrow and low, gradually transforming to the grey dune. This habitat covered about 20 m wide zone. The width of typical grey dune was about 50 m. Inlands grey dune bordered on dry grassland near Scotch pine plantings.

The pitfall traps (opening diameter 7 cm, filled with 4% solution of formaldehyde with addition of ethylenglycole and few drops of detergent) were used to study epigeic fauna. One transect was selected for studies during the whole non-freeze period of the year – from April to November. 40 pitfall traps were arranged on 80 m long transect. Transect started at white dune then crossed typical grey dune and ended at dry coastal meadow. The distance between traps was 2 m. The traps were changed every two weeks from 02.04.2006 to 12.11.2006. Only adults were counted and identified to species, except *Saldula spp.* and Miridae. Species dominance was evaluated in accordance with E.-D.Engelmann (1978) classification. Correlation among variables characterising bug total population in the season, plant species and cover was calculated. All data were log transformed.

Vegetation was described by B.Laime, L.Liepiņa and I.Cera. The plant species and vegetation cover were characterised in one square meter around the every pitfall trap in accordance with Braun-Blanquet classification. Vegetation height was measured by use of light foam plastic plate mounted on graduated handle. Three measures were done around every trap and mean height was calculated. Abiotic factors were not considered in this study.

In total, 724 individuals were collected and 25 species were identified. Of them: dominant species – *Derephysa cristata*, *Nysius ericae* and *Acalypta parvula*; subdominant – *Pionosomus varius*, *Sciocoris cursitans*, *Legnotus picipes* and *Gonianotus marginepunctatus*; the rest 18 species were subprecedent - *Trapezonotus anorus*, *Coranus subapterus*, *Plinthisus pusillus*, *Trapezonotus desertus*, *Phimodera humeralis*, *Geocoris ater*, *Aradus cinnamomeus*, *Neides tipularius*, *Nithecus jacobaea*, *Jalla dumosa*, *Acalypta gracilis*, *Chorosoma schillingi*, *Megalonotus chiragra*, *Sphragisticus nebulosus*, *Trapezonotus arenarius*, *Aelia acuminata*, *Chorosoma schillingi* and *Dictionota tricornis*.

The cover of flowering plants and number of species significantly increased along transect from white dune to grey dune and dry meadow. *Hieracium umbellatum*, *Festuca sabulosa*, *Thymus*

*serphyllum*, *Galium mollugo*, *Carex arenaria*, *Sedum acre*, *Artemisia campestris*, *Leymus arenarius* and *Calamagrostis epigeios* dominated among flowering plant species. The cover of mosses significantly increased along transect from white dune to grey dune and dry meadow. *Hypnum cupressiforme*, *Brachythecium albicans*, *Tortula ruralis* and *Ceratodon purpureus* dominated among moss species. The cover of lichens alone was insignificant.

The bugs could be divided to three definite ecological groups preferring different dune successional stages, having the highest population density there. The first group – *Saldula* spp. and *Gonianotus marginepunctatus* definitely preferred early dune successional stages and negatively correlated with vegetation data. The second group – *Derephysa cristata*, *Nysius ericae*, *Pionosomus varius*, Miridae spp. and *Acalypta parvula* preferred stabilised grey dunes. *Derephysa cristata*, *Nysius ericae*, *Pionosomus varius* and Miridae spp. positively correlated with flowering plant cover and cover of *Artemisia campestris*, but *Acalypta parvula* – with moss cover, flowering plant diversity, cover of *Galium mollugo* and *Sedum acre*. And the third group – *Legnotus picipes* and *Sciocoris cursitans*, having digging behaviour, preferred transition zone from grey dune to coastal meadow. They positively correlated with plant species diversity. Vegetation height was important for *Legnotus picipes*, but moss cover and *Thymus serphyllum* – for *Sciocoris cursitans*. Some plants had minor role in limiting of distribution of bugs, namely *Carex arenarius*, *Leymus arenarius*, *Calamagrostis epigeios*.

The bug species showed clear distribution pattern along dune habitat successional stages. The pitfall tapping was relevant method for collecting bugs, except Miridae and some plant dwelling species.

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# THE APPLICATION OF IMMUNOLOGIC MARKERS IN TAXONOMY OF SEADUCKS

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The methods of immunogenetic analysis allow follow evolution process of proteins chemical structure according to variations of their antigenic specificity. Therefore immunogenetic parameters to which antigenic differences of individuals under investigation belong are of great value for determination of interspecies and intraspecies relationships in various taxonomical levels. Those parameters are also important for the observation of molecular evolution phenomena. Therefore, the objective of our work was to investigate genetically determinate antigenic differentiation of blood sera from individuals belonging to the Seaducks (*Mergini*) of the Anseriformes order.

The blood sera from Smew (*Mergus albellus*), Goosander (*Mergus merganser*), Long-tailed duck (*Clangula hyemalis*) Common Goldeneye (*Bucephala clangula*), Common Scoter (*Melanita nigra*) and also polyspecific antisera obtained by immunisation of Chinchilla breed rabbits with above sera were used in our investigations. The species specific and non-specific antigenic determinants expressed by precipitation lines were detected in the species under the investigation. For this purpose the method of double diffusion in to agar gel according to Ouchterlony has been used. Species specific antigenic determinants were detected between reaction of antigens and antibodies from the same species and non-specific between reaction of antigens and antibodies from the different species blood sera. Phylogenetic interpretation of antigenic heterospecificity was based on equation of Dino and Georgi (1982). Genetic distance=  $1 - X$ . There X is a non weighted, simple matching coefficient obtained by dividing the number of species specific antigen - antibody reactions and total amount of species specific and species non-specific antigen - antibody reactions.

The data of genetic distances obtained by this equation showed such course of genetic similarity: Long - tailed duck (*Clangula hyemalis*), Smew (*Mergus albellus*), Goosander (*Mergus merganser*), Common Scoter (*Melanita nigra*), Common Goldeneye (*Bucephala clangula*). The greatest genetic similarity was observed between Long - tailed duck (*Clangula hyemalis*) and Goosander (*Mergus merganser*) ( $D=0.6636$ ). Goosander (*Mergus merganser*) and Common Goldeneye (*Bucephala clangula*) were mostly remote ( $D=0.8450$ ).

Obtained data are actual for further phylogenetic analysis of such tribe because detection of biopolymers structural differences makes up opportunity to estimate similarity of comparable species genotypes. However, a majority of such tribe previous phylogenetic analysis data are based on investigations carried only on external features which are determined by great amount of genes.

# MORPHOLOGIC AND GENETIC CHARACTERIZATION OF SARCOCYSTIS SPP. FROM HOODET CROW (*CORVUS CORNIX*)

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Protists of the *Sarcocystis* genus are parasites of the carnivorous and omnivorous mammals, birds and reptiles most species of which have the obligatory two-host life cycle. More than 200 species of the *Sarcocystis* have been described, however, little is known about these parasites in birds. The aim of our work was to determine prevalence of *Sarcocystis spp.* in the hooded crow (*Corvus cornix*) in Lithuania and to present certain results of the morphology of cysts and the DNA analysis. In the period between 2002 and 2006 due to presence of sarcocysts in muscles 30 crows were investigated. Samples of leg and neck muscles were stained with methylene blue, pressed in a glass compressor and investigated under a light microscope. Morphology of cysts and cystozoites were studied in native preparations. In one case samples containing cysts were fixed in Karnovski's fixative and investigated under an electronic microscope. Besides, the analysis of ribosomal DNA of cysts was made. Prevalence of infection of the crows investigated was high - *Sarcocystis spp.* cysts were found in 12 (40.0%) individuals. Two types of sarcocysts have been established, which were referred to as cyst type I and cyst type V. Under a light microscope the wall of the *Sarcocystis sp.* (cyst type I) (< 1 mm) was smooth, without visible protrusions on its surface. Cystozoites were small (6-8 mm). The wall (up to 2,5 mm) of *Sarcocystis sp.* (cyst type V) was striated. Ultrastructurally the cyst wall amounted to 2,1 mm and had stump-like protrusions that differed in size and shape on the surface of which microprojections of the primary cyst wall were clearly visible. Cystozoites were small (6-8 mm).

Two *Sarcocystis sp.* (cyst type V) fragments of 28S rRNA 645-649 bp and 18S rRNA 1391-1393 bp in length were obtained during the investigation. A comparison of newly detected gene fragments revealed a striking similarity to the homological sequences of the genera *Sarcocystis* and *Frenkelia*. The phylogenetic analysis based on partial sequences of 18S and 28S ribosomal RNA genes confirmed the unique taxonomic status of the investigated *Sarcocystis spp.*

In conclusion, morphologically and genetically *Sarcocystis sp.* (cyst type V) is distinct from all - named species described in birds and should be considered as newly described species.

