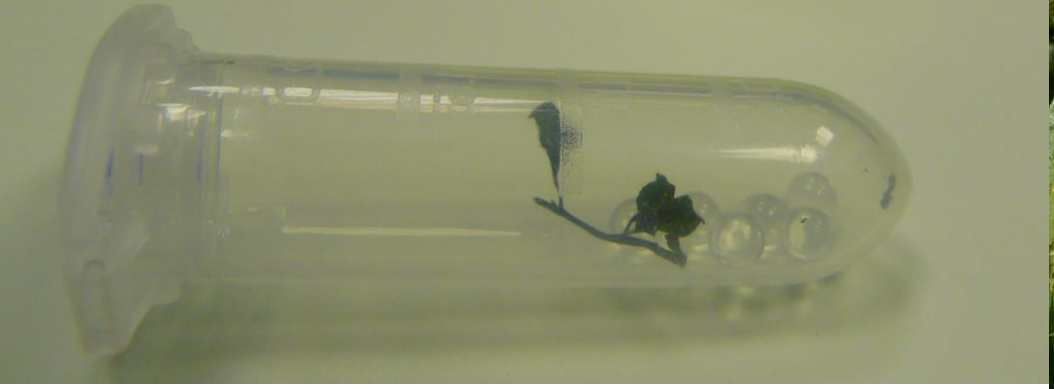
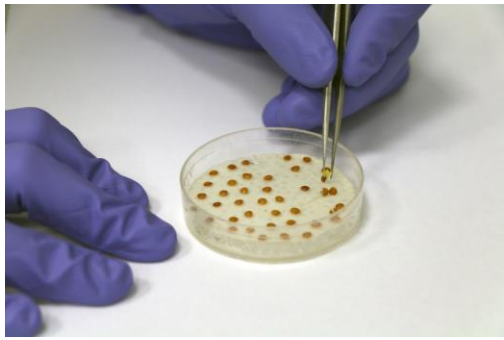
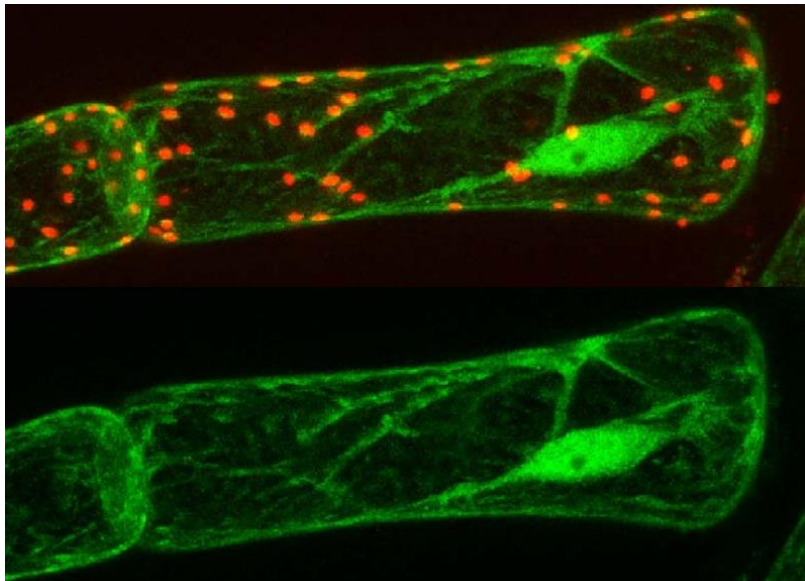


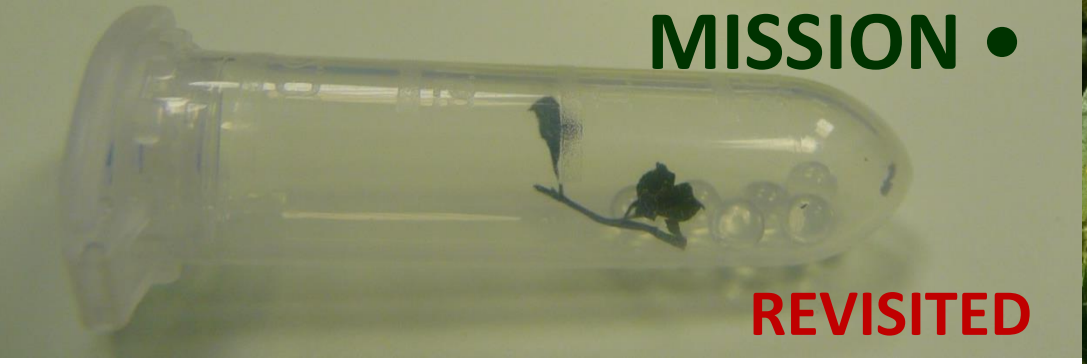
Institute of Botany SAS •



Summary of the main activities
2012 – 2015



MISSION • REVISITED



- **R&D specialization:** evolutionary systematics, phylogeography, phytosociology, ecology, population genetics, chorology and physiology
- **research objects:** biota - mainly naturally growing cryptogams, vascular plants and their communities, invertebrates and fish (since December 2015)
- **research area:** the Carpathians and Pannonia, the distribution ranges of model groups (e.g. the Alps, the Mediterranean, Scandinavia, America and Asia)

WHAT

Biodiversity:

- one of **fundamental assets** of the country – affects its production and security
- fundamental for ecosystem functioning, safeguarding civilization irreplaceable services

The Carpathians:

- among the **richest in biodiversity areas** in Europe (ca 32% of the plant species), one of the northernmost endemism centres in Europe

