Recent doctoral theses (ecology and environmental sciences) in Lithuania

Compiled by Virginija KALCIENĖ

TROPHIC POSITION OF NON-INDIGENOUS CRUSTACEANS AND THEIR IMPACT ON FOOD WEBS IN LAKES
SVETIMKRAŠČIŲ VĖŽIAGYVIŲ VAIDMUO IR JŲ INVAZIJŲ POVEIKIS EŽERŲ MITYBOS TINKLAMS

Vytautas RAKAUSKAS

Scientific supervisor:
Assoc. Prof. Dr. Kęstutis ARBAČIAUSKAS
Nature Research Centre

The thesis defended:
7 April 2014
Nature Research Centre

At present, one of the main reasons causing the loss of biodiversity is the rapid spread of invasive species. Alien crustaceans constitute more than a half of all known higher crustacean fauna in Lithuanian lakes. Most of them were intentionally introduced to Lithuanian lakes in order to enhance fish or crayfish production. Although it passed more than 40 years after the initial introductions, there are still many unanswered questions in relation to the introduced crustacean's impact on local communities.

The aim of this research was to evaluate the impact of alien peracaridans on fish diet and growth in lakes, to explore the trophic position of the alien higher crustaceans and to assess the impact of these crustaceans on the lake food web structure.

The results showed that most of alien crustacean species relied on the littoral carbon source and occupied the transitional position between the typical second and third levels in the lake food chains. Therefore, these species should be considered as omnivorous species in the lake littoral zone. Finally, this research showed that alien crustaceans indeed influenced the feeding niche structure of benthic macro invertebrate assemblage in lakes. However, the feeding niche structure of fish community was not influenced by these crustaceans; it was more associated with abiotic factors, such as size, average depth or trophic status of a lake. Although the perch assimilated the introduced peracaridans into its diet, as did some other fish species feeding in the littoral zone, the collation of available data does not support the enhancement of perch and other fish production in Lithuanian lakes. Thus, the original rationale for introduction of the Ponto-Caspian peracaridan species into Lithuanian waters appears misguided.

Key words: alien crustaceans, stable isotope analysis, lake food webs, invasion impacts

OXIDATIVE STRESS INDUCED BY DIFFERENT STRESSORS AND ITS IMPACT ON RESISTANCE OF SPRING BARLEY (*HORDEUM VULGARE* L.)
SKIRTINGŲ VEIKSNIŲ SUKELIAMAS OKSIDACINIS STRESAS IR JO ĮTAKA VASARINIŲ MIEŽIŲ (*HORDEUM VULGARE* L.) ATSPARUMUI

Giedrė KACIENĖ

Scientific supervisor:
Prof. Habil. Dr. Romualdas JUKNYS
Vytautas Magnus University

The thesis defended:
25 April 2014
Vytautas Magnus University

Oxidative stress, described as an imbalance between the concentration of reactive oxygen species (ROS) and antioxidants, is one of the most important mechanisms of stressors' action on plants. On the other hand, a similar plants' response to different stress factors and oxidative stress induced an increase in the activity of antioxidative enzymes triggers plants' adaptation to the particular stressor as well as cross-adaptation to different stress factors. The aim of the dissertation research is to investigate the impact of different stress factors (ozone, UV-B radiation, drought and heavy metals) on the growth of spring barley and the intensity of oxidative stress, and to estimate the role of oxidative stress and antioxidative system on plants resistance and cross-adaptation to different stress factors.

It was detected that oxidative stress is the major cause of plant's growth reduction induced by similar stress factors (heavy metals), whereas the specific impact of stressors is low. When plants are exposed to different stressors (drought, ozone, UV-B radiation, heavy metals Cd and Cu), the impact of their specific action increases, however, oxidative stress remains the major reason of plants' growth reduction. The increase in antioxidative protection and the reduction in the intensity of oxidative stress is the reason of plant adaptation to the stressors with strong oxidative features (Cu and ozone); whereas cross-adaptation to the stressors with lower oxidative potential (Cd and UV-B radiation) is determined by the mechanisms, that are not related to oxidative stress directly.