# BIODIVERSITY OF GREY DUNES PLANT COMMUNITIES IN THE LITHUANIAN SEACOAST

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The investigated sand vegetation in the Lithuanian seacoast includes plant communities of grey dunes and psammophyte grasslands. It is represented by the class *Koelerio-Coryneporetea* Klika in Klika et Nowak 1941. These communities are sensitive to the amount of light thus can poorly compete with other plant communities and stretch in grey dunes, palve, abandoned military grounds, sandy grasslands, open forest areas on the Baltic Sea coast of Lithuania.

Botanists (FUKAREK, 1961; MATUSZKIEWICZ 1984; PIOTROWSKA, STASIAK 1984; POTT 1992; DIERSSEN 1996) of various countries (Poland, Germany) disagree concerning the extent of this class and its taxonomic structure, because it comprises the communities differing in edaphic conditions of habitats. Hierarchic systems of syntaxa created by J. Klika (1934); R. Tüxen (1951); D. Korneck (1978); W. Matuszkiewicz (1984); R. Pott (1992); K. Dierssen (1996) are employed in this work. The communities described in the Lithuanian seacoast belong to the *Coryneporetalia canescentis* Klika 1934 order, which comprises comparatively open two layered communities of low grasses. Three alliances belong to this order; they differ in specificity of the occupied habitats and species diversity.

The *Corynephorion canescentis* Klika 1934 alliance and the association *Violo-Coryneporetum canescentis* (Böcher 1941) Westhoff et al. 1946, which belongs to the alliance, comprise primary communities of grey dunes, where plants consolidate the sand. Two variants of this association have been described:

- *Violo-Coryneporetum canescentis* v. *Cladonia* spp. are initial communities of grey dunes. In the described communities of this variant 52 plant species grow, still in some relevés there are 11–16 species. Grass layer is not abundant (projection coverage 20–40 %), bryophytes distributed unevenly, their abundance in the relevés varies (from 1 % to 70 %). Lichens are very important components of these communities; 21 lichen species grow there. Together with bryophytes they fill in the gaps amidst other plants and form almost continuous cover (projection coverage 60–90 %). Most stable and abundant are *Cladonia mitis*, *C. chlorophaea*, *C. cornuta*, *C. gracilis*, *C. glauca*, *Cetraria aculeata*. In the communities of such structure water distribution is even, humus layer starts forming from the parts of dead plants, acidity of soil changes, and the conditions for the settlement of competitively weak plants occur.

- *Violo-Coryneporetum canescentis* v. *typicum* – communities characteristic to seacoast grey dunes. Total number of species is 62, in separate relevés 13–18. Herb layer is particularly abundant (projection coverage 60–80 %). Bryophyte cover is not abundant (projection coverage 1–20 %), *Ceratodon purpureus* prevails, *Brachythecium albicans*, *Polytrichum piliferum* are also found. The number of lichen species (11) has strongly decreased. They do not form continuous cover, only in some relevés their projection coverage reaches 80 %. In such communities the conditions favourable for the settlement of trees and shrubs occur. Very rarely single *Pinus sylvestris*, *Salix daphnoides*, *Salix rosmarinifolia* start to grow.

The association *Carici arenariae-Airetum praecocis* (Schwickerath 1944) Krausch 1967 is ascribed to the Thero-Airion R. Tx. 1951 alliance. These communities of seacoast sandy grasslands are rare in the whole area. In the continental part of the Lithuanian seacoast (Klaipėda–Nemirseta) the subassociation *Carici arenariae-Airetum praecocis* subas. *centaurietosum littoralis* (BALEVIČIENĖ, STANKEVIČIŪTĖ, 2000) has been newly described. Characteristic species – *Centaureum littoralis*, differential species – *Radiola linoides*. Herb

layer is thick (60–80 %), bryophytes are abundant (70 %). The species characteristic to the class (*Jasione montana*, *Brachythecium albicans*, *Cerastium arvense*), order (*Carex arenaria*, *Corynephorus canescens*, *Trifolium arvense*), and alliance (*Aira praecox*) prevail. Apart from the mentioned species *Ceratodon purpureus*, *Hypochaeris radicata*, *Polytrichum juniperinum*, *Euphrasia stricta*, *Holcus lanatus*, *Trifolium dubium* grow constantly and abundantly. In time the number of not characteristic species will increase, shrubs and trees will start growing in these communities. Due to gradual alteration of habitats, these communities will become extinct. Special protection measures (limited trampling and riding) could help to stop the processes of swarding.

*Koelerion glaucae* (Volker 1931) Klika 1935 is represented by *Helichryso-Jasionetum* Libbert 1940 only. The communities are distributed in palve occupying a transitional zone between the seaward dune cordons (covered by psammophyte communities) and parabolic dune ranges (covered by forest). The herb layer is rich and rather dense. The communities are particularly dominated by the species found mostly in grey dunes (*Jasione montana*, *Carex montana*, *Corynephorus canescens*, *Viola tricolor*, *Erigeron acris*, *Trifolium arvense*), in white dunes (*Lathyrus maritimus*, *Tragopogon heterospermus*, *Honckenya peploides*, *Linaria loeselii*), and in forest formations (*Empetrum nigrum*, *Melampyrum pratense*, *Deschampsia flexuosa*, *Luzula pilosa*). The bryophyte layer is suppressed by a dense herb layer (the coverage reaches 20–40 %).

As Lithuania is in the zone of mixed (deciduous and coniferous) forests, the vegetation of littoral sand is azonic. Observations of the alteration, structure and formation of the communities where littoral, endemic species grow as well as their preservation are interesting theoretically and important in nature protection aspect.

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# THE LICHENOINDICATIVE CHARACTERISTIC OF GIANT OAK TREES IN WOODLAND KEY HABITATS IN LATVIA

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Giant oak trees are biologically old and huge growing solitary or in forests. They serve as a substratum and habitat for many rare and threatened species of epiphytic lichen species. In the inventory of natural woodland habitats lichen is one of the groups of organisms, which is used to evaluate the biological diversity and forest continuity. A part of these species is used as a woodland key habitat indicator species (IS) and habitat specialist species (SBS). The presence of IS and SBS is a sign that determines the woodland key habitat (WKH) status for the tree. In order to provide a habitat for oak related SBS, different management techniques have to be used to giant trees growing in different conditions. The origin of the tree is evaluated according to the history of land use in the respective location (the age and the structure of the surrounding stand), tree structure (the shape of crown and branches, the depth of cracks in the bark) and the species of epiphyte on the tree.

The lichenoidicative evaluation and comparison of giant oak trees have been carried out in nine research sites in Latvia. In total 70 oaks were measured using the lichenoidicative method. The age of oaks according to the inventory data is within the limits of 126 to 228 years.

28 lichen species, belonging to 23 genera were found on giant oak trees. 5 indicator species and 3 habitat specialist species of woodland key habitats, as well as 5 specially protected species, have been found on oaks. The diversity of lichen species and the lichen cover in percentage is smaller at the trunk height of 0.5 m than at the trunk height of 1.5 m it can be attributed to the physical properties of the bark which are similar with respect of age, the presence of moss on the base of the trunk and to mechanical damages of the bark (fallen off bark, cracks). There are substantial differences among the research sites with regard to the coverage in percentage of lichens at the height of 1.5 m. The exposition of lichen species depending on the cardinal points has been analysed. At the height of 0.5 m more species can be found on S and SE side, but at the height of 1.5 m on N and NW side and it can be attributed to differences of moisture in different heights, as well as the competition between lichens and mosses on the base of the trunk. The stand basal area of oak woodland key habitats correlates with following ecological indicators: light, temperature and moisture, but interconnection among continentality, reaction, amount of nutrients and toxicotolerance is not found.

# THE 19TH CENTURY INVESTIGATIONS OF MACROPHYTE FLORA IN LAKES OF THE ILŪKSTE LAKELAND AND ITS VICINITY

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The Ilūkste Lakeland (ILE) is one of the richest lake regions in Latvia that includes the whole of the Augšzeme Highlands with the adjacent territory and is situated in the very south-east of the country between River Daugava and state border with Lithuania and Byelorussia. The area of the Lakeland is 1657 km<sup>2</sup> making up 2.57 % of the country and there are about 200, mainly glacial lakes with the total surface area 43.88 km<sup>2</sup> constituting 2.6 % of the Lakeland area. In addition to that, 17 lakes of the Lakeland are situated on state border with Lithuania and 5 ones with Byelorussia so that approximately 3.09 km<sup>2</sup> of their area fall within the territory of Lithuania and 8.89 km<sup>2</sup> within that of Byelorussia. Irrespective of state borders, the total surface area of all lakes of the Lakeland would be 55.86 km<sup>2</sup>.

