Questionnaire
Summary of the main activities of a research institute of the Slovak Academy of Sciences

Period: January 1, 2012 - December 31, 2015

1. Basic information on the institute:

1.1. Legal name and address

Institute of Forest Ecology, Slovak Academy of Sciences
Štúrova 2, 960 53 Zvolen, Slovakia

1.2. URL of the institute web site

www.savzv.sk,www.arboretum.sav.sk/sk/o-arborete/general-information/

1.3. Executive body of the institute and its composition

Directoriat	Name	Age	Years in the position
Director	Ing. Jozef Váľka, CSc.	64	01/2012 - 12/2015
Deputy director	Ing. Peter Zach, CSc.	54	01/2012 - 10/2012
Deputy director	RNDr. Ľubica Ditmarová, PhD.	52	11/2012 - 12/2015
Scientific secretary	Ing. Miroslav Blazenec, PhD.	41	01/2012 - 12/2015

1.4. Head of the Scientific Board

RNDr. Ján Kulfan, CSc.

1.5. Basic information on the research personnel

1.5.1. Number of employees with university degrees (PhD students included) engaged in research projects, their full time equivalent work capacity (FTE) in 2012, 2013, 2014, 2015, and average number of employees in the assessment period

	2012		2013		2014		2015		total		
	number	FTE	number	FTE	number	FTE	number	FTE	number	averaged number per year	averaged FTE
Number of employees with university degrees	70,0	52,820	68,0	57,110	62,0	57,010	65,0	58,240	**265,0**	**66,3**	**56,295**
Number of PhD students	11,0	11,000	12,0	12,000	12,0	12,000	11,0	11,000	**46,0**	**11,5**	**11,500**
Total number	81,0	63,820	80,0	69,110	74,0	69,010	76,0	69,240	**311,0**	**77,8**	**67,795**

1.5.2. Institute units/departments and their FTE employees with university degrees engaged in research and development

Research staff	2012		2013		2014		2015		average	
	No.	FTE	No.	FTE	No.	FTE	No.	FTE	No.	FTE
Institute in whole	70,0	52,820	68,0	57,110	62,0	57,010	65,0	58,240	**66,3**	**56,295**
Department of Soil and Plant Ecology	7,0	4,850	5,0	4,340	5,0	4,210	4,0	3,110	**5,3**	**4,128**
Department of Animal Ecology	10,0	8,300	8,0	7,410	7,0	7,000	9,0	7,640	**8,5**	**7,588**
Department of Production Ecology	11,0	9,390	11,0	10,030	11,0	10,010	11,0	9,790	**11,0**	**9,805**
Department of Ecotoxicology	6,0	5,330	6,0	5,740	6,0	5,180	6,0	5,840	**6,0**	**5,523**
Department of Woody Plants Biology	8,0	6,150	11,0	8,070	9,0	8,300	10,0	8,600	**9,5**	**7,780**
Mlyňany Arboretum	14,0	11,000	13,0	10,580	11,0	11,000	12,0	11,170	**12,5**	**10,938**
Department of Strategic Environmental Analyses	6,0	0,440	6,0	4,730	6,0	4,970	6,0	5,270	**6,0**	**3,853**
Department of Molecular Apidology			2,0	0,210	2,0	1,340	2,0	1,900	**2,0**	**1,150**
Department of Management and Secretary	8,0	7,360	6,0	6,000	5,0	5,000	5,0	4,920	**6,0**	**5,820**

1.6. Basic information on the funding of the institute

Institutional salary budget and others salary budget

Salary budget	2012	2013	2014	2015	average
Institutional Salary budget *[thousands of EUR]*	736,943	780,591	817,408	861,636	**799,145**
Other Salary budget *[thousands of EUR]*	94,645	115,938	145,389	98,366	**113,585**

1.7. Mission Statement of the Institute as presented in the Foundation Charter

The Institute of Forest Ecology of the Slovak Academy of Sciences (SAS) was established by the decision No. 689/1 of the Presidium SAS dated 17 June 1987. Since 1 July 1990 it has been operating as an independent economic unit; as a contributory organisation since 1 January 1993.

The headquarters of the institute are situated in Zvolen. The other satellite workplaces are located in Nitra (the branch of Woody plants biology), Bratislava (two departments), Mlyňany (the Arboretum) and Staré Hory (Research station).

The most recent enlargement of the institute facilities represent a detached branch in Bratislava (since 1 November 2012, the Department of strategic environmental analyses formerly belonging to the Prognostic Institute of the SAS and since 1 December 2013, the Department of molecular apidology formerly belonging to the Institute of Molecular Biology SAS). Following the decision No. 242C of the Presidium SAS dated 3 April 2014, the specialised organisation of SAS – Arboretum Mlyňany was merged with the Institute of Forest Ecology SAS since 1 July 2014, while the original name of the workplace "Arboretum Mlyňany" was retained.

According to the Foundation Charter No 305/G/12/20147 signed on 20 June 2014, the institute focuses on the basic and applied research in forest ecology. Institute's research programme features the research on changes, processes and stressors important for the stability, structure, production and protection of forest ecosystems. The research focuses on close-to-nature and human-influenced ecosystems, their dynamics, components, regimes, elements and relationships, leading to conclusions that can be applied in several scientific fields and research

branches, mainly in forest silviculture and protection, and strategic management of biodiversity. The impact of abiotic and biotic natural stressors, anthropogenic load and interventions on the health status of forest tree species and the stability of forest ecosystems is studied comprehensively. The study of native as well as introduced tree species and their stands is among research priorities of the institute. A special emphasis is put on biology, ecology, management and protection of tree species and their fungal and animal associates, in both forest and urban environments, human settlements included.

The institute has been gaining original knowledge in the field of forest ecology in the home country and abroad. It has been providing advisory and expert services on forest ecology to state and private institutions. In the form of postgraduate studies it has been providing education in the area of ecology, biodiversity protection and related research areas.