WHY

The aims:

- **to explain** processes forming diversity of organisms and their communities, and to conserve it;
- **to identify** the mechanisms of plant cell ontogeny and their adaptation to unfavourable environmental conditions with an emphasis on abiotic and biotic stress;
- **to discover** and document the diversity and distribution of organisms and their communities

SPECIFIC AIMS

RESEARCH • FOCUS

Projects:

- CIP-ICT - EU FP Competitiveness and Innovation, EU-BON 7FP, Millenium Seed Bank, Andrew A. Mellon Foundation, EU DG ENV, COST, SYNTHESIS FP7, ROMO (USA), Visegrad Fund, OTKA
- VEGA, APVV (including LPP and mobility schemes), SAIA

Evolutionary processes:
polyploidy, cytotype coexistence and spatial distribution, hybridisation, reproductive isolation, cryptic speciation, apomixis, glacial and poslglacial history reconstruction

Ecological niche differentiation, species co-existence and distribution patterns:
niche expansion, conservativism or contraction

Large-scale biodiversity studies, e-infrastructures:
Red list of European Habitats, Flora of Slovakia, Vegetation of Slovakia, European Vegetation Archive, European Information System for Alien Species, DataFlos

Projects:

- FP7 KBBE MycoRed
- VEGA, APVV

Plant stress (biotic, abiotic):
structural & functional responses – drought, salinity, pathogens, metals, toxic elements

Applied research
NATURA 2000 – MoE SR, State Nature Conservation
bio-monitoring applied research

RESEARCH • HIGHLIGHTS

Cardamine ×schulzii : origin and evolution merging genomes

Research — New Phytologist

When fathers are instant losers: homogenization of rDNA loci in recently formed *Cardamine* × *schulzii* trigenomic allopolyploid

Judita Zozomová-Lihová[1]*, Terezie Mandáková[2]*, Alena Kovaříková[3], Andreas Mühlhausen[4], Klaus Mummenhoff[4], Martin A. Lysak[2] and Aleš Kovařík[3]

Multiple molecular, genomic and cytogenetic approaches employed to:

- determine intragenomic heterogeneity, expression and chromosomal localisation of rDNA arrays in the progenitors
- to trace the evolution of such arrays in the allopolyploid genomes

the rDNA loci analyzed by cloning, NGS, RT-PCR and FISH

i. **prevalent clonal propagation - evidence for concerted evolution, in the absence of extensive meiotic cycles**
ii. **in hybrids, paternally inherited genes and loci were eliminated**

The Plant Cell, Vol. 25: 3280–3295, !

The More the Merrier: Recent Hybridization and Polyploidy in *Cardamine*

Terezie Mandáková,[a] Aleš Kovařík,[b] Judita Zozomová-Lihová,[c] Rie Shimizu-Inatsugi,[d] Kentaro K. Shimizu,[d] Klaus Mummenhoff,[e] Karol Marhold,[c,f] and Martin A. Lysak[a,1]

- an excellent system to study impacts of hybridization and genomic duplication on genome structure and evolution
  - **Flow Cytometry & Chromosome Counts**
  - **454 Sequencing & Tandem Repeat Identification**
  - **Tandem Repeat Probes**
  - **DNA Labeling & Fluorescence in Situ Hybridization**
  - **Cloning of Crambo Repeats & DNA Gel Blot Hybridization**
  - **Quantification of SNP Ratio by Pyrosequencing (PyroMark)**
  - **cpDNA Analysis**
  - **Pollen Fertility**

i. **a complex case of recurrent hybridization and polyploidization events**
ii. **highlights the role of triploids, which promoted the origin of trigenomic hybrids**
iii. **allohexaploid formed by 2 subsequent hybridization events within the past ca 150 years**
iv. **novel rDNA loci in *C. ×schulzii* identified, suggesting that lost loci might be slowly reinstalled by translocation (not recombination) of genes from partner genomes**

RESEARCH • HIGHLIGHTS

Describing so far globally unrecognized diversity – North America

Collaborative initiative - a mind-shift with a multi-authored, community-wide classification for the fungal kingdom

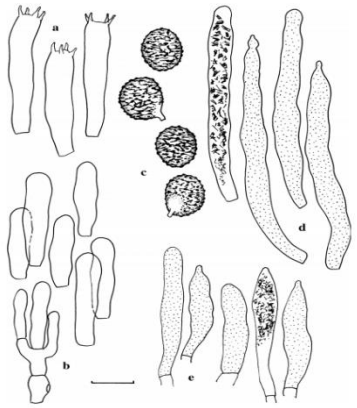
- genus *Russula* - strikingly colourful fruiting bodies
- hundreds of species known from Northern Hemisphere, also edible ones
- important role in forests - colonize root tips of woody species, form symbiosis to support the exchange of nutrients and water