Regarding the diversity of macrophyte flora, the Ilūkste Lakeland is one of the richest and the most interesting lake regions in Latvia. Along with many common species a lot of rare and endangered macrophytes are to be found here, e.g. vascular plants – *Alisma gramineum*, *Berula erecta*, *Ceratophyllum submersum*, *Elatine hydropiper*, *Hydrilla verticillata*, *Isoetes lacustris*, *Leersia oryzoides*, *Najas flexilis*, *N. marina*, *N. minor*, *Nuphar pumila*, *Potamogeton acutifolius*, *P. rutilus*, *P. trichoides*, *Scirpus radicans*, *Scolochloa festucacea*, *Zannichellia palustris*, bryophytes – *Fontinalis hypnoides* and *Hamatocaulis lapponicus* and charophytes – *Chara filiformis*, *Nitella confervacea* and *N. syncarpa*. During the 19th century investigations of macrophyte flora in lakes of the Ilūkste Lakeland and its vicinity were carried out by four outstanding botanists – Rev. Józef Fiedorowicz (1777-1860), Eduard Lehmann (1841-1902), Theophil Bienert (1833-1873) and Karl Reinhold Kupffer (1872-1835).

The first and the most important investigations in course of 34 years from 1818 till 1851 were carried out by the outstanding Selonian botanist, the teacher of natural history at the Ilūkste Missionary School, the Roman Catholic priest of Lithuanian descent Józef Fiedorowicz (also Juozapas Fedoravičius, Juozas Federavičius and Jāzeps Fedorovičs) who has spent the most of his life, i.e., 51 year from 1810 (some sources mention 1813) till the end of his life in 1860 living and serving at Ilūkste. The results of his long-term and profound investigations were performed in close cooperation and friendship with his contemporary – the outstanding Lithuanian botanist and pharmacist, professor of the Vilnius University Jan Frederyk Wolfgang (1776-1859). It is important to mention that one of the main interests of Prof. J. F. Wolfgang were aquatic macrophytes and he is the author of monographs on genera *Potamogeton* and *Chara* (in 1827 he also described a new macrophyte species – *Potamogeton rutilus* Wolfg.). Rev. J. Fiedorowicz conducted a regular correspondence with Prof. J. F. Wolfgang and regularly sent his herbarium to him at the Vilnius University. The total number of herbaria collected by Rev. J. Fiedorowicz around Ilūkste was about 1000 and it was originally stored at the Vilnius University. Unfortunately, because of various historical changes the greatest part of the herbaria was taken away to Kiev in the Ukraine (still regarded as missing) and today there are only about 120 herbaria left at the Vilnius University (examined by the author in 1997). Results of his profound investigations Rev. J. Fiedorowicz has summarized in two manuscripts written in Polish. The first one compiled in 1830 under the title “Katalog roślin około Iłukszty znalezionej i zdeterminowanych przez ks. Józefa Fiedorowicza nauczyciela historii naturalnej w szkole Iłukszańskiej porządkiem Linneusza i nazwiskami jego roku 1830 zrobiony” today is

regarded as missing, however, might still be preserved at a library in Kiev where it was kept at least till the end of the 19th century. The other one signed at Ilūkste on the July 5, 1851 is two times thicker and contains 88 pages under the title “Katalog rošlin dziko rosnących i niektórych przyswojonych około Iłukszty przez X. Jozefa Fiedorowicza od roku 1818 aż dotąd postrzeżonych i zadeterminowanych, według układu Linneusza roku 1851. napisany. Nazwiska rošlin połacinie, popolsku i politewsku“. This manuscript is today kept at the National Library of Lithuania. Thanks to the thorough and continuous investigations performed by Rev. J. Fiedorowicz the Ilūkste Region is to be regarded as floristically the most carefully investigated territory in Latvia in the first half of the 19th century. Rather many species found by Rev. J. Fiedorowicz around Ilūkste represent their first records for the territory of Latvia.

The careful study of the manuscript and the available herbaria of Rev. J. Fiedorowicz shows that from 891 vascular plant taxons included in his manuscript totally 42 macrophyte species – 41 vascular plants and 1 charophyte were found in lakes of the Ilūkste Lakeland: *Acorus calamus*, *Batrachium aquatile*, *Butomus umbellatus*, *Callitriche hermaphroditica*, *Ceratophyllum demersum*, *Eleocharis palustris*, *Equisetum fluviatile*, *Glyceria maxima*, *Hydrocharis morsus-ranae*, *Lemna minor*, *L. trisulca*, *Myriophyllum spicatum*, *Nuphar lutea*, *Nymphaea alba*, *N. candida*, *Phragmites australis*, *Polygonum amphibium*, *Potamogeton acutifolius*, *P. bercholdii*, *P. compressus*, *P. crispus*, *P. filiformis*, *P. friesii*, *P. gramineus*, *P. lucens*, *P. natans*, *P. obtusifolius*, *P. pectinatus*, *P. praelongus*, *P. perfoliatus*, *P. rutilus*, *Ranunculus lingua*, *Sagittaria sagittifolia*, *Scirpus lacustris*, *Scolochloa festucacea*, *Sium latifolium*, *Sparganium emersum*, *S. microcarpum*, *Spirodela polyrhiza*, *Stratiotes aloides*, *Utricularia vulgaris* as well as *Chara globularis*. The high number of *Potamogeton* species amounting to 14 (from totally 17 ones known in Latvia) also clearly indicates the high research level of the lake flora. Eight other macrophyte species found nowadays in lakes of the Ilūkste Lakeland Rev. J. Fiedorowicz indicates for other types of biotopes: *Alisma plantago-aquatica* (ditches, pools), *Carex rostrata* (mires), *Ceratophyllum submersum* (millpond), *Fontinalis antipyretica* (river), *Hottonia palustris* (ditches), *Myriophyllum verticillatum* (ditches), *Potamogeton alpinus* (ditches, rivulets) and *Typha latifolia* (mires). In addition to that, Rev. J. Fiedorowicz mentions also 13 vascular plant species for quagmires and shorelines of lakes of the Ilūkste Lakeland: *Carex acuta*, *C. pseudocyperus*, *C. riparia*, *Cicuta virosa*, *Hammarbya paludosa*, *Leersia oryzoides*, *Liparis loeselii*, *Phragmites australis*, *Rumex aquaticus*, *R. hydrolapathum*, *Scirpus radicans*, *Utricularia minor* and *Viola palustris*. Rev. J. Fiedorowicz also indicates 5 macrophyte species and 1 hybrid for the neighboring territories of the Ilūkste Lakeland: two for lakes of Latgale – *Trapa natans* and *Typha angustifolia*, two for Lithuania (the Aukštaitija Highlands) – *Hydrilla verticillata* and a hybrid *Potamogeton gramineus x friesii* as well as three for Byelorussia – *Myosoton aquaticum*, *Rumex maritimus* and *Typha angustifolia*. The most interesting of these are the finding of *Trapa natans* in Lake Kalupes (20 km to the north of Daugavpils, discovered 1824) and that of *Hydrilla verticillata* in Lake Auslas (10 km to the east of Zarasai, discovered 1833).

Next investigations of macrophytes of the Ilūkste Lakeland were carried out in the summer of 1858 (from the end of June till the beginning of August) by the outstanding botanist (also doctor) of Latgale Eduard Lehmann who was at that time just 17 years old secondary school boy but 37 years later wrote his famous “Flora von Polnisch-Livland” (1895). His investigations covered a large area of the Ilūkste Lakeland stretching from Ilūkste and Pilskalne in the west towards Bruņene and Elerne in the east and their results were published in paper “Beitrag zur Kenntnis der Flora Kurlands” (1859). It is important to note that E. Lehmann knew almost nothing about the extensive botanical investigations performed in this region by Rev. J. Fiedorowicz who was at that time spending the wane of his life in Ilūkste.