The institute collects, registers and presents global and national gene pools of woody plants. It organises their collections according to the scientific rules for organisation and presentation of woody plants. Under in-situ conditions it gathers and protects endangered autochthonous woody plants of Slovakia facing extinction. Apart from the semper vireo character of the natural collections, the presentation of the gene pools is performed also on the base of the ecological and geographic principles.

The institute works out the master plans of greenery and projects of green landscaping, designs of greenery and undertakes their development, designs of terrestrial systems of ecological stability, valuation and assessment of the health status of the greenery. From the production activities the institute grows bare-root plant material, reproduces ornamental plants by micropropagation of tissue cultures, and supplies and plants grown woody plants within landscape design activities.

1.8. Summary of R&D activity pursued by the institute during the assessment period in both national and international contexts, (recommended 5 pages, max. 10 pages)

The summary of the research and development activities pursued by the institute has been determined on the base of our long-term studied topics with regard to the quality of scientific outputs and their perspectives in the global scientific context. Ten topics listed below present the main contributions to their understanding that were achieved during the assessment period (with references to the most important relevant publications indexed in the Web of Science™ Core Collection database). Thus this summary arises from the original knowledge, well established research and good personal and material infrastructure (with promising improvements due to recent investments into new technologies and laboratories). The list of the results in the presented research topics is compiled using the top down approach starting from ecosystems to organisms and from natural processes to human activities, all associated with the forest environment that has recently undergone global changes. Our pursued research has thus focused on various topics from developmental processes and changes, biodiversity and stress factors in forest ecosystems, through microorganisms in biotechnology and pests and invasive species control to evolution of species adaptations and interdisciplinary research on global change.

Effects of global changes on forest ecosystems and disturbance regimes

Conditions of forest ecosystems are changing depending on various factors. The most dynamic changes occur due to the influence of large-scale disturbances, the impacts of which on the status and development of forest ecosystems are often accelerated by global changes. On an example of the wind impact and the subsequent bark beetle outbreaks in spruce ecosystems, we analysed factors that directly affect these systems, as well as the site and host factors that affect the population of bark beetles. We developed a decision support system for spruce ecosystems with the possibility of operative mapping of the areas affected by disturbances (wind, bark beetles). According to the collected data, it will be possible to predict further development and management of these ecosystems in time and space. For management needs

of bark beetle populations we were focusing also on the research of attractants and anti-attractants (For Ecol Manage 2014; Funct Ecol 2014; Ann For Res 2014; J Chem Ecol 2015).

Stress factors and adaptive potential of forest trees

The life cycle of forest woody plants is associated with many changes in their environment. These may be adverse, even stressful, and as such they can negatively influence the tree health condition and vitality. Physiological processes in forest woody plants act as sensitive indicators of changes induced by stress impact. These processes are closely connected with growth processes and stability of forest ecosystems. Today, the knowledge of these processes allows us to assess the status and the changes in forest woody plants by analysing the key spots of the physiological flows of energy and substances. Based on the physiological and growth analysis of drought impact on forest trees we identified symptoms, consequences and adaptive potential of selected population of forest woody plants. Climate change may threaten the survival and productivity of local populations not only by pushing climate conditions beyond the ecological limits of species. Weather extremes or shifts in intra-annual weather courses may disturb climatic signals perceived by trees and consequently confuse physiological processes initiated by these signals or initiate them at an unsuitable time. The analysis of the critical values of environmental factors (by simulation mainly heat and drought stress) causing changes in physiological processes allowed us to give appropriate recommendation to forestry practice and timber producers (Eur J For Res 2012; Plant Soil Environ 2013; Ecohydrology 2015; Photosynthetica 2015).

Pollution, stand regeneration and litter decomposition in forests

Pollution loads which acidify the atmosphere and soil have a negative influence on the growth and development of plant species and their communities. Forest ecosystems have been affected by pollution for a long time, however, the consequences on natural regeneration have remained unclear. It appears that by applying different felling methods some attributes of subsequent stands originating from natural regeneration can change in the longer-term but the interventions intensity has only a shorter-term impact on some of the attributes. Another priority area of our research included the decomposition of forest litter and carbon sequestration. Approximately three times more carbon is accumulated in soils than in the entire atmosphere of the planet. Carbon in the form of carbon dioxide gas is released from the soil into the atmosphere during the decomposition of organic matter. This degradation is mainly driven by microbial activity. Soil communities are also affected by a number of other factors, which are mainly temperature, humidity, nutrients or pollution load, from which the temperature is the most important factor in relation to global warming (Polish J Ecol 2014; For Ecol Manage 2015; Plant Soil Environ 2015).

Parasitic fungi and woody plants interactions

Parasitic microscopic fungi belong to important disease vectors, which not only decrease the aesthetic and decorative value of woody plants, but also often cause withering of branches or possibly whole plants. Seasonal climatic changes evidently affect activation of invasive and quarantine fungal species, which occur in new areas and on new hosts, and by causing annually repeated infections they have a negative impact on the growth of woody plants and in grave cases they can cause a gradual dieback of plants. A diverse spectrum of parasitic fungi which take part in the dieback and withering of branches and in the damage of foliage of selected woody plants was determined. The chestnut blight is a serious problem in central European populations of the European chestnut. No natural healing of cankers was observed. In addition to the host susceptibility it is also the environment that plays an important role in triggering the disease. High air temperatures and drought during summer showed to have a positive effect on the development of chestnut blight cankers. Breeding with Asiatic chestnuts has been suggested as one of the most effective ways how to control the chestnut blight in the European chestnut. Until now, several chestnut genotypes of different taxonomic origin and with different levels of resistance to the chestnut blight are subjected to rapid ex situ tests (Cent Eur J Biol 2012; Myctaxon 2014; Cryptogam Mycol 2014; Plant Protect Sci 2015).

Biotechnology in plant propagation, tree pest control and invasive species elimination
The knowledge about the effects of different stressors (particularly drought) on vitality and reproduction characteristics of ornamental trees is important in urban ecology from social and economic aspects. The issues of reduced plant reproduction ability in unfavourable or changing environmental conditions can be solved by biotechnological methods used in plant propagation. The first quantification of the potential exchange of invasive plant propagules as a result of the trade among European countries was carried out and the bio-regulation methods of invasive woody plants based on allelopathy or natural pests were described. In terms of maintaining a good status of tree health, regular monitoring of their pests and diseases is essential. New methods of biological control of tree pests with the exploitation of species-specific entomopathogenic fungi were investigated (Mycologia 2013; J Inverebr Pathol 2014; Mycotaxon 2014; Biocontrol Sci Technol 2014).