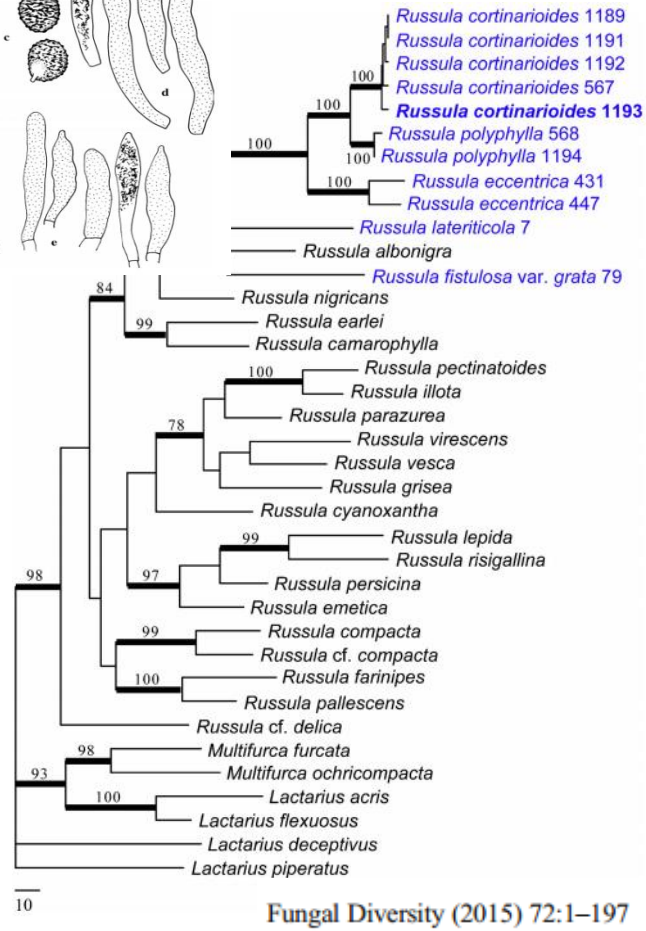
Fungal diversity notes 1–110: taxonomic and phylogenetic contributions to fungal species

Liu JK, Hyde K, Jones EBG, Ariyawansa HA, Bhat DJ, ...**Adamčík S**, ... Camporesi E

- new species described of 67 genera

110. ***Russula cortinarioides*** Buyck, Adamčík, Lewis & V. Hofstetter, ***sp. nov.***





Fungal Diversity (2015) 72:1–197
DOI 10.1007/s13225-015-0324-y

RESEARCH • HIGHLIGHTS

How the landscape structure affects different components of plant species diversity in semi-natural grasslands

Alpha diversity:

- affected by % cover and diversity of different habitats
- increased with increasing proportion or diversity of different natural and semi-natural habitats
- decreased with increasing proportion or diversity of non-natural habitats

Identification of best predictors of hight alpha diversity in different types of grasslands:

- xerophilous or wet grasslands: high proportion of ecologically valuable grasslands in the surroundings
- sub-xerophilous and mesophilous grasslands: proportion of natural and semi-natural habitats, proportion of non-natural habitats

Explanation of results

interplay of 2 main mechanisms: the effect of species pool on alpha diversity was stronger than the spatial mass effect

Agriculture, Ecosystems and Environment 182 (2014) 47–58

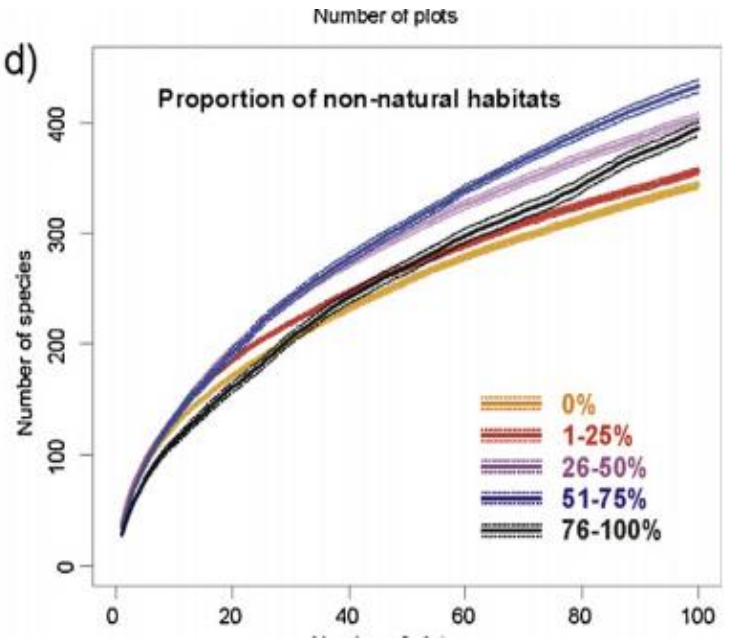
Contents lists available at ScienceDirect

Agriculture, Ecosystems and Environment

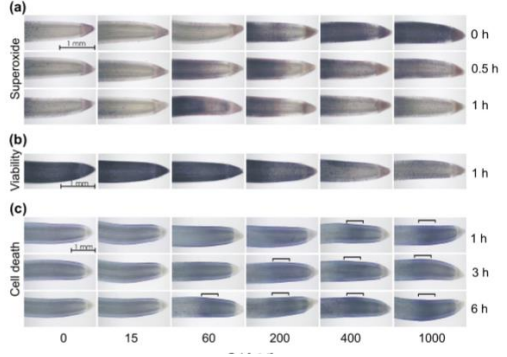
journal homepage: www.elsevier.com/locate/agee

Landscape effects on diversity of semi-natural grasslands

Monika Janišová[a,*], Dana Michalcová[b], Giovanni Bacaro[c], Anne Ghisla[d]



Spatially constrained rarefaction curves - how different diversity components behave with changing structure of landscape



RESEARCH • HIGHLIGHTS

Possible effect of high toxic Cd concentration-induced superoxide production on the moderate Cd concentration-induced morphogenic changes in barley root tip

Planta (2014) 239:1003–1013
DOI 10.1007/s00425-014-2030-5

Ladislav Tamás · Igor Mistrík · Aster Alemayehu

ORIGINAL ARTICLE

Low Cd concentration-activated morphogenic defence responses are inhibited by high Cd concentration-induced toxic superoxide generation in barley root tip