Among 594 vascular plant species found by E. Lehmann there are 20 macrophytes from lakes of the Ilūkste Lakeland: *Acorus calamus*, *Batrachium aquatile*, *Batrachium trichophyllum*, *Ceratophyllum demersum*, *Equisetum fluviatile*, *Hydrocharis morsus-ranae*, *Myriophyllum spicatum*, *Nuphar lutea*, *Nymphaea alba*, *Phragmites australis*, *Polygonum amphibium*, *Potamogeton crispus*, *Potamogeton lucens*, *Ranunculus*

*lingua*, *R. reptans*, *Sagittaria sagittifolia*, *Sium latifolium*, *Sparganium microcarpum*, *Stratiotes aloides* and *Typha latifolia*. Besides that, there are 7 other common macrophyte species given in his paper that might as well be found in lakes, however, there is no other information provided what concerns the habitat or location (*Alisma plantago-aquatica*, *Eleocharis palustris*, *Lemna minor*, *Potamogeton natans*, *P. pectinatus*, *Scirpus lacustris*, *Sparganium emersum*). In his paper E. Lehmann also provides very interesting data about 4 rare and very rare species growing at lake shores: *Angelica palustris* (E shore of Lake Sventes), *Juncus stygius* (S shore of Lake Meduma), *Pycreus flavescens* (S shore of Lake Meduma and E shore of Lake Sventes), *Scirpus radicans* (shores of the Pilskalne Lakes) as well as the common species *Lythrum salicaria* (shores of the Pilskalne Lakes). It is clear from the paper that E. Lehmann has made investigations mostly in 5 lakes of the Ilūkste Lakeland: Lake Dubezers, Lake Kumpinišķu, Lake Lauces, Lake Meduma and Lake Sventes.

Next investigations in the Ilūkste Region were made in the summer of 1860 (from the 3rd decade of July till the beginning of August) by botanist (also pharmacist and entomologist) Teophil Bienert who visited surroundings of 6 places – Ilūkste, Grīva, Saliēna, Sīķele, Ilgas and Ezerne (near Silene). Main results of his investigations were published in “Flora von Polnisch-Livland” (Lehmann, 1985). From these it can be inferred that T. Bienert has found in lakes of the Ilūkste Lakeland 7 or 8 macrophyte species (*Callitriche stagnalis* at Ilgas might also be found in a different biotope than lake). Four of them are rather common species – *Eleocharis acicularis* (Ilgas), *E. palustris* (Ilgas, Ilūkste), *Myriophyllum verticillatum* (Ilgas), *Nymphaea alba* (Ilgas), two other – *Elatine hydropiper* (Ilūkste) and *Scolochloa festuacea* (Ilgas) are rather rare or rare while *Eleocharis ovata* (Ilgas) is today regarded as completely extinct from the flora of Latvia (and other Baltic states as well). It is most likely that T. Bienert found *Scolochloa festuacea* in Lake Riču or Lake Sila where it grows also today and that the most probable location of *Eleocharis ovata* was the SEE shore of Lake Riču. T. Bienert recorded at Ilgas also two rather rare species that are characteristic of quagmires at lakes of the Ilūkste Lakeland – *Eriophorum gracile* and *Stellaria crassifolia*. Another very interesting species found by him at Ilgas as well as in the territory between Ilgas and Saliēna is *Pycreus flavescens* that at least in the 19th century was growing at shores of some lakes of the Ilūkste Lakeland. Today this species is also regarded as completely extinct from the flora of Latvia (and other Baltic states as well). One of the most probable locations for this species at Ilgas could have been the vicinity of Lake Riču.

The conclusive investigations of the 19th century in lakes of the Ilūkste Lakeland were made by the outstanding botanist (later also professor on mathematics) Karl Reinhold Kupffer who was at that time just 26 years old. In the second part of the summer 1898 he made floristic investigations throughout the most part of the Ilūkste Region stretching from Robeždaugava at Varnaviči in the very east to Subate and Laši in the west as well as from the Ēģipte village, Demene and Lake Dārzamuižas in the south to Ilūkste and Grīva in the north. Results of his investigations were summarized in paper „Beitrag zur Kenntnis der Gefässpflanzenflora Kurlands” that was published 1899 in the 42nd volume of the „Korrespondenzblatt des Naturforscher-Vereins zu Riga”. Unfortunately, K.R. Kupffer has paid attention mostly to the terrestrial plants and therefore mentions just 2 species from 2 lakes of the Ilūkste Lakeland at Pilskalne – a macrophyte *Ceratophyllum demersum* in Lake Dubezers as well as *Scirpus radicans* at the shore of Lake Pastarītis.

It can be concluded that the 19th century investigations by Rev. J. Fiedorowicz, E. Lehmann, T. Bienert and K.R. Kupffer have made a significant contribution to the investigation of macrophyte flora of the Ilūkste Lakeland.

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# NAJAS TENUISSIMA (A. BRAUN) MAGNUS – A NEW MACROPHYTE SPECIES IN FLORA OF THE BALTIC COUNTRIES

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A new native macrophyte species – *Najas tenuissima* (A. Braun) Magnus is recorded for the first time in flora of vascular plants of the Baltic Countries. It is a very endangered and demanding relict species (widespread as a fossil in Quaternary floras) that grows on sandy or muddy sediments in the littoral of freshwater small ponds, lakes or brackish bays (at mouths of rivers) near and at the northern coast of the Finnish Gulf, in the Neva Bay and in lakes with clean and transparent water. The species is recently known just from 15 or so localities in the whole world (earlier 24): South-Finland (6 localities, 2 of them extinct), South-Karelia (Russia) around Vyborg (4 localities, 1 of them extinct) and St. Petersburg (3 localities, all recently extinct), Tver, Novgorod and Ryazan Regions (8 localities, 1 of them extinct), South-East Latvia (1 locality), East Kazakhstan (1 old locality) and the Far East of Russia on the coast of the Posyet Bay (1 locality). *Najas tenuissima* is included in Red Data Books of the Baltic Region, East Fennoscandia, the Russian Federation and the Leningrad District as well as in the Annexes II and IV of the European Union Species and Habitat Directive.

The new locality was discovered on the 6th of August 2006 and is situated in the very south-east of Latvia – the Latgale Region, the Krāslava District (the Kombuļi Parish), in Lake Ārdavs at the northern side of Hill Sauleskalns (square 25/52, coordinates 56° 01', 27° 15').

Lake Ārdavs is a 14.0 m deep, eutrophic glacial lake lying 159.3 m above the sea level. Its surface area is 2.29 km<sup>2</sup> and the lake is characterized by a much curved shoreline with many bays, peninsulas and 2 islands, mostly deforested catchment area and, nevertheless, a remarkable water transparency reaching 5.0 m. Just a small area of the lake was explored during the examination of localities of rare and protected plant species in the Krāslava District and *N. tenuissima* was found in a rather considerable quantity in 2 places (15 – 20 x 2 – 3 m and 10 x 5 m) growing mostly at a depth of 1.7 m (also deeper in 2 – 3 m) on mineral ground in the belt of submerged macrophytes (situated next to the belt of *Phragmites australis* with a small admixture by *Scirpus lacustris*) together with *Najas flexilis*, *Hydrilla verticillata*, *Utricularia vulgaris*, *Elodea canadensis*, *Drepanocladus aduncus*, *Fontinalis antipyretica*, *Nitellopsis obtusa*, *Chara globularis* and *Cladophora glomerata*. It is important to notice that in both places *Najas tenuissima* grows together with another very rare, endangered and relict macrophyte species – *N. flexilis* which is also included in Red Data Books of many European countries as well as in the Annexes II and IV of the European Union Species and Habitat Directive. It is also interesting that the quantity of *Najas tenuissima* in both habitats is about three times greater than that of *N. flexilis*. Recently, *Najas tenuissima* has also been recorded by D. Znots as a fossil (seeds, together with *N. flexilis*, *N. marina* and *N. major*) in gyttja deposits of Lake Brīdeitis near Dagda in the Krāslava District (Ceriņa, 2003).

*Najas tenuissima* (A. Braun) Magnus (1870) is a monoecious submerged annual macrophyte species with a 5 – 30 cm high, intensively branched, dark green stem and very fragile branches. Its leaves are narrow-linear, remotely-dentate on the margins and alternate, almost opposite or arranged in false whorles, about (7) 13 – 20 mm long, (0.19) 0.2 – 0.3 (0.5) mm wide. Leaf lamina near base abruptly turns into a 3 – 4 times wider sheath consisting of two rounded-truncate auricles that are finely dentate in the upper part. Flowers are unisexual,

axillary, male flowers with a spathe, anther 1-theous with small perianth of two tepals, female flowers without a spathe, pistil of 1 carpel without perianth. Fruits are narrow-elliptic or elongated ellipsoid, one-seeded, (2.2) 2.5 – 2.8 (3.0) mm long, 0.6 – 0.8 mm wide, areoles of seeds are longitudinal (4 – 7 times longer than wide). Morphologically, *Najas tenuissima* (A. Braun) Magnus is to certain extent similar to *Najas minor* All. (especially, in leaves with a wide sheath that is finely dentate in the upper part), however, its shoots are apparently more delicate, dark green (never pink-tinged) leaves are smaller and mostly straight (not recurved), teeth on their margins are much smaller with their 2 basal cells just slightly protruding from the margins (consist just of 1 – 3 cells not of a group of many cells considerably protruding from the margins). One of the main differences, however, is in the areolation of seeds which by *Najas tenuissima* is longitudinal (longer than wide) but transverse (wider than long) by *N. minor*.