Genomics and functional proteomics of honeybee royal jelly proteins and peptides
Recent results obtained in the area of genomics, functional proteomics, molecular biology, purification and characterisation of physiologically active honeybee royal jelly proteins and peptides can significantly contribute to solving the serious problems of the currently unfavourable situation in beekeeping. This situation is caused by the usage of chemotherapy in healing and prevention of honeybee colonies against the microbial diseases. The knowledge gathered by us opens a new field for research of protein pharmaceuticals and bee protein additives to functional foods, and of the industrial usage of the economically effective, biotechnological process of the preparation of a new class of proteo-biopharmaceuticals. On the other hand, the screening of apalbumin1 content in honey samples from all over the world in cooperation with partners of the International Honey Commission, will provide a platform for improving the EU standards for honey authenticity and quality, that will protect consumers against the honey adulteration, which is a serious problem on the commercial markets (Arh Hig Rada Toksikol 2015; Peptides 2015).

Habitat selection and foraging ecology of endangered and rare animal species
Over the last decades, forest environment has been considerably fragmented due to massive application of intensive management measures and due to natural disturbances. Colonisation pathways, principles of population founding in new habitats and the impact of forest fragmentation on distributional patterns, genetic structure and morphology of various animal taxa were studied. Habitat characteristics and decision strategies for breeding site selection of selected insect and bird species of European importance were summarised. Along with field observations, experimental studies were conducted to explore and understand foraging preferences of species in new or changed conditions (Oecologia 2012; Evol Ecol 2012; Eur J Entomol 2013; J Insect Conserv 2014).

Risk assessment of native and non-native insects' performance in forests
Changing environmental conditions, mainly warming of the atmosphere, have globally changed forest structure and occurrence, spatial distribution, abundance of species and interactions between animals and woody plants in forest ecosystems. Global changes are often modified locally by natural and anthropogenic influences. Changes in forest ecosystems are also reflected by the spread of non-native species. Several invasive species now cause serious damage to tree species, and their timber, or affect native animals on woody plants, in forests and urban areas. Until now, the emphasis has been placed on the interactions between native species of animals, primarily phytophagous insects, and woody plants in forests modified by natural disturbances (drought and wind) and anthropogenic impacts (tree felling). The spread of invasive insect species resulted in more frequent research activities focused on non-native species influencing native species and their habitats (Zookeys 2014; Ann For Res 2015).

Behavioural algorithms for solving complex tasks
Sexual reproduction and social life are very frequent in the animal kingdom. The process of biological evolution induced and optimised also behavioural algorithms with the ability to solve intricate problems at a level of an organism. We are dedicated to search for and understand such algorithms of species in a complex and changing environment of forest ecosystems. Our cutting-edge research focuses on algorithms responsible for (i) maintaining group cohesion of

social animals with higher cognitive abilities, and (ii) an optimal mating strategy in systems with antagonistic co-evolution between the sexes. Our novel results revealed behavioural mechanisms which were unknown until now. Along with better understanding of evolutionary adaptations in species survival, this research has also a great potential for the development of bio-inspired computational tools (Acta Chiropterol 2013; J Insect Behav 2014; Behav Process 2015; Evol Ecol 2015).

Interdisciplinary research of a human dimension of global environmental change and ecosystem services

Vulnerability of ecosystems in global era is increasing as human activities have moved beyond the range of natural variability and are approaching critical tipping points. Traditional policies and management approaches are challenged by a global market and its actors, and result in overuse and resource depletion. Research on a human dimension of global change addresses these challenges by developing strategies for society adaptation. Using a multiple method approach (experimental approaches, agent based modelling, institutional analyses, remote sensing and GIS analyses) we study variables of behavioural changes towards sustainability and innovations in environmental strategic decision making. Our concern is about the role of ecosystem services, self organisation and innovative incentive mechanisms of natural resources and land use under the global change. This research is dominantly funded from the EU project schemes (Environ Plann C 2013; Ecol Econ 2013; Int J Commons 2013; Ecol Indic 2014).

2. Partial indicators of main activities:

2.1. Research output

2.1.1. Principal types of research output of the institute: basic research/applied research, international/regional (ratios in percentage)

basic research/applied research = 90/10

international research/regional research= 90/10

2.1.2 List of selected publications documenting the most important results of basic research. The total number of publications listed for the assessment period should not exceed the average number of employees with university degrees engaged in research projects. The principal research outputs (max. 5, including Digital Object Identifier - DOI) should be underlined

ADAMČÍKOVÁ, Katarína - KOBZA, Marek - BOLVANSKÝ, Milan - ONDRUŠKOVÁ, Emília. Spread and population structure of Cryphonectria parasitica in a young chestnut orchard in Slovakia. In *Central European Journal of Biology*, 2012, vol. 7, no. 2, p. 267-274. (1.000 - IF2011). (2012 - Current Contents). ISSN 1895-104X.

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BAUS, Peter - KOVÁČ, Urban - PAUDITŠOVÁ, Eva - KOHUTKOVÁ, Ivana - KOMORNÍK, Jozef. Identification of interconnections between landscape pattern and urban dynamics—Case study Bratislava, Slovakia. In *Ecological Indicators*, 2014, vol. 42, p. 104-111. (3.230 - IF2013). (2014 - Current Contents). ISSN 1470-160X.

BÍLIKOVÁ, Katarína - HUANG, Sheng-Chang - LIN, I-Ping - ŠIMÚTH, Jozef - PENG, Chi-Chung. Structure and antimicrobial activity relationship of royalisin, an antimicrobial peptide from royal jelly of Apis mellifera. In *Peptides*, June 2015, vol. 68, p. 190-196. (2.618 - IF2014). (2015 - Current Contents). ISSN 0196-9781.