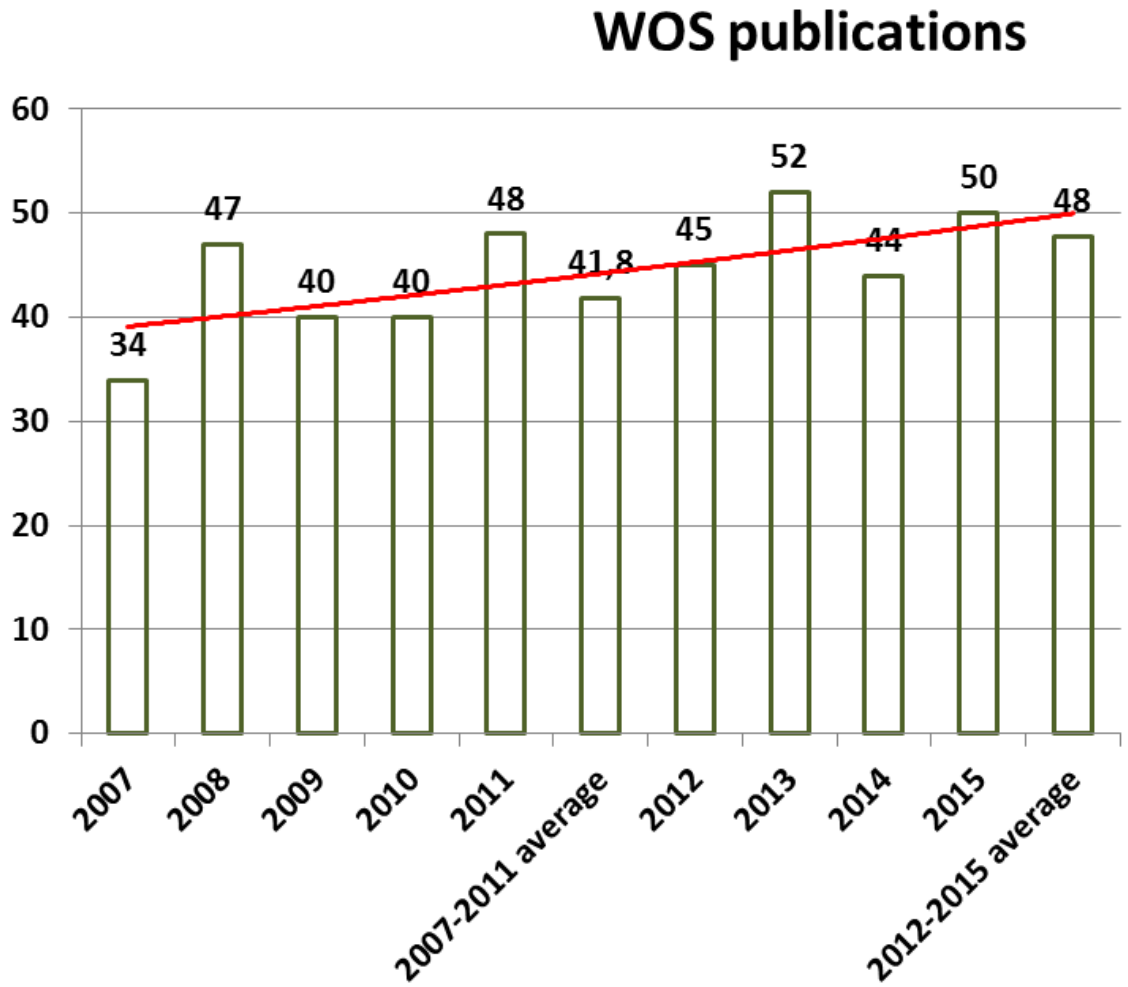
i. localization of superoxide production
ii. detection of root viability
iii. localization of cell death

Results suggest:

- a clear difference between the processes involved in Cd-induced morphogenic changes as defence responses and harmful superoxide generation as a symptom of Cd toxicity in barley root tip
- low Cd concentration-induced reduction of primary root growth and increase of root diameter - components of an adaptive response to Cd stress to avoid the unrepairable lethal damages (i.e. high Cd concentration-induced superoxide production, subsequent cell death)
- auxin signaling involved in the activation of Cd-induced morphogenic defence responses
- oxidative stress is not a primary cause for the Cd induced morphogenic responses (i.e. growth reduction and radial cell expansion in barley root tips)