In order to facilitate the preservation of *Najas tenuissima* (A. Braun) Magnus in Latvia, it is suggested to include the species in the 1st category of the Red Data Book of Latvia as well as in the lists of Rare and Especially Protected Plants of Latvia. It is also reasonable and necessary to establishment a new nature protected area (most probably nature park) around Lake Ārdavs to preserve not only *N. tenuissima* but also at least four other endangered macrophyte species found so far in this lake (*Hydrilla verticillata*, *Littorella uniflora*, *Najas flexilis*, *N. tenuissima*, *Potamogeton acutifolius*).

### Acknowledgements

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# EUTROPHICATION AND VEGETATION CHANGE: RESULTS OF A TEMPORAL ANALYSIS OF PINE FORESTS BETWEEN 1988 AND 2004

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Vegetation of pine (*Pinus sylvestris* L.) forests subjected to intense air pollution stress in the impact zone of one of the largest air pollution sources in Lithuania – the mineral fertilizer plant Achema data were analysed to determine eutrophication effects between 1988 and 2004. The study sites were established at 3-22 km distances in the prevailing wind direction (70–90 azimuth to the east from the plant) where vegetation data from pine stands which had first been surveyed by prof. S.Karazija in 1987-1988 were available (further referred as 1988). Stands with an age of 55 years with vegetation assigned to the *Vaccinio-myrtillosa* site type and with similar dendrometrical characteristics were preferred and were investigated in July, 2004.

The species that had increased were typical for *Vaccinio-myrtillosa* site type – *Vaccinium myrtillus*, *Pteridium aquilinum*, *Trientalis europaea*, *Oxalis acetosella*, *Festuca ovina*, *Luzula pilosa*, *Vaccinium vitis-idaea*, *Calamagrostis arundinacea*, *Melampyrum pratense*, *Convallaria majalis*, *Solidago virgaurea*. The species that had decreased most significantly between sample years were related with nutrient-rich conditions with an indicator value for nitrogen ?6 (Weber, 1991; Ellenberg, 1991). Frequency of such species as *Rubus idaeus*, *Rubus caesius*, *Impatiens noli-tangere* and *Chamerion angustifolium* decreased significantly ( $p < 0.05$ ), others species also decreased but was not so significantly ( $p > 0.05$ ) – *Galeopsis tetrahit*, *Stellaria media*, while the other nitrophilic species were relatively extinct – *Aegopodium podagraria*, *Epilobium montanum*.

The mean nitrophilic species frequency per sample quadrat was significantly higher in 1988 than in 2004 (85.6% and 63.8%, respectively,  $p < 0.01$ ). The mean number of nitrophilic species was also higher in 1988 comparing with nitrophilous number in 2004 (4.7 and 4.3, respectively) but the difference was not significant ( $p > 0.05$ ). The cover of nitrophilous plants comprised the significantly larger part of the sample quadrates in 1988 (58%) comparing with 2004 (21%) ( $p < 0.001$ ).

# DETERMINATION OF GENETIC DIVERSITY OF LATVIAN PINE PROVENIENCES USING SIMPLE SEQUENCE REPEATS (SSR)

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*Pinus sylvestris* represents the biggest source of wood in Latvian forests and is a species of great economical importance. To improve quality of commercial pine growths a breeding program is carried out.

The objectives of this research were to estimate the variability present within and between Latvian proveniences of *Pinus sylvestris*. In this study 12 Latvian proveniences representing different districts of Latvia were characterised. For comparison four foreign proveniences from Belarus, Finland, Germany and Lithuania were included in the study. Four microsatellite markers were used to characterise the proveniences. Statistical analysis showed that the markers used were polymorphic and, taking together, they gave 60 different alleles. Nei's standard (Nei, 1972., Am. Nat. 106:283-292) analysis using Unweighted Pair Group Method with Arithmetic mean (UPGMA) showed that most similar proveniences are PKK (Krāslava, South - East Latvia) and PSS (Saldus, West Latvia) but the most distant proveniences are PTT (Tukums, West Latvia) and PK (Kalsnava, East Latvia). Interestingly, the PTT provenience is more similar to Finnish and Lithuanian proveniences than to those from Latvia. German and Belarusian proveniences do not differ much from Latvian proveniences. Biggest genetic distance observed in this study was 0.1888 (Nei's standard).

# THE ANALYSIS OF THE IMPACT OF LONG DISTANCE AIR MASS TO AIRBORNE POLLEN CONCENTRATION

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From viewpoint of modern environmental science the airborne pollen is qualifying not only as a component of plant reproduction system, but like an element of environmental quality as well. Both country boundaries and preventive means against mechanical or chemical atmospheric pollution do not exist for these biological particles. Basic methods for management of this air component are monitoring, society information and modelling the processes. The modelling of airborne pollen dispersion is important not only for the information of allergenic people, but for dealing problems with heterogeneity of plant populations and for the control of wild flora conservation as well. The aim of this investigation is to analyze the impact of long distance air mass on airborne pollen concentration. The monthly amount of pollen fixed in three aerobiological stations (Vilnius, Klaipėda, Šiauliai) in the period of 2005-2006 year was analyzed to estimate dispersion of atmospheric pollen in Lithuania. The percentage variety of pollen from anemophyleos plants was established by the amount of pollen cached in aerobiological stations. The calculated backward air masses trajectory was used as an auxiliary tool to find out influence of atmospheric circulation of pollen and its distribution in the air. HYbrid Single-Particle Lagrangian Integrated Trajectory Model (HYSPLIT 4) was used for construct the trajectory of backward air masses.

The result shows that in the atmosphere in 2006 year there was about 65 % more pollen in comparison with previous one. This situation can be determined by the peculiarity phenological or reproductive plant and long distance transport too. May was distinguished by the great abundance of pollen all over Lithuania. North West direction (1 Euro region) air masses were the dominant in this period. The analysis of 2005 year showed a high concentration of pine (*Pinus L.*) genus pollen and it consisted 55 % of all year content. But in 2006 year birch (*Betula L.*) genus gave much more pollen (about 66%). The analysis of backward air masses trajectory indicated the moved of air masses from 1, 2 and 4 Euro region. This analysis proves the presumption of the increasing of biological atmospheric pollution because of long distance pollen transport.

# ZOOBENTHOS AS A CRITERION OF THE ENVIRONMENTAL STATE OF RIVER JAĀA

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Latvia geographically is located in the west part of Eastern European low land. Latvia's river net consists of more than 12 400 rivers. The length of only 880 rivers exceeds 10 km, but the most part of Latvia's rivers are of the length of less than 10 km (their total length is 51% of the total length of all the rivers in Latvia). Length of 17 rivers is greater than 100 km.

River Jasa is located in: west part of Latgale highland, in hilly landscape of Feimani and in the administrative territories of Preili district - Riebini area - Rusona rural municipality, Preili district – Aizkalne rural municipality and Preili district – Peleci rural municipality. The river flows through following populated places: Kastire, Aizkalne, Peleci, Nidermuiza.

River Jasa belongs to the big river Daugava basin (a potamal type river). It flows out of lake Jasa whose absolute height-notes of surface are approximately 100 – 110 m over the sea level. And river Jasa discharges in river Dubna (right - bank confluent of river Dubna). Hydrological net of the river is formed by the following confluent: Neica, Dzalbovka, Gubaika and the sources of Pelecu and Viragnas lakes. The total length of river Jasa is approximately 28 km, fall – 0,5 m/km. Prevailing the riverbed consists of sand, gravel, and pebbles. In some places there are clusters of stone and sections of sludge that are located in the weir - parts (hydroelectric power stations) and in swampy territories. On river Jasa there are two hydroelectric power stations – SIA “Korna dzirnavu HES” (in Preili district – Preili area - Aizkalne rural municipality) and SIA “Jasas HES” (in Preili district – Peleci rural municipality). Both hydroelectric power stations are located in a specially preserved nature area (NATURA 2000) – in nature restricted area “JaĀa”. The paper research paper explores indicate – bodies and saprobity in different sections of river Jasa. The sections were chosen in the upper course of a river (Nr1 “Kastire”), middle course (Nr2 “Aizkalne” and Nr3 “Peleci”) and in the mouth area of the river (Nr4 “Nidermuiza”), so that it would be possible to characterize the general biological quality of the river. Three times samples of zoobenthos were collected in the four above mentioned sections – 10 October, 2005; 14 June, 2006; 8 August, 2006. The average distance between the places where the samples were taken is 9 km. In the samples were collected bodies of zoobenthos, including indicate – bodies and the saprobity of each certain section was set. In the analysis of the zoobenthos – bodies' data 15 zoobenthos species were found. They represented 11 groups – Plecoptera, Trichoptera, Odonata, Oligochaeta, Hidrudnea, Ephemeroptera, Diptera, Coleoptera, Heteroptera, Gastropoda and Bivalvia.