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Erysiphe platani: new records, teleomorph formation and re-examination of herbarium collections. In *Cryptogamie, Mycologie*, 2014, vol. 35, no. 2, p. 163-176. (1.153 - IF2013). (2014 - Current Contents). ISSN 0181-1584.

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PŠIDOVÁ, Eva - DITMAROVÁ, Ľubica - JAMNICKÁ, Gabriela - KURJAK, Daniel - **MAJEROVÁ, Jana** - CZAJKOWSKI, T. - BOLTE, A. Photosynthetic response of beech seedlings of different origin to water deficit. In *Photosynthetica : international journal for photosynthesis research*, 2015, vol. 53, no. 2, p. 187-194. (1.409 - IF2014). (2015 - Current Contents). ISSN 0300-3604. DOI: 10.1007/s11099-015-0101-x

SEDMÁK, Róbert - SEDMÁKOVÁ, Denisa - BOŠEĽA, Michal - MARUŠÁK, Róbert - JEŽÍK, Marek - MURGAŠ, Vlastimil - BLAŽENEC, Miroslav. Age estimation of Norway spruce using incomplete increment cores: Testing new and improved methods. In *Dendrochronologia*, 2014, vol. 32, issue 4, p. 327–335. (1.697 - IF2013). (2014 - Current Contents). ISSN 1125-7865.

SLIACKA, Anna - KRIŠTÍN, Anton - NAĎO, Ladislav. Response of Orthoptera to clear-cuts in beech forests. In *European Journal of Entomology*, 2013, vol. 110, no. 2, p. 319-326. (0.918 - IF2012). (2013 - Current Contents). ISSN 1210-5759.

STREBEROVÁ, Eva - JUSKOVÁ, Ľubica. Standards of quality for outdoor recreation in Tatra National Park: a contribution to integrated visitor monitoring and management. In *eco.mont : Journal on Protected Mountain Areas Research and Management*, 2015, vol. 7, no. 1, p. 56-65. (0.394 - IF2014). (2015 - Current Contents). ISSN 2073-106X.

ŠTOFÍK, Jozef - MERGANIČ, Ján - MERGANIČOVÁ, Katarína - SANIGA, Miroslav. Seasonal changes in food composition of the brown bear (Ursus arctos) from the edge of its occurence - Eastern Carpathians (Slovakia). In *Folia zoologica : international journal of vertebrate zoology*, 2013, vol. 62, no. 3, p. 222-231. (0.494 - IF2012). (2013 - Current Contents). ISSN 0139-7893.

UVÁČKOVÁ, Ľubica - ONDRUŠKOVÁ, Emília - DANCHENKO, Maksym - ŠKULTÉTY, Ľudovít - MIERNYK, J.A. - HRUBÍK, Pavel - HAJDUCH, Martin. Establishing a Leaf Proteome Reference Map for Ginkgo biloba Provides Insight into Potential Ethnobotanical Uses. In *Journal of agricultural and food chemistry*, 2014, vol. 62, no. 47, p. 11547 - 11556. (3.107 - IF2013). (2014 - Current Contents). ISSN 0021-8561.

2.1.3 List of monographs/books published abroad

N/A

2.1.4. List of monographs/books published in Slovakia

ADAMČÍKOVÁ, Katarína - KOBZA, Marek - JUHÁSOVÁ, Gabriela - ONDRUŠKOVÁ, Emília - BOLVANSKÝ, Milan - KÁDASI HORÁKOVÁ, Miriam. *Gaštan jedlý na Slovensku a v Európe: pestovanie, ochrana, variabilita a využitie* [European chestnut in Slovakia : growing, protection, use and genetic variability]. Nitra: Garmond, 2014. 155 pp. ISBN 978-80-89408-18-4.

APFELOVÁ, Mária - BUČKO, Jozef - CEĽUCH, Martin - DANKO, Štefan - FENĎA, Peter - HANZELOVÁ, Vladimíra - HELL, P. - CHOVANCOVÁ, Barbara - KADLEČÍK, Ján - KADLEČÍKOVÁ, Zuzana - KAŇUCH, Peter - KARASKA, Dušan - KAŠTIER, Peter - KOCIAN, Ľudovít - KOCIANOVÁ-ADAMCOVÁ, M. - KRIŠTÍN, Anton - KRIŠTOFÍK, Ján - KÜRTHY, Alexander - LEHOTSKÁ, Blanka - LEHOTSKÝ, Roman - MIKLÓS, Peter - MATIS, Štefan - MOŠANSKÝ, Ladislav - PČOLA, Štefan - PJENČÁK, Peter - SLÁDEK, Jozef - STANKO, Michal - STOLLMAN, Andrej - ŠEVČÍK, Martin - ŠPAKULOVÁ, Marta - UHRIN, Marcel - URBAN, Peter

- VALACHOVIČ, Dušan - ŽIAK, Dávid. *Cicavce Slovenska: rozšírenie, bionómia a ochrana* = Mammals of Slovakia, distribution, bionomy and protection. Bratislava: Veda, 2012. 712 pp. ISBN 978-80-224-1264-3.

BALKOVIČ, Juraj - BEDRNA, Zoltán - BUBLINEC, Eduard - ČURLÍK, J. - DLAPA, Pavel - FULAJTÁR, Emil jr - GÖMÖRYOVÁ, Erika - GREGOR, Juraj - HANES, Jozef - HOUŠKOVÁ, Beata - HUTÁR, Vladimír - CHLPÍK, J. - ILAVSKÁ, Blanka - JURÁNI, Bohdan - KOBZA, Jozef - KOTOROVÁ, Dana - KUKLA, Ján - KUKLOVÁ, Margita - MACHAVA, Ján - NÁDAŠSKÝ, Ján - NOCHTA, Peter - NOVÁKOVÁ, Katarína - ORFÁNUS, Tomáš - PAVLENDA, Pavol - PICHLER, Viliam - PIŠÚT, Peter - SKALSKÝ, Rastislav - SOBOCKÁ, Jaroslava - ŠIMANSKÝ, Vladimír - TATARKOVÁ, Zuzana - TOBIÁŠOVÁ, Erika - ZAUJEC, Anton - ZVERKOVÁ, Martina. *Morfogenetický klasifikačný systém pôd Slovenska: bazálna referenčná taxonómia* [Morphogenetic soil classification system of Slovakia : basal reference taxonomy]. Bratislava: Výskumný ústav pôdoznalectva a ochrany pôdy, 2014. 96 pp. ISBN 978-80-8163-005-7.