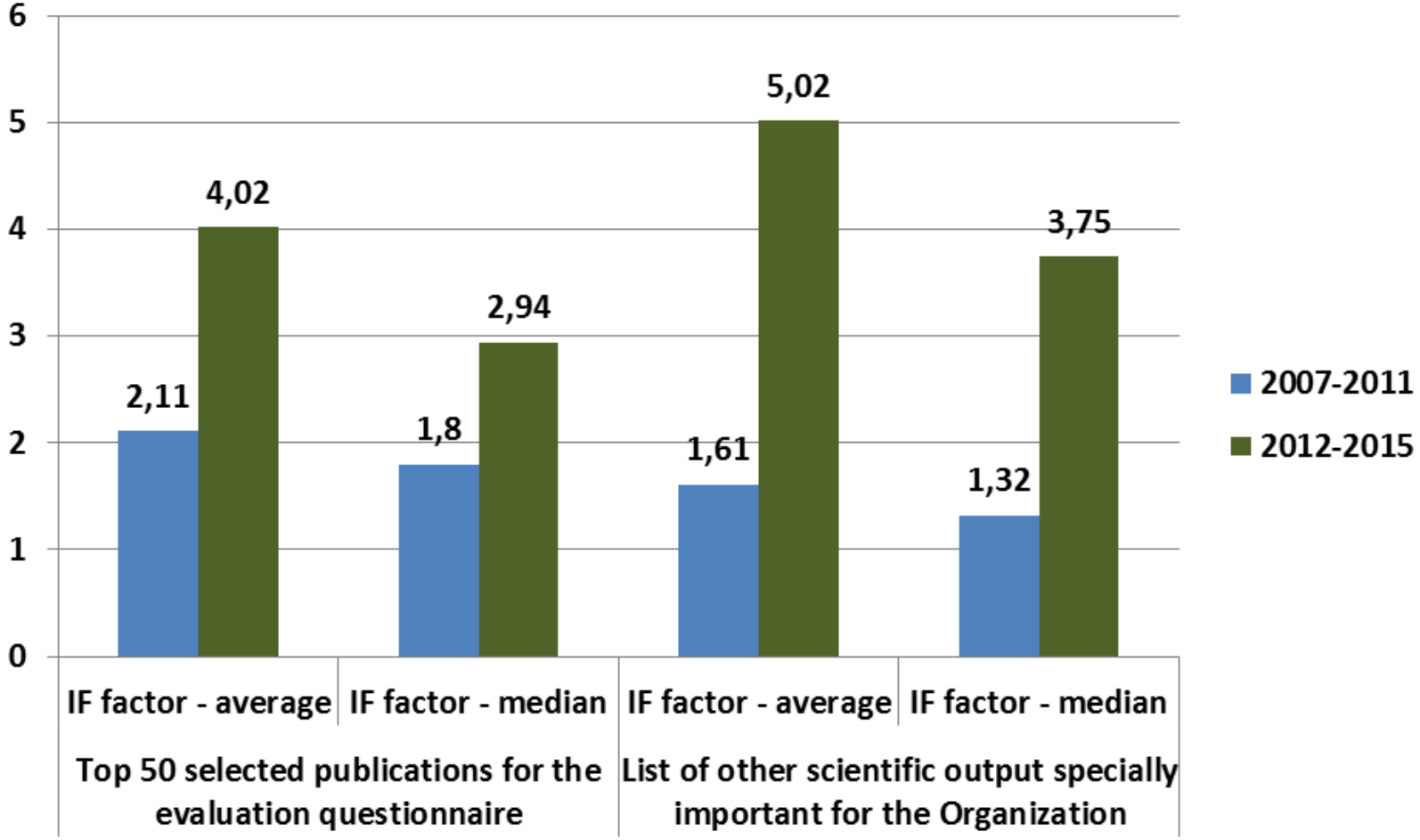
RESEARCH • PUBLISHED





RESEARCH • PUBLISHED

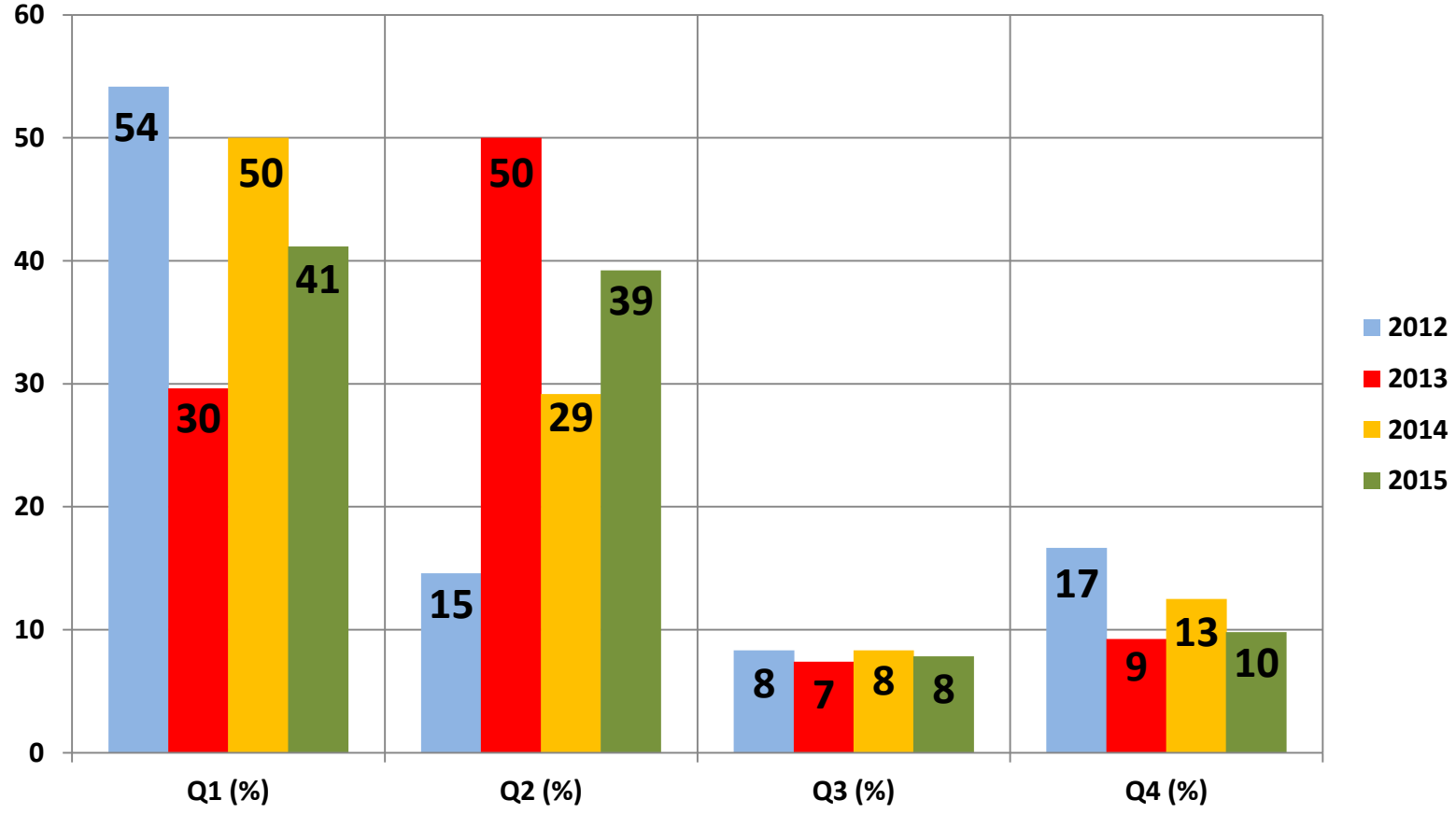