While analyzing these zoobenthos samples, we came to conclusions that most widely represented were 4 groups of zoobenthos – Plecoptera, Ephemeroptera, Coleoptera and Bivalvia.

Processing the data saprobity level of the flowing water in each section of the river was set. Sample taking place of the flowing water's saprobity level (S):

07.10.2005. – Kastire – 2,24, Aizkalne – 2,18, Peleci – 1,57, Nidermuiza – 1,85;

14.06.2007. - Kastire – 2,13, Aizkalne – 1,975, Peleci – 1,95, Nidermuiza – 1,84;

08.08.2007. - Kastire – 1,98, Aizkalne – 1,95, Peleci – 1,90, Nidermuiza – 1,96.

The average index of saprobity in each place where the samples were taken is:

Kastire – Saverage – 2,1, Aizkalne - Saverage – 2,0, Peleci - Saverage – 1,8, Nidermuiza - Saverage – 1,9.

# CONSERVATION OF BIODIVERSITY IN THE LITHUANIAN PART OF THE DAUGAVA RIVER BASIN

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The Daugava River basin covers a small territory in the north-east part of Lithuania, but this area is very important for the conservation of biological diversity of the Eastern Baltic region. The data on biodiversity values of the north-eastern Lithuania were mainly collected during the inventory of all potential Ramsar sites in Lithuania in 1997 - 2000 and during the cross-border investigations of certain important wetlands shared by Lithuania and Belarus implemented in 2001 - 2006. The distribution and abundance of rare species were recently investigated in all newly established territories of the "Natura 2000" network. Lake Druksiai with adjacent wetlands is the most important nature area in the Lithuanian part of the Daugava River basin. It is a potential Ramsar site shared by Lithuania and Belarus (total area – 6,600 ha). The Druksiai wetland complex supports numerous rare plant species, protected in Lithuania and Europe. Six rare in Europe types of habitats protected according to the EU Habitats Directive are characteristic of the site. Lake Druksiai is distinguished by several relict species of fishes and crustaceans. 27 breeding bird species listed in the Annex I of the EU Birds Directive were recorded in the site in recent years. The lake is used as a cooler for the Ignalina nuclear power station. The thermal pollution accelerates eutrophication of the lake and negatively impacts the most valuable relict species inhabiting the lake. The Adutiskis/Vileity wetland complex, including old wet forests, fens, transition mires and numerous streams is also shared by Lithuania and Belarus (total area – 12,500 ha). It is particularly important for rare bird species. 40 breeding bird species listed in the Annex I of the EU Birds Directive were recorded in the site in 2001–2006, including Great Snipe *Gallinago media* – the globally threatened species. The site is inhabited by several species of mammals protected in the EU. Seven types of habitats of European importance (according to the EU Habitats Directive Annex I) are characteristic of this area. The Smalvas complex of wetlands, including 2 lakes, raised bogs, transition mires and fens (area – 2,200 ha) holds rare plant species listed in the Lithuanian Red Data Book, several species of mammals protected in the EU and 13 breeding bird species listed in the Annex I of the EU Birds Directive. A small Pusnis mire complex, consisting of transition mires, fens and several small lakes (area – 1,400 ha) is one of very few breeding sites of Great Snipe remaining in Lithuania. The site supports several rare plant species, four mammal species and 13 breeding bird species protected in the EU. Lakes Dysnai and Disnykstis with adjacent wetlands (area – 4,000 ha) holds 5 breeding bird species listed in the Annex I of the EU Birds Directive and relict species of fishes. Very important for birds is the Birveta fish-ponds complex, including segments of valleys of the Dysna and Birveta Rivers (area – 1,300 ha). It is one of the key breeding and staging grounds of waterbirds in eastern Lithuania. The site holds 14 breeding bird species listed in the Annex I of the EU Birds Directive. All important nature areas listed above are at least partly protected at the national level. Certain key territories of Druksiai, Adutiskis, Smalvas, Dysnai and Birveta sites were included into the European "Natura 2000" network in 2005 and special management plans for these key territories were elaborated in 2006. The results of a joint Lithuanian-Belarusian program on conservation of biodiversity in important transboundary wetlands enabled to provide the background data necessary for the establishment of the Vileity National Landscape Reserve in the Belarusian part of Adutiskis/Vileity wetland complex. A special EU INTERREG III B Programme project conducted by several Lithuanian and Belarusian organizations in 2006-2007 aims to grant conservation and sustainable management of biodiversity in Lake Druksiai – transboundary wetland complex of international importance.

# **ANALYSIS OF THE LANDSCAPE ECOLOGICAL STRUCTURE APPLYING MAPS OF DIFFERENT SCALE**

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The topographic maps at the scale of 1:10 000 and 1:50 000 as well as forest management data base were used for landscape structure analysis.

In total 10 variables describing landscape structure were derived from topographic and forest maps and used in the analysis. These variables included: number of patches (NP), total area (CA), edge density (ED), total edge (TE), mean patch edge (MPE), mean shape index (MSI), mean perimeter-area ratio (MPAR), mean fractal dimension (MFRACT), mean patch size (MPS) and patch size standard deviation (PSSD).

The research clearly demonstrated that in the case of the Latvian mosaic type of landscapes for the majority of those variables, characterizing the landscape structure, impact of the scale of the maps is substantial.

# CHARACTERIZATION OF LATVIAN FAUNA OF THE GENUS *CHRYPTOCEPHALUS* GEOFFR. (COLEOPTERA: CHRYSOMELIDAE)

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The investigations of Latvian fauna of the genus *Cryptocephalus* Geoffr. (Coleoptera: Chrysomelidae) are considered to be incomplete till now. In the published data only separate facts about fauna of the genus *Cryptocephalus* Geoffr. can be found. The actual distribution of many species is unclear in Latvia due to lack of faunistic data. This is the first research, which is particularly dedicated to clarification of faunistic structure of the genus *Cryptocephalus* Geoffr. in Latvia.

In Latvian fauna 37 species of the genus *Cryptocephalus* (Coleoptera: Chrysomelidae) are represented, they belong to 3 sub-genera – *Cryptocephalus* Geoffroy, 1762, *Burlinius* Lopatin, 1965 and *Disopus* Chevrolat, 1837. *Cryptocephalus* Geoffr. (21 species) sub-genus is the most widespread in Latvian fauna, 15 species belong to *Burlinius* Lopatin sub-genus, *Disopus* Chevrolat in its turn is represented only by one species (*C. (Disopus) pini* (L.)) in Latvian fauna.

Occurrence of two species of the genus *Cryptocephalus* Geoffr. is unclear in Latvia. In 19th century *C. anticus* Suffr. and *C. quadripustulatus* Gyll. were recorded for „Livland” (Livonia) with no precise locality. The southern part of the former Livland now belongs to Latvia, but the northern one is part of Estonia. In later years no data about the occurrence of this species in Latvia can be found, therefore it is unlikely that these species can be traced in Latvia.

Three of the *Cryptocephalus* Geoffr. species, which occur in Latvia, in Northern Europe are known only from Latvia – *C. (Burlinius) chrysopus* (Gmelin, 1788), *C. (Burlinius) elegantulus* Gravenhorst, 1807 and *C. signatifrons* Suffrian, 1847.

Two of the species represented in Latvia (*C. (Burlinius) exiguus* Schneid. and *C. (Burlinius) punctiger* Payk.) are considered to be very rare. *C. (Burlinius) exiguus* Schneid. is known from only 4 localities in Latvia, but *C. (Burlinius) punctiger* Payk. from 2 localities. 9 species, which occur in Latvia, are considered to be rare – *C. distinguendus* Sch., *C. cordiger* L., *C. hypochoeridis* (L.), *C. parvulus* Muell., *C. bipunctatus* L., *C. vittatus* F., *C. decemmaculatus* L., *C. (Burlinius) pallifrons* (Gyll.), *C. (Burlinius) pusillus* F.

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# **DEVELOPMENT OF DNA FINGERPRINTING PROTOCOLS FOR LATVIAN FOREST AND CROP SPECIES**

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The Genetic Resource Centre (GRC) was established last year with funding from the Latvian Ministry of Agriculture. It incorporates the Latvian Gene Bank, the Gene Bank database, and a molecular genetics laboratory. The Latvian Gene Bank holds seed collections of Latvian agricultural crops and their wild relatives, and there are plans to expand the collection to include seeds from forest tree species as well. The database contains information regarding these collections, as well as data about field collections held by various breeding institutes in Latvia. The molecular genetics laboratory is equipped with an ABI 3100 genetic analyser, and functions as a research facility as well as providing molecular marker support for breeding programs.