BUBLINEC, Eduard - MACHAVA, Ján - JANČEKOVÁ, Mária - DEMKO, J. - BLAHÚTOVÁ, Dana. *Chemizmus zrážok a jeho dynamika v Liptovskej kotline* [Precipitation chemistry and its dynamics in Liptovská kotlina (Slovakia)]. Ružomberok: Verbum, 2014. 156 pp. ISBN 978-80-561-0192-6.

HOŤKA, Peter - BARTA, Marek. *Dreviny Arboréta Mlyňany SAV* = Inventory of Living Collections of the Mlyňany Arboretum SAS. Bratislava: Veda, 2012. 132 pp. ISBN 978-80-224-1252-0.

JUHÁSOVÁ, Gabriela - ADAMČÍKOVÁ, Katarína - BOLVANSKÝ, Milan - IVANOVÁ, Helena - TOKÁR, Ferdinand - HRUBÍK, Pavel - KONÔPKOVÁ, Jana - KOBZA, Marek - ONDRUŠKOVÁ, Emília - KUNOVÁ, Andrea - KOLLÁR, Ján. *Gaštan jedlý na Slovensku: perspektívy jeho ochrany a pestovania* = European chestnut in Slovakia - prospects of its protection and cultivation. Nitra: Garmond, 2012. 154 pp., ISBN 978-80-89408-14-6.

POLLÁKOVÁ, Nora - KONÔPKOVÁ, Jana. *Vlastnosti pôdy pod vybranými domácimi a introdukovanými druhmi drevín v Arboréte Mlyňany* = Soil Characteristics under Selected Autochthonous and Allochthonous Trees and Shrubs in the Mlyňany Arboretum. Nitra: Slovenská poľnohospodárska univerzita, 2012. 88 pp. ISBN 978-80-552-0831-2.

ŠTRBOVÁ, Eva - KULFAN, Ján. *Význam ovocných sadov pre denné motýle v extenzívnej krajine pri Novej Bani (stredné Slovensko)* = Importance of orchads for diurnal Lepidoptera in an extensively used landscape in the surroudings of Nová Baňa (Central Slovakia). Banská Bystrica: BELIANUM, 2013. 114 pp. ISBN 978-80-557-0625-2.

2.1.5. List of other scientific outputs specifically important for the institute, max. 10 items

N/A

2.1.6. List of patents, patent applications, and other intellectual property rights registered abroad, incl. revenues

N/A

2.1.7. List of patents, patent applications, and other intellectual property rights registered in Slovakia, incl. revenues

N/A

2.1.8. Table of research outputs (as in annual reports).

Papers from international collaborations in large-scale scientific projects (Dwarf team, ALICE Collaboration, ATLAS collaboration, CD Collaboration, H1 Collaboration, HADES Collaboration, and STAR Collaboration) have to be listed separately.

Scientific publications	2012			2013			2014			2015			total			
	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	averaged number per year	av. No. / FTE	av. No. / salary budget
Scientific monographs and monographic studies in journals and proceedings published abroad *(AAA, ABA)*	0,0	0,000	0,000	0,0	0,000	0,000	0,0	0,000	0,000	0,0	0,000	0,000	**0,0**	**0,0**	**0,000**	**0,000**
Scientific monographs and monographic studies in journals and proceedings published in Slovakia *(AAB, ABB)*	4,0	0,063	0,005	1,0	0,014	0,001	3,0	0,043	0,004	0,0	0,000	0,000	**8,0**	**2,0**	**0,030**	**0,003**
Chapters in scientific monographs published abroad *(ABC)*	0,0	0,000	0,000	1,0	0,014	0,001	0,0	0,000	0,000	4,0	0,058	0,005	**5,0**	**1,3**	**0,018**	**0,002**
Chapters in scientific monographs published in Slovakia *(ABD)*	0,0	0,000	0,000	7,0	0,101	0,009	3,0	0,043	0,004	0,0	0,000	0,000	**10,0**	**2,5**	**0,037**	**0,003**
Scientific papers published in journals registered in Current Contents Connect *(ADCA, ADCB, ADDA, ADDB)*	13,0	0,204	0,018	17,0	0,246	0,022	23,0	0,333	0,028	23,0	0,332	0,027	**76,0**	**19,0**	**0,280**	**0,024**
Scientific papers published in journals registered in Web of Science Core Collection and SCOPUS *(ADMA, ADMB, ADNA, ADNB)*	13,0	0,204	0,018	23,0	0,333	0,029	15,0	0,217	0,018	7,0	0,101	0,008	**58,0**	**14,5**	**0,214**	**0,018**
Scientific papers published in other foreign journals (not listed above) *(ADEA, ADEB)*	7,0	0,110	0,009	4,0	0,058	0,005	8,0	0,116	0,010	2,0	0,029	0,002	**21,0**	**5,3**	**0,077**	**0,007**
Scientific papers published in other domestic journals (not listed above) *(ADFA, ADFB)*	9,0	0,141	0,012	9,0	0,130	0,012	6,0	0,087	0,007	6,0	0,087	0,007	**30,0**	**7,5**	**0,111**	**0,009**
Scientific papers published in foreign peer-reviewed proceedings *(AEC, AECA)*	3,0	0,047	0,004	10,0	0,145	0,013	14,0	0,203	0,017	11,0	0,159	0,013	**38,0**	**9,5**	**0,140**	**0,012**
Scientific papers published in domestic peer-reviewed proceedings *(AED, AEDA)*	8,0	0,125	0,011	13,0	0,188	0,017	22,0	0,319	0,027	7,0	0,101	0,008	**50,0**	**12,5**	**0,184**	**0,016**
Published papers (full text) from foreign and international scientific conferences *(AFA, AFC, AFBA, AFDA)*	3,0	0,047	0,004	1,0	0,014	0,001	5,0	0,072	0,006	2,0	0,029	0,002	**11,0**	**2,8**	**0,041**	**0,003**
Published papers (full text) from domestic scientific conferences *(AFB, AFD, AFBB, AFDB)*	3,0	0,047	0,004	3,0	0,043	0,004	0,0	0,000	0,000	17,0	0,246	0,020	**23,0**	**5,8**	**0,085**	**0,007**