WOS publications – Impact Factor





RESEARCH • PUBLISHED

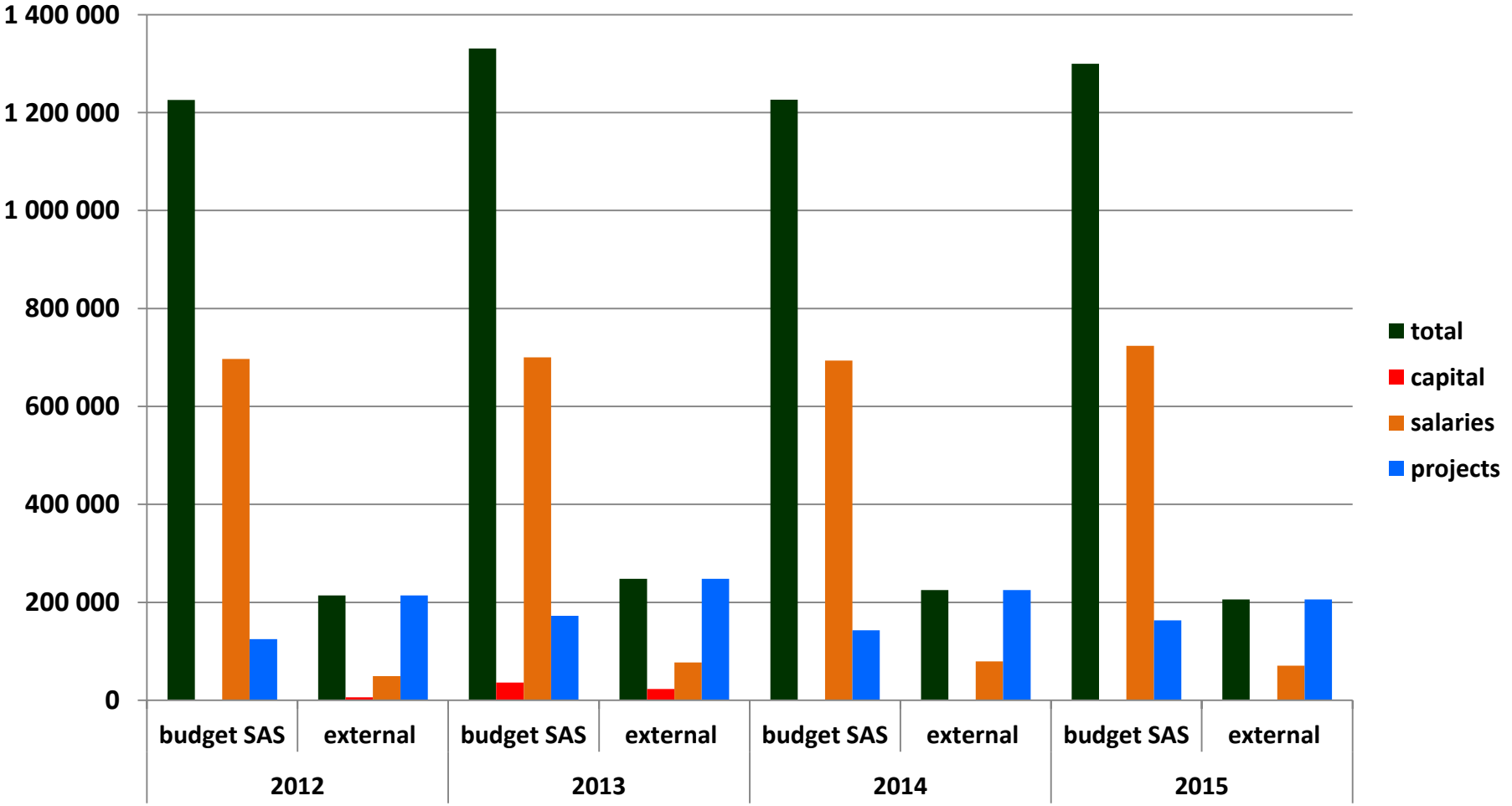
WOS publications – distribution in quartiles (%)