Key words: environmental stress, plant oxidative stress, reactive oxygen species, antioxidants, *Hordeum vulgare*

THE EFFECT OF TRIHALOMETHANES INTERNAL DOSE RECEIVED FROM PUBLICLY SUPPLIED WATER AND OTHER ENVIRONMENTAL FACTORS ON RISK OF ADVERSE PREGNANCY OUTCOMES
VIDINIŲ TRICHALOMETANŲ DOZIŲ, GAUNAMŲ IŠ BUITYJE VARTOJAMO VANDENS, IR KITŲ APLINKOS VEIKSNIŲ POVEIKIS NEPALANKIŲ NĖŠTUMO BAIGČIŲ RIZIKAI

Gediminas BALČIUS

Scientific supervisor:
Prof. Habil. Dr. Regina GRAŽULEVIČIENĖ
Vytautas Magnus University

The thesis defended:
23 May 2014
Vytautas Magnus University

Epidemiological studies reveal diversified effects of exposure to trihalomethanes (THM) and preterm birth, low birth weight, small-for-gestational-age and other unfavorable pregnancy outcomes. Results of scientific research are still insufficient and inconclusive as it is still unclear which of trihalomethanes have the greatest effect on adverse pregnancy outcomes.

The objective of this study was to evaluate the effect of exposure to drinking water THMs and work environment, socio-demographic factors on adverse pregnancy outcomes: preterm birth, low birth weight and small-for-gestational-age.

Results of this study revealed an increase of adverse pregnancy outcomes risk at trihalomethanes levels below regulated limits. A dose–response relationship was found for the internal dibromochloromethane dose and elevated preterm birth and low birth weight risk. Low birth weight and small for gestational risk odds were higher for women assigned to lower social class. For a low birth weight risk a synergic effect of the internal dose of trihalomethanes and working conditions was established. Textile industry workers experienced small for gestational risk increase due to exposure to noise or chemical materials combined with the internal dose of trihalomethanes.

Results of this research can be widely used when designing Public Health Policy instruments, to improve and ensure water safety and working environment quality. Public Health specialists can use these findings as scientific arguments for educational and preventive purposes in order to minimize and control risk of adverse pregnancy outcomes.

Key words: trihalomethanes, drinking water, pregnancy outcomes, health, water disinfection by-products

THE INFLUENCE OF AGRI-ENVIRONMENTAL MEASURES BASED GRASSLAND MANAGEMENT ON GRASSLAND PLANT COMMUNITIES
AGRARINĖS APLINKOSAUGOS PRIEMONĖMIS PAREMTŲ TVARKYMO METODŲ ĮTAKA PIEVŲ AUGALŲ BENDRIJOMS

Aurelija LOŽYTĖ

Scientific supervisor:
Assoc. Prof. Dr. Gytautas IGNATAVIČIUS
Vilnius University

The thesis defended:
23 May 2014
Vilnius University

Grassland is an important component of agrarian landscape, performing a wide range of ecological, economic and social functions. Long-term changes of the conditions of habitats, determined by human economic activities, influence the state of grassland plants. The Rural Development Programme for Lithuania 2007–2013 sets measures to preserve biological diversity of grassland. The purpose of it is to reduce a negative anthropogenic effect on grassland plant communities using the EU funds.

Having researched the differences of grassland plant diversity and economic value, influenced by different intensity economic activities, the main objective of this paper is to evaluate the efficiency of EU regulated, agri-environmental measures based grassland management methods in a small farming sector of Lithuania. The research, involving the assessment of the number of plant species, diversity of plant families, distribution of relative plant abundance, and dominance of plant species in plant communities in grassland managed traditionally and according to the requirements of agri-environmental farming, showed that both types of grassland had similar plant communities. Such conclusion was drawn from the analysis of Jaccard and Sörensen similarity coefficients. The difference of plant adaptation to soil dampness, acidity, and nutrition was not statistically significant in grasslands of both types. Most of the plants in grassland researched were mesophytes; soil acidity was not a determining factor to the most of plant species; mesooligotrophic and mesotrophic plant communities prevailed. Biological diversity favourable farming does not reduce the economic value of grassland. Grassland of both types was of an average high or high economic value. Agri-environmental measures are not efficient enough taking into consideration the amount of financial resources allocated and the result of the preservation of plant diversity obtained.