We have initiated a program of DNA fingerprinting for Latvian agricultural crops. SSR-based fingerprinting protocols were established for cherry, onion, melon, potato, barley, clover and wheat last year, and DNA fingerprinting of these crops will commence this year. Further SSR marker protocols are being developed for triticale, raspberry, blackcurrant, garlic, oats, rye and pea. Currently, we are concentrating on SSR markers, as these have been established for the crops listed above, they are robust, and data can be compared with results from other laboratories.

We are also closely collaborating with tree breeders, both in selection programs as well as genetic diversity surveys of Latvian forest populations. We have established SSR-based fingerprinting protocols for hybrid poplar clones that are being used in plantations here in Latvia. We are also in the process of undertaking a survey of the genetic diversity and population structure of Latvian forest tree species (pine, spruce and birch). As expected, little population differentiation was found in spruce and pine, and the birch diversity study is currently underway. The next step will be to investigate the use of chloroplast SSR markers in these forest species which may allow for better population differentiation and provenance identification. Another program is just starting that will look at developing species specific DNA markers for *Alnus* spp., which would aid in identifying hybrids of these species.

# THE DIVERSITY OF BENTHIC INVERTEBRATES IN THREE LITHUANIAN RIVERS

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Benthic invertebrates are very important part in aquatic ecosystems that is why investigations of water invertebrates can provide a lot of information about the state of water body. The aim of this work was to estimate differences in fauna, abundance and biomass of water invertebrates in three rivers and to elucidate some of the factors which can have an influence on the distribution of water invertebrates.

The studies of zoobenthos were performed in three rivers located in different regions of Lithuania – the Dubysa, the Merkys and the Dvantoji. The samples were collected every month from April to September in 2004, by kick-sampling method in three 0.1m<sup>2</sup> areas at each study site. The habitat of each study site was determined with respect to environmental factors: bottom structure, water temperature, depth, flow velocity. Amount of nitrites, nitrates, phosphates, oxygen dissolved in the water, water hardness, ph were investigated (Merck compact laboratory for water testing was used). The amount of organic matter was tested according to general accepted methods. More than 60 samples were collected and analyzed following standard hydrobiological methods. Composition of species, biomass (g/m<sup>2</sup>) and abundance (ind./m<sup>2</sup>) were determined for each sample. During the studies more than 150 species of Mollusca, Oligochaeta, Arachnida, Hirudinea, and Insecta (Trichoptera, Ephemeroptera, Plecoptera, Odonata, Coleoptera, Megaloptera, Heteroptera, Diptera) were registered in three investigated rivers.

Rivers were similar in discharge, amount of organic matter, velocity, ph. Rivers differed in water temperature, amount of oxygen dissolved in the water, in substratum. Dominant species of invertebrates were different in different rivers. The Merkys river was dominated by Ephemeroptera and Arachnida, the Dubysa river was dominated by Ephemeroptera, Trichoptera and Oligochaeta and the Dvantoji river was dominated by Mollusca. The time of the greatest biodiversity of water invertebrates differed in rivers. The greatest biodiversity was determined in spring in the Merkys and Dvantoji rivers and in autumn in the Dubysa river. The time when the greatest biomass was detected in the river was different in different rivers as well.

The factors which can have an influence on the fauna, abundance and biomass of water invertebrates are discussed in the paper.

# **DAUGAVPILS' FORTRESS - THE BIGGEST HIBERNATION SITE OF BATS IN LATVIA**

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Underground cellars of the Fortress of Daugavpils City contain the biggest colony of hibernating bats in Latvia. Number of hibernating bats had fluctuated from ca. 800 to 1140 during last 5 winters. There are 5 species of bats found wintering at the site, however 90% belong to one species: Daubenton's bat *Myotis daubentonii*. With 70 – 80 hibernating Pond bats *Myotis dasycneme* Daugavpils' Fortress is the main recently known hibernation site for this particularly protected species in Latvia. The main threats on the site are lack of legal protection, potential rebuilding of cellars for economic activities and unauthorized human visits during winter.

# RECENT CHANGES IN DISTRIBUTION PATTERNS OF BARK BEETLES OF THE GENUS *IPS* IN ESTONIA

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Bark beetles of the genus *Ips* (Coleoptera, Curculionidae, Scolytinae) belong to the insect species, which, in certain circumstances, can seriously affect forests. From five species of the genus occurring in Estonia, three inhabit Norway spruce (*Picea abies*) and two Scots pine (*Pinus sylvestris*). Although all these species are well known, the data collected in recent decades have shown certain changes in the distribution patterns of some species.

*Ips typographus* is one of the most common and abundant species among the bark beetles in whole Europe. In Estonia, no changes have been observed in its distribution patterns during recent decades. *Ips typographus* was and remains one of the most serious forest pests in spruce forests.

*Ips duplicatus* also belongs to the most injurious species in spruce forests. In some regions of Estonia it has been even more abundant than *Ips typographus*. For instance, in the 1930s, the ratio in numbers of *Ips duplicatus* and *Ips typographus* was 7:3 in Central Estonia, and 4:6 in the southeastern part of the country (Kohh, 1939). During recent decades, no such prevalence in abundance of *Ips duplicatus* has been registered.

*Ips amitinus* was first recorded in Estonia in 1900 (Mikutowicz, 1905). Before 1930 it was known only in southern Estonia but already in 1939 K. Leius reported that *Ips amitinus* was common in spruce forests in whole Estonia. In spite of wide distribution throughout the country, it occurs in small numbers and not very frequently.

*Ips sexdentatus* was distributed only in the western part of Estonia in the 1930s (Zolk, 1932). Later the species spread throughout the country and in the 1960s and 1970s it frequently attacked pine logs or stems damaged by storm or forest fire. In the following years, the recorded occurrences became less frequent and only few observations have been made during recent years. In some countries (e.g. Sweden) *Ips sexdentatus* was listed in the Red Data Book as a rare and threatened species.

*Ips acuminatus*, another species inhabiting Scots pine, on the contrary, was more frequently observed only during recent years. There were only few records of the beetle in Estonia during the last century, but in the 2000s, the species has been collected from southern Estonia in great numbers.

# THE UVB INFLUENCE ON THE ENZYME OF ANTIOXIDANT SYSTEM ON *PISUM SATIVUM* L. LEAVES AND ROOTS

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Depletion of the stratospheric ozone affected by anthropogenic factors induces more intensive UVB radiation. These elements of climate warming directly influence plant growth and productivity as well as their biodiversity. Therefore, plants frequently have to adapt to the climate changes. The aim of the research was to investigate the tolerance of *Pisum sativum* L. to UVB radiation under controlled conditions. The plants were grown in controlled conditions under different irradiance with or without UVB radiation. The physiological and biochemical parameters were investigated. The amount of fresh weight, plant height, photosynthetic pigments, amount of proteins and SOD total activity were determined. It has been revealed that the UVB irradiation unequally affected different parameters: plant height, fresh weight, photosynthetic parameters (chlorophyll a and b, carotenoids) slightly changed, but the leaf deformation was more pronounced, root length slightly increased, protein amount reduced. Still, UVB increased the total SOD activity at 3-5 kJ m<sup>-2</sup>d<sup>-1</sup> UVB doses in leaves and induced new bands of isoenzymes in roots. These alterations were most frequently associated with the plant response to oxidative stress induced under UVB. An increased activity of SOD after UVB irradiation should be regarded as adaptation response of a plant towards oxidation stress. It confirms the participation of SOD isoforms in protection mechanisms against abiotic stress.

# GENETIC STRUCTURE OF ISOLATED *VACCINIUM OXYCOCCUS* POPULATIONS

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The genetic population structure of the wild Cranberry *Vaccinium oxycoccus* was studied using RAPDs (random amplified polymorphic DNA). In the last century during intensive peat bogs drainage, regulation of water levels, intensive cranberry picking has caused risk for wild cranberry *Vaccinium oxycoccus* populations survival in Lithuania. Genetic variation among and within three isolated *V. oxycoccus* populations with RAPD profiles was investigated. Forty-eight clones were sampled in 4 populations at Čepkeliai, Žuvintas, Kamanos rezerves and Aukštaitijos national park. RAPD analyses of 9 primers have shown 213 polymorphic loci in the total sample. Polymorphism level in Čepkeliai rezerve population was 52.11%, in Žuvintas 37.09%, in Kamanos 36.62% and in Aukštaitijos national park 43.19%. Polymorphism among populations was 99,53%. For the total sample, Shannon's Information Index was 0.19 and Nei's gene diversity 0.10. The estimated total proportion of diversity among populations (GST) and gene flow (Nm) were 0.15 and 2.89 respectively. The UPGMA analyses have revealed that populations of *V.oxycoccus* are clearly separated into four lineages and just one Čepkeliai lineage had homogenous haplotype. Others lineages differ from each other. The four clones sampled from Kamanos (k12, k15, k10) reserve and one from Aukštaitijos national park (a4, a8) had unique haplotypes.