- **Supplementary information and/or comments on the scientific outputs of the institute.**

N/A

2.2. Responses to the research outputs (citations, etc.)

2.2.1. Table with citations per annum.

Citations of papers from international collaborations in large-scale scientific projects (Dwarf team, ALICE Collaboration, ATLAS collaboration, CD Collaboration, H1 Collaboration, HADES Collaboration, and STAR Collaboration) have to be listed separately.

Citations, reviews	2011		2012		2013		2014		total		
	number	No. / FTE	number	No. / FTE	number	No. / FTE	number	No. / FTE	number	averaged number per year	av. No. / FTE
Citations in Web of Science Core Collection (1.1, 2.1)	132,0	2,068	167,0	2,416	184,0	2,666	183,0	2,643	**666,0**	**166,5**	**2,456**
Citations in SCOPUS (1.2, 2.2) if not listed above	62,0	0,971	48,0	0,695	57,0	0,826	65,0	0,939	**232,0**	**58,0**	**0,856**
Citations in other citation indexes and databases (not listed above) (3.2,4.2,9,10)	36,0	0,564	48,0	0,695	33,0	0,478	32,0	0,462	**149,0**	**37,3**	**0,549**
Other citations (not listed above) (3, 4, 3.1, 4.1)	174,0	2,726	118,0	1,707	120,0	1,739	52,0	0,751	**464,0**	**116,0**	**1,711**
Reviews (5,6)	0,0	0,000	3,0	0,043	2,0	0,029	0,0	0,000	**5,0**	**1,3**	**0,018**

2.2.2. List of 10 most-cited publications, with number of citations, in the assessment period (2011 – 2014).

SVOBODA, Lubomír - PASTIRČÁKOVÁ, Katarína - KALAČ, Pavel. Concentrations of mercury, cadmium, lead and copper in fruiting bodies of edible mushrooms in an emission area of a copper smelter and a mercury smelter. In *Science of the Total Environment : an international journal for scientific research into the environment and its relationship with humankind*, 2000, vol. 246, no. 1, p. 61-67. ISSN 0048-9697.
Citacions: 48

DANKO, Štefan - DAROLOVÁ, Alžbeta - KRIŠTÍN Anton (eds). *Rozšírenie vtákov na Slovensku* = Birds distribution in Slovakia. Bratislava : Veda, 2002. 688 s. ISBN 80-224-0714-3.
Citacions: 41

ADAMS, Jonathan M. - FANG, Wei - CALLAWAY, Ragan M. - CIPOLLINI, Don - NEWELL, Elizabeth - CINCOTTA, Christy - ESPENSCHIED-REILLY, Amanda - HINZ, Hariet L. - NIEMELA, Pekka - VETELI, Timo - ROUSI, Mati - SELAS, Vidar - WEIS, Judith S. - PRASSE, Ruediger - SINGER, Michael S. - TOMOV, Rumen - KULFAN, Ján - CICÁK, Alojz - MIHÁL, Ivan - KUKLA, Ján - ZACH, Peter - MODY, Karsten - SCHMIDT, Wolfgang - LUNDHOLM, Jeremy - ROQUES, Alain - LUO, Yi. A cross-continental test of the Enemy Release Hypothesis : leaf herbivory on Acer platanoides (L.) is three times lower in North America than in its native Europe. In *Biological Invasions*, 2009, vol. 11, issue 4, p. 1005-1016. ISSN 1387-3547.
Citacions: 24

KAPPES, Heike - TOPP, Werner - ZACH, Peter - KULFAN, Ján. Coarse woody debris, soil properties and snails (Mollusca: Gastropoda) in European primeval forests of different environmental conditions. In *European Journal of Soil Biology*, 2006, vol. 42, no. 3, p. 139-146. ISSN 1164-5563.
Citacions: 20

TOPP, Werner - KAPPES, Heike - KULFAN, Ján - ZACH, Peter. Distribution pattern of woodlice (Isopoda) and millipedes (Diplopoda) in four primeval forests of the Western Carpathians (Central Slovakia). In *Soil Biology & Biochemistry*, 2006, vol. 38, no. 1, p. 43-50. ISSN 0038-0717.
Citacions: 20

PATOČKA, Jan - KULFAN, Ján. *Lepidoptera of Slovakia : bionomics and ecology* = Motýle Slovenska : bionómia a ekológia. Bratislava : Veda, 2009. 312 s. ISBN 978-80-224-1085-4.
Citacions: 18

SANIGA, Miroslav. Nest loss and chick mortality in capercaillie (Tetrao urogallus) and hazel grouse (Bonasa bonasia) in West Carpathians. In *Folia zoologica : international journal of vertebrate zoology*, 2002, vol. 51, no. 3, p. 205-214. ISSN 0139-7893.
Citacions: 18

VALERA, Francisco - HOI, Herbert - KRIŠTÍN, Anton. Male shrikes punish unfaithful females. In *Behavioral Ecology*, 2003, vol. 14, no. 3, p. 403-408. ISSN 1045-2249.
Citacions: 18

KAPPES, Heike - JABIN, Marc - KULFAN, Ján - ZACH, Peter - TOPP, Werner. Spatial patterns of litter-dwelling taxa in relation to the amounts of coarse woody debris in European temperate deciduous forests. In *Forest Ecology and Management*, 2009, vol. 257, no. 4, p. 1255-1260. ISSN 0378-1127.
Citacions: 17

DITMAROVÁ, Ľubica - KURJAK, Daniel - PALMROTH, Sari - KMEŤ, Jaroslav - STŘELCOVÁ, Katarína. Physiological responses of Norway spruce (Picea abies) seedlings to drought stress. In *Tree physiology*, 2010, vol. 30, no. 2, p. 205-213. ISSN 0829-318X.
Citacions: 15

2.2.3. List of most-cited authors from the Institute (at most 10 % of the research employees with university degree engaged in research projects) and their number of citations in the assessment period (2011– 2014).