Key words: agri-environmental measures, grassland plant communities, economic value, composition of plant species

SMALL MAMMAL COMMUNITY CHANGES DURING EARLY FOREST SUCCESSION STAGES
SMULKIŲJŲ ŽINDUOLIŲ BENDRIJOS POKYČIAI PRADINĖSE MIŠKO SUKCESIJOS STADIJOSE

Aušra ČEPUKIENĖ

Scientific supervisor:
Assoc. Prof. Dr. Linas BALČIAUSKAS
Nature Research Centre

The thesis defended:
25 June 2014
Vilnius University

The aim of the work was to investigate small mammal community changes due to early forest succession (meadow – forest plantation – forest stand) and to assess the effect of the non-vegetative period of the year on them in Lithuania. This work contributes to the understanding of small mammal community changes in the early stages of forest succession, the effect of forest cover enlargement on small mammals and on feeding conditions for predators preying on them. Investigations widen the knowledge of the impact of the non-vegetative period on small mammals and of changes in their community indices in the course of the year; they allow comparing the data from different seasons within the same geographical region. It was found that: (1) In the process of succession the number of species decreases, the order of species dominance changes, relative abundance increases, meadow species disappear due to transformation of the forest plantation to the forest stand; (2) Biological indices of small mammal communities differ between natural and human-induced succession; (3) The species diversity of small mammals does not change in the non-vegetative period of the year and decreases only in the beginning of spring. The breeding of some species takes place in winter; (4) Changes in small mammal diversity due to meadow-to-forest stand succession do not cause reduction in the abundance and biomass of small mammals; therefore, feeding conditions for predators preying on them do not become worse.

Key words: small mammals, succession, non-vegetative period

NORWAY SPRUCE (*PICEA ABIES* (L.) H. KARST.) CONDITION AND DISTURBANCES IN THE CHANGING CLIMATE
PAPRASTOSIOS EGLĖS (*PICEA ABIES* (L.) H. KARST.) BŪKLĖ IR PAŽEIDŽIAMUMAS KLIMATO KAITOS SĄLYGOMIS

Povilas ŽEMAITIS

Scientific supervisor:
Dr. Vidas STAKĖNAS
Institute of Forestry of Lithuanian
Research Centre for Agriculture and Forestry

The thesis defended:
7 November 2014
Institute of Forestry of Lithuanian
Research Centre for Agriculture and Forestry

Research studies indicate that during the XXI century the rate of damages and vulnerability of Norway spruce (*Picea abies* (L.) H. Karst.) will increase.

The aim of the study was to assess changes of the condition and vulnerability of Norway spruce in Lithuania and evaluate the impact of the main affecting factors, including climate change.

To achieve this aim the following **objectives** were set up: to evaluate the dynamics of spruce crown condition during the 1990–2013 period in different climatic regions of Lithuania and hydrotops and assess the impact of climatic factors on defoliation; to identify factors which have impact on the frequency of biotic and abiotic damages, evaluate the dynamics of damages and assess the relation between damages and crown condition; to identify factors which have impact on the frequency of wood decay in spruce stands and assess the impact of wood decay on crown defoliation; to assess changes of the spruce phonological structure in different climatic regions of Lithuania.

Novelty of the study. For the first time in Lithuania, a systematic (integrated) research has been done on the Norway spruce condition in a changing climate. The effects of precipitation and temperature on the crown condition in different climatic and site humidity gradients were identified. The key biotic and abiotic damaging factors were identified and their impact on crown defoliation was assessed. A relation of the incidence of decay and crown defoliation was identified. The structure of spruce phenological forms in different climatic regions was assessed and compared to the changes in understory (compared to the canopy trees) in the climatic gradient of Lithuania.