# THE INFLUENCE OF THE ANTROPOGENOUS FACTORS ON THE FORMATION OF CARABIDOCOMPLEXES (CARABIDAE, COLEOPTERA) IN THE AREA OF FRUNZE PARK IN VITEBSK

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As it is known the problem of urban ecology is rather actual today. Any city full of life activity forms a peculiar biogeocenosis. The climatic peculiarities of nature and appearance of new ecological niches, not existing in nature, have resulted in combinations of factors and in formation of specific fauna, and specific animal communities, connected by new relations (Klausnitzer 1990). The study of above mentioned regularities is of current importance. The habitat of many animals and plants is destroyed as a result of people's impact on the environment. No research had been conducted hitherto on the territory of Vitebsk's public parks, therefore the data obtained by us should be considered actual. One of the model group of the soil mesofauna is represented by the group of mobile polyvalent numerous predators, the majority of which are carabids. Almost all of the species of the Carabidae family in this or that way are connected with soil. They are rather sensitive to the conditions of aeration and humidity, salt mode. They display high selectivity to the conditions of the environment. The purpose: to study the influence of antropogenous factors on population of carabids in Frunze Park and adjacent territories. Tasks: 1. To reveal species composition and dominance structure of carabid beetles in researched biocoenoses. 2. To retrace variation of zoocenotical characteristics of carabids (life-forms spectra and types of areals, spectra of biological adaptability, hygropreferendums) with various types of antropogenous influence on park's ecosystem.

The material was collected, using Barber traps (Gr&#252;ntal, 1981; Berghe, 1992) with 9 % solution of acetic acid. We checked up these traps every ten days from the second decade of May till the first decade of September 2005-2006 in three biocoenoses at various degrees of transformation and the control. The total quantity of gathered beetles was 5773 specimens. 4573 traps-days have been processed and 66 species assembled, 32 species in the park and 47 in the control among them.

In the first line the maximum amount of species - 21 were found, that is possible to explain by the more diverse conditions and niches of habitats. Meadow-wood (41,7 %), meadow-field (33,7 %) and evritopical (16,5 %) species relating to westcentralpaleartic, eurocaucasian and transpaleartic types of areals (16,8 - 52,5 %) were dominating. In the second line with a smaller degree of recreation there are 14 species, with the average density of 1,75 specimens for 10 traps-days. Here on the boundary of ecotone meadow - deciduous forest the conditions for carabids' population are not absolutely favorable for full realization of their biological potential. This must be also conditioned by high antropogenous load. Meadow-wood (33,1 %), wood (37,3 %) and evritopical (20,3 %) species relating to westcentralpaleartic, eurosiberian and european types of areals are dominating (20,3 - 37,3 %). The rare and protected species of *Carabus coriaceus*, introduced in the

Red book of Belarus (2004) was detected here. In the third line 16 species were found. The representatives of the genus *Carabus* are dominating: *C. cancellatus*, *C. nemoralis*. The prevalence of wood and evritopical species relating to european and eurosiberian types of areals (22.8 - of 41.3 %) is notable. Such rare species as *Carabus coriaceus*, *Curtonotus gebleri*, *Ophonus nitidulus* were revealed. When moving from the school neighborhood to the park with a decrease in an antropogenous load one can observe the increase in the number of wood european and eurosiberian species, and the decrease in the number of meadow-field eurocaucasian and west centralpaleartic species. The number of evritopical species practically does not vary, and the number of meadow-wood species drops by 50%, that shows there is still quite high antropogenous load in the park. The number of xerophylous drops up to zero opposing the increase in the number of mesophylous up to 78,8 %. When analyzing the factors we can see that despite external indications of the well-being of carabid beetles, a most critical situation has developed in the park because of negative antropogenous load resulting from the mowing of grass and summer merrymaking during Slavianski Bazar-2006.

## **PREDATORS AND HERBIVORES (COLEOPTERA) NATURALLY OCCURRING ON STRAWBERRY (LATVIA)**

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A list of 118 species Coleoptera recorded from Latvian strawberry has been compiled using earlier publications and author's own data. Forty-four species known as pests (from those 23 known as strawberry pests), 70 species are predators, and pantophages, 3 species are phytophages and one species saprophages. Seven species found for the first time in Latvia and two species are new for Baltic countries. The families Staphylinidae, Carabidae, Curculionidae had the highest number of species are with 35, 27, 13, respectively.

## **THRIPS SPECIES (INSECTA, THYSANOPTERA) COMPOUND ON CULTIVATED STRAWBERRY AND THEIR INFESTATION IN THE NORTHWESTERN PART OF LATVIA**

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Field study was conducted over 6-year period in the Pure Horticultural Research Station to study thrips species compound, using leaf sampling, sweep netting and pitfall trapping methods, and to monitor the infestation of strawberry plants.

Twenty three species of thrips from three families (Thripidae, Phloeothripidae, and Aeolothripidae) colonized strawberry fields. Seven thrips species, *Thrips tabaci* L., *Th. atratus* Hal., *Th. fuscipennis* Hal., *Frankliniella intonsa* Tryb., *Aeolothrips intermedius* Bagn. (predatory), *Anaphothrips obscurus* Müll., *Chirothrips manicatus* Hal. were frequently occurred on strawberry, and four thrips species, *Th. tabaci*, *Th. fuscipennis*, *Th. atratus*, *Fr. intonsa* were the most widespread and dominant.

# MACROALGAE OF WATER AREA OF THE GULF OF FINLAND RELATED TO REGIONAL COMPLEX SANCTUARY "GLADYSHEVSKY " ( VAMMESUUJOKI)

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The flora of macroalgae of water area of the Gulf of Finland related to regional complex sanctuary "Gladyshevsky " ( Vammesuujoiki) presented by 16 species. 13 species from them (belonging to 8 genera, 5 families, 3 orders) related to Chlorophyceae. Phaeophyceae are presented by 2 species, related to 2 genera, belonging to two families, one order. And one species belong to Rhodophyceae. According to the number of species, the basic order is Ulotrighales (Chlorophyceae).

3 species of macroalgae are included in the Red Data Book of Nature of the Leningrad region.

8 species of macroalgae are recorded in Transition zone of eastern part of the Gulf of Finland for the first time.

As the result of the floristic composition investigations of protected area " Gladyshevsky " were obtained data, allows to correct existing conception about ecology of a number of macroalgae species and to specify data on depth and horizontal distribution of macroalgae in the Gulf of Finland.

Macroalgal vegetation is well developed in water areas of the Gulf of Finland, belonged to Protected Area " Gladyshevsky ". Hard substrates on lower horizon of hydro-littoral and sublittoral colonized by filamentous algae, mainly by *Cladophora glomerata*.

# **SUSTAINABLE WILD HARVESTING: HOW TO JOIN TOGETHER CONSERVATIONISTS AND THE COMPANIES FOR NATURE MANAGEMENT AND BIOTRADE?**

**Vida Motiekaityte**

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The paper is designed to the third objective “Using Plant Diversity Sustainably” of Global Strategy for Plant Conservation (GSPC) approved during Convention on Biological Diversity (CBD) conference in Hague, 2002 (decision VI/9). Project “National Grassland Inventory in Lithuania” (2002-2005) gave us the impulse to research the sustainability of wild herbal harvesting. The purpose of this paper is to analyze the scope and current situation implementing third objective of GSPC and to plan ongoing politics to meeting its targets. Far more species of medicinal plants are harvested than any other product from the natural world. The great majority is still provided by collection from wild. Moreover, cultivation is not the most beneficial production system. However, over-harvesting and habitat loss increasingly threaten a considerable portion of the worlds species and populations. For these reasons, approaches to wild medicinal and aromatic plants collection that balance the need of international, regional and local markets with the need for species protection and sustainable use are urgently needed. For agricultural systems sustainable use is usually defined quite differently than for wild plants. Sustainable use is also a social process: wild plants under pressure from trade should be managed, and adaptive management is the type of management most likely to succeed.

Being directly connected with the harvesters, the companies, that purchase wild plants from collectors, are in a good position to influence how the plants are harvested. How can consumers know wheather these plants have been harvested sustainably? Combined labelling for all three aspects of product quality that refer to how the botanical ingredients have originated is required: product quality (i.e. the right species have been collected), Fair Trade, sustainability. The next steps promoting sustainable use for wild-collected medicinal plants are discussed.



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