Krištín Anton, RNDr, DrSc. – 410 citacions
Kulfan Ján, RNDr. CSc. – 225 citacions
Kaňuch Peter, Mgr. PhD. – 178 citacions
Zach Peter, Ing. CSc. – 149 citacions
Jakuš Rastislav, Ing. PhD. – 97 citacions

- **Supplementary information and/or comments on responses to the scientific output of the institute.**

We give attention to the following paper published in *Science*. Prof. Kluvánková-Oravská, a co-author of the publication, prepared the manuscript during the process of joining her department to the Institute of Forest Ecology.

BIERMANN, S. - ABBOTT, K. - ANDRESEN, S. - BÄCKSTRAND, K. - BERNSTEIN, S. - BETSILL, M.M. - BULKELEY, H. - CASHORE, B. - CLAPP, J. - FOLKE, C. - GUPTA, A. - GUPTA, J. - M. HAAS, P. - JORDAN, A. - KANIE, N. - KLUVÁNKOVÁ-ORAVSKÁ, T. - LEBEL, L. - LIVERMAN, D. - MEADOWCROFT, J. - B. MITCHELL, R.B. - NEWELL, P. - OBERTHÜR, S. - OLSSON, L. - PATTBERG, P. - SÁNCHEZ-ODRÍGUEZ, R. - SCHROEDER, H. - UNDERDAL, A. - CAMARGO VIEIRA, S. - VOGEL, C. - R. YOUNG, O.R. - BROCK, A. - ZONDERVAN, R. Navigating the Anthropocene: improving earth system governance. In *Science*, Vol. 335, Issue 6074, p. 1306-1307.
203 citacions

2.3. Research status of the institute in international and national contexts

- **International/European position of the institute**

2.3.1. List of the most important research activities demonstrating the international relevance of the research performed by the institute, incl. major projects (details of projects should be supplied under Indicator 2.4). Max. 10 items.

During the assessment period the researchers from the institute were involved in:

1 7FP project
ECOFINDERS – *Ecological Function and Biodiversity Indicators in European Soils* – 7FP Project, no. 264465, start date : 01/2011, end date: 12/2014. WP 5 Leader: T. Kluvánková. Other collaborators from SEA IFE SAS – V. Gežík, P.Baus, U. Kováč, E. Streberová, S. Brnkaľáková, Scientific Coordinator: Institut National de la Recherche Agronomique (INRA), France

2 H2020 projects
INSPIRATION – *Integrated Spatial Planning, Lan Use and Soil Management Research Action*, H2020, no.642372, start date: 04/2015, end date: 02/2018, WP Leader: T. Kluvánková, Other collaborators from IFE SAS: S. Brnkaľáková, I. Štecová , Scientific Coordinator: Umweltbundesamt (UBA) Germany
eLTER – *European Long-Term Ecosystem and socio-ecological Research Infrastructure*, H2020, no. 654359, start date: 06/2015 , end date: 05/2019 , Collaborator from IFE SAS: M. Barna, Scientific Coordinator: Umweltbundesamt (UBA) Germany

14 COST projects
See Table 2.4.1

Field experimets running in abroad (e.g. Germany, Austria, Russia, Sweden, Great Britain)

Organization of international conference on the occasion of 100 years of famous Slovak ecologist Dr František J Turček

2.3.2. List of international conferences (co)organised by the institute.

Dendrological days in Mlyňany arboretum SAV 2012, 18.09.-19.09.2012

ECOSYSTEM SERVICES: ADAPTIVE EU POLICIES FOR FUTURE EU REGIONS, Slovak University of Technology, Vazovova 5, Bratislava, 30.09.-01.10.2013

Special session: Institutions and Policies for Ecosystem Services in Europe na konferencii 'Wellbeing and Equity within planetary boundaries', Reykjavík, Island, 13.08.-15.08.2014

Influence of abiotic and biotic stresses on properties of plants 2014, Zvolen, Slovensko, 10.09.-11.09.2014

Special session: Ecosystems Services as Commons? 2014 3rd European IASC Meeting, From generation to generation: the use of commons in a changing society, Umea, Švédsko, 16.09.-19.09.2014

Dendrological days in Mlyňany arboretum SAV 2014, 18.09.2014

The 2015 AESOP PhD workshop: „Fuzzy Responsibility - Multi-actors Decision Making under Uncertainty and Global Changes", Stará Lesná, 06.07.-11.07.2015

Influence of abiotic and biotic stresses on properties of plants 2015, Praha, 16.09.-17.09.2015

Conference 100 years of F. J. Turček, Zvolen, 11.12.-12.12.2015

2.3.3. List of edited proceedings from international scientific conferences.

Proceedings of the second European congress on chestnut: Debrecen, Hungary, Baia Mare, Romania, Modry Kamen, Slovakia, October 9-12, 2013. Editor L. Radócz, M. Botu, M. Bolvanský. Leuven, Belgium : ISHS, 2014. 224 p. Acta Horticulturae ; no. 1043. ISBN 978 94 6261 032 3. ISSN 0567-7572.7

A tribute to FJT - A collection of papers honouring Dr František J. Turček. Editor P. Kaňuch, A. Krištín, Folia Oecologica, Vol. 43, Special Issue (in press).