http://scimagojr.com/journalsearch.php?q=acta+physiologiae+plantarum



FINANCES •

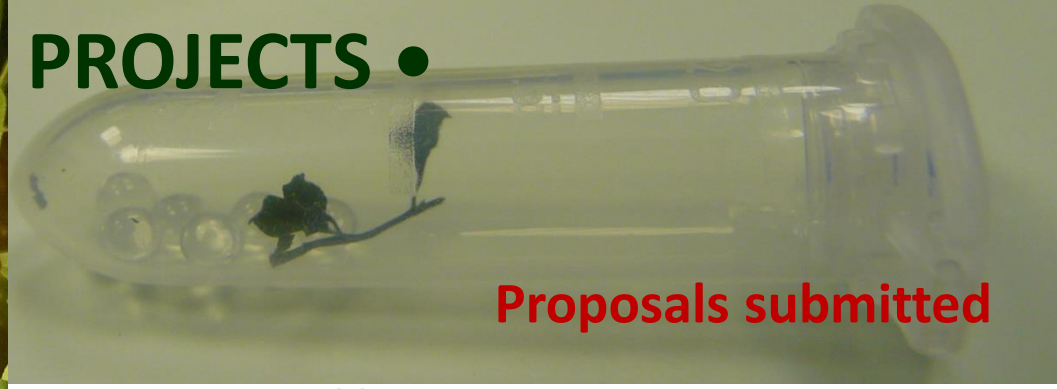

1 400 000
1 200 000
1 000 000
800 000
600 000
400 000
200 000
0
budget SAS
external
budget SAS
external
budget SAS
external
budget SAS
external
2012
2013
2014
2015
total
capital
salaries
projects



FINANCES •


salaries
800 000
700 000
600 000
500 000
400 000
300 000
200 000
100 000
0
budget SAS
external
2009
2010
2011
2012
2013
2014
2015
salaries

PROJECTS •



Proposals submitted

2012

National:

APVV: **4/1**

International:

COST: **1/1**

2013

National:

Structural funds OP R&D: **2/0**

APVV: **1/0**

APVV bilateral mobility: **1/0**

International:

Synthesis: **2/0**

DG ENV: **1/1**

2014

National:

APVV: **6/0**

SAIA – National stipends: **1**

SASPRO: **1/0**

International:

H2020-InFRADEV: **1/0**

COST: **1/0**

Synthesis: **4/1**

Visegrad fund: **3/2**

EMBO fellowship: **2/0**

Swedish Taxonomic Initiative (STI): **1/0**

SCIEX-NMS: **1/0**

2015

National

APVV: **6/1**

APVV bilateral mobility: **1/1**

Slovak Literature Fund: **1/1**

GAPF: **1/1**

SASPRO: **1/0**

International

COST: **1/0**

Synthesis: **3/0**

Stapledon Memorial Trust Fellowship: **1/1**

MBZ: **1/0**

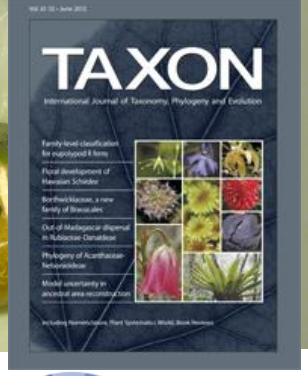
STI: **1/0**

FRPB´s Fall 2015 Research Dissemination Faculty Development: **1/1**

National Geographic Society: **1/0**

NASA: **1/0**

ESFRI: building a proposal with Museum für Naturkunde - Leibniz Institute for Research on Evolution and Biodiversity, Berlin



International Context•

IB SAS a seat of and member of:

BRATISLAVA IAPT INTERNATIONAL ASSOCIATION FOR PLANT TAXONOMY

Association | Taxon | Projects | Grants Program | Nomenclature | Regnum Vegetabile | Login

TAXON (IF 2014/15: 3.299) systematic and evolutionary biology, plants and fungi

International Bureau for Plant Taxonomy and Nomenclature - Institute of Botany SAS, Bratislava

Management – officers and council 2012-2017

Secretary – General: Karol Marhold

CETAF CONSORTIUM OF EUROPEAN TAXONOMIC FACILITIES

EXPLORING AND DOCUMENTING DIVERSITY IN NATURE

We ARE a taxonomic research network formed by institutions of reference in Europe. We HOLD 80% of the worlds' described biodiversity as specimens, collections and their data. We CONNECT over 5000 researchers in European Natural History Museums, Natural Sciences Museums, Botanic Gardens and other research institutions. We CONTRIBUTE to Europe's knowledge-base by enhancing the synergies of our Member's collections and research capabilities.

Home | About Us | Taxonomy | Taxonomic Facilities | Members | Media | Community | Contact

organisation of symposia at international meetings

Botany 2015 – Science and Plants for People, Botanical Society of America, July 25-29, Edmonton, Alberta, Canada

Botany 2013, Celebrating diversity! Botanical Society of America, July 27-31, New Orleans, USA

XIV Meeting of the Organisation for Phyto-Taxonomic Investigation of Mediterranean Area, September, 9-15, 2013, Palermo, Italy