Key words: Norway spruce, crown condition, vulnerability, climate change

THE DISTRIBUTION, GENETIC DIVERSITY AND HELMINTHS OF ALIEN MAMMAL MUSKRAT (*ONDATRA ZIBETHICUS*)
SVETIMKRAŠČIO ŽINDUOLIO ONDATROS (*ONDATRA ZIBETHICUS*) PAPLITIMAS, GENETINĖ ĮVAIROVĖ IR HELMINTAI

Gintarė SKYRIENĖ

Scientific supervisor:
Prof. Habil. Dr. Algimantas PAULAUSKAS
Vytautas Magnus University

The thesis defended:
18 November 2014
Vytautas Magnus University

The muskrat is an alien semi-aquatic mammal which was introduced to various regions around the world from North America. The aim of the study was to investigate the distribution, genetic diversity and helminths of alien mammal muskrat (*Ondatra zibethicus*). The evaluated distribution and the abundance of muskrats showed that it was not the same, very much varying in different years and falling significantly in the various water bodies in Lithuania. Therefore, the impact of muskrats on native species and communities, habitats and ecosystems is insignificant and localized. Until now, the attention to the genetic structure of this invasive animal was very little. The genetic analysis and genetic diversity of the population of muskrats was assessed for the first time in Lithuania. The genetic diversity was studied using the microsatellite DNA markers. This allowed for the evaluation that the genetic diversity was lower in Lithuania than in Karelia (Russia) or native Canadian populations of muskrat. After the evaluation of the helminthological analysis it was determined that the muskrat has lost American origin parasites after the period of acclimatization. The comparison of the helminth community structure and infection rates of muskrat determined that the rates were higher in the period of the highest abundance of muskrats (1973–1975) compared to the period when it significantly reduced (2001–2014). The investigated number of muskrats suggests that the helminthological impact of muskrat to humans and the environment is low.

Key words: muskrat, distribution, impact, genetic diversity, helminths

GENETIC EFFECTS OF ALIEN CERVIDS ON THE NATIVE SPECIES, BIOLOGICAL DIVERSITY AND STABILITY OF THE COMMUNITY
SVETIMKRAŠČIŲ ELNINIŲ GENETINIS POVEIKIS VIETINĖMS RŪŠIMS, ĮTAKA BENDRIJŲ BIOLOGINEI ĮVAIROVEI IR STABILUMUI

Irma PŪRAITĖ

Scientific supervisor:
Prof. Habil. Dr. Aniolas SRUOGA
Vytautas Magnus University

The thesis defended:
21 November 2014
Vytautas Magnus University

Family Cervidae Animal Molecular Research is new in Lithuania. There are multitude morphological and ecological studies, but so far no data on the genetic diversity of the deer in Lithuania has been published. This dissertation presented genetic diversity studies of sika deer, red deer and roe deer and assessed the impact of non-native animal on community diversity and stability.

The most important results of this study are that for the first time a set of microsatellite markers was used to sika deer population genetic studies, which until now has been only used in the research of reindeer, roe deer, fallow deer and red deer. Hybrid animals are found in sika deer and red deer populations (in nature and in captivity). We identified the 20 mtDNA D-loop sequence fragments of roe deer and placed in the "GenBank" sequence database (identification numbers: KM215767-KM215786). Three new haplotypes and eight mtDNA sequences in the Lithuanian roe deer population were unique and have no equivalent in "GenBank" deposited sequences. The results indicated introgression of Siberian roe deer (*C. pygargus*) mtDNA in the European roe deer genome, introgressed individuals constituted 20% of the roe deer studied.

Key words: sika deer, red deer, roe deer, genetic diversity, microsatellite, mtDNA

APPLICATION OF UNDERWATER REMOTE IMAGERY AND ACOUSTIC DATA FOR QUANTITATIVE BENTHIC BIOTOPES IDENTIFICATION, PREDICTIVE MAPPING AND BUILDING OF EXPLANATORY MODELS
POVANDENINIŲ NUOTOLINIŲ VAIZDO IR AKUSTINIŲ DUOMENŲ PANAUDOJIMAS KIEKYBINEI DUGNO BIOTOPŲ IDENTIFIKACIJAI, PROGNOSTINIAM KARTOGRAFAVIMUI IR AIŠKINAMŲJŲ MODELIŲ KŪRIMUI

Aleksej ŠAŠKOV

Scientific supervisor:
Prof. Habil. Dr. Sergej OLENIN
Klaipėda University

The thesis defended:
26 November 2014
Klaipėda University

Remote sensing methods application in benthic studies is explored in the dissertation.