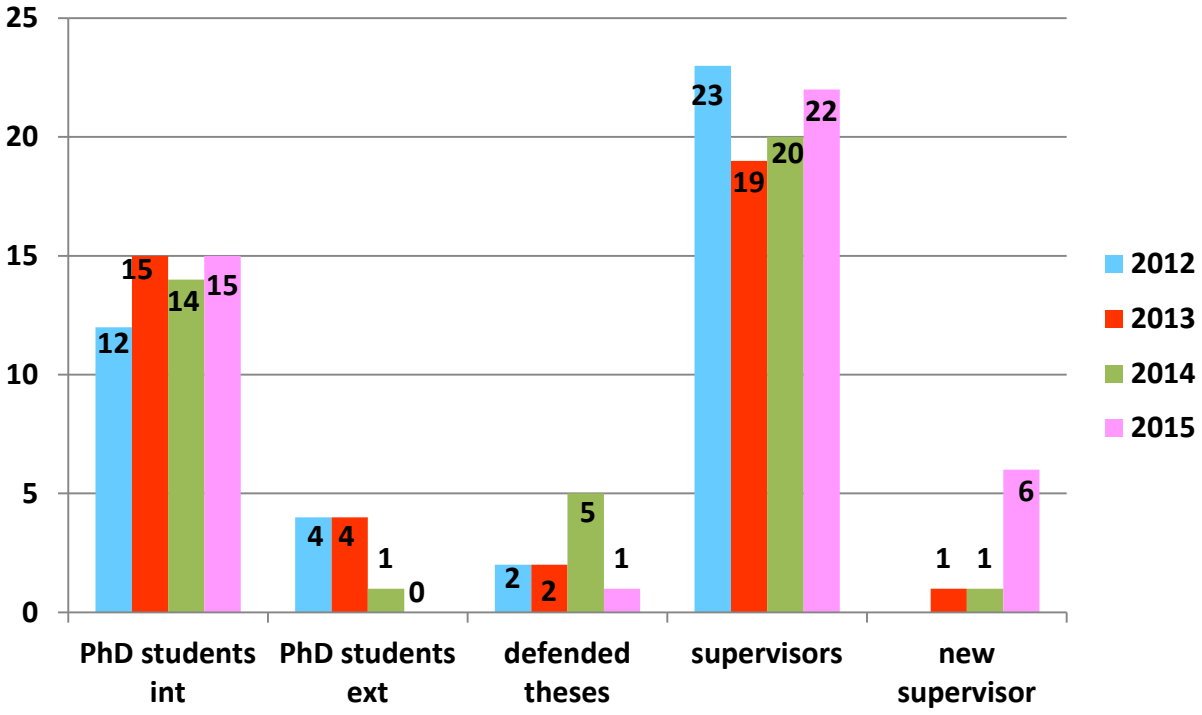
58th Annual Symposium of International Association for Vegetation Science, Brno – post symposium event Western Carpathians

PhD studies •

Accredited programmes:
4.2.6 botany, 4. 2. 9 plant physiology

PhD students - annually:

- progress presentation – competition, ranking
- International exchange patforms for PhD students in Visegrad area: plant systematics, vegetation scientists



Teaching:

university – lectures, practicum courses

Joint research facilities:

National Taxonomic Facility

Cooperation with foreign universities:

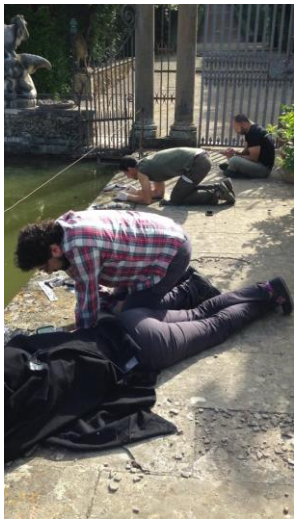
University of Vienna
Charles University Prague
Masaryk University Brno
University of Innsbruck

Outlook for next period:

- focus on Cotutelle and joint PhD programme

Social Impact•

PUBLIC SUPPORT NEEDED



OUTLOOK • BUILD ON STRENGTHS – address larger scientific audience

S Strength

- high quality input data sets
- international cooperation
- long-term increase in quantity and quality of outputs
- object of study is one of the most important country´s assets
- efficient use of resources

W Weakness

- see potential in dataset
- slow process to achieve results (e.g. dependence of seasons)
- transformation of international cooperation into common projects
- lack of applied projects

O Opportunities

- introduction of novel analytical approaches

- mission addresses important and urgent societal challenges
- Centre of Plant Biology and Biodiversity (since 1.1.2017)
- participative leadership

T Threats

- lack of consistente research policy and grant support
- research topics at the margin of societal interest
- red tape (public procurement , bilingual project proposals)
- biodiv projects underfunded or not funder under H2020

OUTLOOK• research strategy – what we want to see in 2021

THEMES

Polyploidy: evolutionary triggers and consequences of chromosomal change ultimately leading to speciation

Evolutionary relationships, taxonomy, diversity and distribution of biota:

- micro-evolutionary processes = species formation
- evolution and diversification of mid-altitudinal biota in Europe
- how trophic strategies and corresponding adaptation mechanisms are related with the flexibility of fungi to inhabit various climatic zones

Invasive alien species and the level of invasion of individiual habitats

Vegetation dynamics, spatio-temporal changes and restoration, vegetation surveying: identification and monitoring NATURA 2000 habitats by dynamic segmentation of satellite images

Water ecosystems – vulnerable habitats influencing the landscape

Plant stress: functional analysis of synaptotagmins in responses of plants to environmental stress – how membrane trafficking is involved in stress responses

APPROACHES

Genotyping approaches:

- restriction site-associated DNA seq (RAD-Seq), Hyb-SeQ and other NGS methods (cp, nc, mt markers)
- flow cytometry, chromosome number cunts, multivariate morphometrics

Ecoinformatic approach: GIS data

Satellite data: filtering, segmentation and tracking os Sentinel-1 synthetic aperture data, Sentinel-2 multispectral imaging data
Vegetation data: Slovak Vegetation Database, EU VD

Characterization of Arabidopsis SYT1 expression, description of AtSYTs mutant lines, subcellular localisation of AtSYTs, intracellular dynamics