Study aim: to develop and explore procedures of using underwater remote imagery and acoustic data for quantitative identification of benthic biotopes, predictive mapping and building of explanatory models.

Tasks: to assess performance of different manual underwater imagery analysis methods with different benthic features and experience of operators; to compare a newly developed semi-automatic underwater imagery analysis method with a point-based manual method in terms of accuracy, reliability and cost effectiveness; to perform and assess a quantitative identification of benthic biotopes in coastal and offshore areas of the Lithuanian part of the Baltic Sea from the underwater video using the developed formalized procedure; to build explanatory models deriving preferences of key benthic species at the exposed cost of the Norwegian Sea with geomorphology in order to identify their significance and to formulate grounded impact hypotheses; to derive factors driving distribution patterns of the Baltic herring spawning grounds in the Lithuanian coastal area, using a geomorphological analysis of bottom profiles and a probability map based on acoustical survey data built with the Maxent model.

Novelty of the study: a new semi-automatic color-based benthic cover estimation method using video mosaics has been developed and compared with the traditional point-based manual method; for the first time the impact hypotheses of a planned wind farm on extremely exposed rocky shore were formulated based on explanatory models build on underwater remote sensing data; a high resolution (20 × 20 meters) predictive map of the Baltic herring spawning grounds was built for the Lithuanian coastal area based on SCUBA diving field surveys in combination with remote sensing data in order to provide new insights on the spawning grounds distribution; new workflow for the quantitative benthic biotopes identification based on an underwater video analysis had been proposed and tested in the Lithuanian part of the Baltic Sea.

Key words: benthic ecology, remote sensing, underwater imagery, statistical modeling

ABUNDANCE AND SPATIAL DISTRIBUTION, BREEDING HABITAT SELECTION, BREEDING SUCCESS AND SPRING ARRIVAL OF THE WHITE STORK *CICONIA CICONIA* IN THE NORTH-WESTERN PERIPHERY OF THE RANGE
BALTOJO GANDRO *CICONIA CICONIA* GAUSUMAS IR ERDVINIS PASISKIRSTYMAS, PERĖJIMO BUVEINIŲ PASIRINKIMAS, PERĖJIMO SĖKMINGUMAS IR PAVASARINIS ATSKRIDIMAS AREALO ŠIAURĖS VAKARŲ PERIFERIJOJE

Daiva VAITKUVIENĖ

Scientific supervisor:
dr. Mindaugas DAGYS
Nature Research Centre

The thesis defended:
22 December June 2014
Nature Research Centre

In this study, changes during the period 1994–2010 in White Stork abundance and spatial distribution, as well as in nest-site selection were determined; regularities in breeding habitat selection and the effect of some habitat characteristics on the breeding success were investigated. The White Stork habitat selection study was carried out in the north-western periphery of the species' range on a sample, comprising 8.4% of the total breeding population of this species, concentrated in an area covering just 1.1% of its range. It was revealed that a considerable increase in the White Stork abundance in 1994–2010 coincided with the adaptation by birds to breeding at a new nest-site – on poles of overhead electricity lines. However, from the standpoint of reproduction, this change in the White Stork nesting behaviour was partly non-adaptive due to significantly lower breeding success in nests built on poles of operating overhead electricity lines. Data on the White Stork first spring arrival, collected during the period 1961–2000, revealed a significant advancement of the spring arrival date, by almost 5 days, to the breeding grounds in the north-western periphery of the range. Factors, affecting the first spring arrival to the breeding grounds, were determined. The study revealed that local weather conditions on the last leg of the spring migration route and in the breeding grounds strongly influenced the arrival timing of White Storks. These local weather parameters were far better predictors of the spring arrival time than regional climatic phenomena – the North Atlantic Oscillation. The main threats facing the breeding White Storks were determined, their importance was assessed, and recommendations for the mitigation of these negative impacts were prepared for this species of the EU conservation concern.

Key words: white stork, habitat selection, breeding success, spring arrival