2.3.4. List of journals edited/published by the institute:

2.3.4.1. WOS (IF of journals in each year of the assessment period)

N/A

2.3.4.2. SCOPUS

Folia Oecologica (ISSN 1336-5266)

2.3.4.3. other databases

Tichodroma (ISSN 1337-026X)

2.3.4.4. not included in databases

N/A

- **National position of the institute**

2.3.5. List of selected projects of national importance

Adaptive and non-adaptive changes of phenotype traits evolving in isolated populations (APVV-0497-10)

Influence of water decit on the physiological and growth processes of spruce and beech provenances (APVV-0436-10)

The study of bark beetle infestation spreading mechanism in spruce forests (APVV-0297-12)

Adaptive genetic potential of forest tree populations in the context of climate changes (APVV-0135-12)

Climate change and prospects of introduced taxons of East-Asian dendroflora in Arboretum Mlynany SAS (2/0085/09)

Influence of ecological factors and anthropic load on succession, diversity, phytoparameters and development of forest ecosystems (2/0034/10)

Management-related biodiversity changes in forest ecosystems (1/0362/13)

Responses of animals to changing forest structure (2/0035/13)

Stress state identification in forest woody plants by a comprehensive eco-physiological approach (2/0034/14)

Endophytic microorganisms in trees and their potential role in stress tolerance enhancement (2/0025/15)

Study of the effect of environmental variables on the incidence and spread of chestnut blight in European chestnut (Castane sativa) in Slovakia and possibilities to control this disease (2/0143/15)

2.3.6. Projects of the Slovak Research and Development Agency (APVV)

Ecophysiological and spatial aspects of the impact of the drought on forests in climate change conditions (APVV-0111-10)

Influence of water decit on the physiological and growth processes of spruce and beech provenances (APVV-0436-10)

The analysis of natural risk concerning the evolution of landscape ecosystems under the conditions of climate change (APVV-0423-10)

Adaptive and non-adaptive changes of phenotype traits evolving in isolated populations (APVV-0497-10)

The study of bark beetle infestation spreading mechanism in spruce forests (APVV-0297-12)

Adaptive genetic potential of forest tree populations in the context of climate changes (APVV-0135-12)

Nutrient-energy cycles as disturbance indicators of terrestrial ecosystems (APVV-0480-12)

Complex utilization of bark extractives (APVV-14-0393)

Information and warning system for invasive organisms in forest and urban environments (APVV-14-567)

2.3.7. Projects of the Scientific Grant Agency of the Slovak Academy of Sciences and the Ministry of Education (VEGA)

Interactions between forest trees and bark beetles (Col. Scolytinae) (2/0194/12)

Social behaviour and relations of tree-dwelling bats (2/0102/13)

Responses of animals to changing forest structure (2/0035/13)

Hybrid swarms of Scots pine and mountain dwarf pine in Slovakia, genetical status and fertility (2/0057/13)

Stress state identification in forest woody plants by a comprehensive eco-physiological approach (2/0034/14)

Environmental risks of rhododendron cultivation in Mlyňany Arboretum SAS (2/0183/14)

Adaptation strategies to natural and social disturbancies in the forest landscape (2/0038/14)

The dynamics of health status, mycoflora and selected dendrometrical and ecophysiological characteristics of beech ecosystems (2/0039/14)

Species diversity and biological characteristics of parasitic fungi associated with damage and withering of woody plants (2/0071/14)

Evolutionary ecology of nuptial gift-giving invertebrates: effects of distributional area, environment, phenotype and genetics (2/0061/15)

2.3.8. Projects of SAS Centres of Excellence

N/A

2.3.9. National projects supported by EU Structural Funds

Centre of excellence of biological forest protection methods (ITMS 26220120008)

Forecasting-information system for increase the efficiency of forest management (ITMS 26220220109)

Dynamic diagnostic and prognostic system of forest ecosystems state (ITMS 26210120015)

Centre of Excellence: Adaptive Forest Ecosystems (ITMS 26220120006)

Completion of the Centre of Excellence: Adaptive Forest Ecosystems (ITMS 26220120049)

2.3.10. List of journals (published only in the Slovak language) edited/published by the institute:

2.3.10.1. WOS (IF of journals in each year of the assessment period)

N/A

2.3.10.2. SCOPUS

N/A

2.3.10.3. Other databases

N/A

2.3.10.4. Not included in databases

N/A

- **Position of individual researchers in an international context**

2.3.11. List of invited/keynote presentations at international conferences, as documented by programme or invitation letter

JAKUŠ Rastislav: Koncepcia diferencovaného aktívneho managementu chránených území = The concept of the differentiated active management of protected areas. In: Lesník 21. století. Kašperské Hory, 29.3.2012, Czech Republic. Oral presentation

KUKLA Ján, KUKLOVÁ Margita: Akumulácia, distribúcia a transformácia bioenergy = Accumulation, distribution and transformation of bioenergy. In: 34. International Czech and Slovak calorimetric workshop. Hotel Svornost, Harrachov, 28.5. – 1.6.2012, Czech Republic. Oral presentation

SANIGA Miroslav: Zachráňme hlucháňa hôrneho – odveký vtáčí symbol pralesovitých lesných katedrál = Save the Western capercaillie – ancient bird symbol of primeval forest cathedrals. In: (International scientific conference „Capercaillie-friendly forest management“, 1.-2.3.2012, Rajecké Teplice. Oral presentation

SANIGA Miroslav: Quo vadis, hlucháň hôrny (Tetrao urogallus), v lesoch Slovenska? = Quo vadis, Western capercaillie (Tetrao urogallus), in forests of Slovakia? In: International scientific conference „Capercaillie-friendly forest management“, 1.-2.3.2012, Rajecké Teplice. Oral presentation

ZACH Peter, KULFAN Ján: Moths and bark beetles after excessive wind disturbance in Tatra Mountains. In: The role of insects in functioning of forest ecosystems. International scientific conference, 13.-14.9.2012, Kraków, Poland. Oral presentation

OSZLANYI Július, BUBLINEC Eduard, BARNA Milan: The Energy Distribution and Accumulation in Beech Ecosystems. In: Swiss Federal Research Institute WSL, 2013: International Conference Primeval Beech Forests Reference Systems for the Management and Conservation of Biodiversity, Forest Resources and Ecosystem Services. 2.-9.6.2013, Lviv, Ukraina. Abstracts. Birmensdorf, Swiss Federal Institute for Forest, Snow and Landscape Research WSL. Oral presentation

JUHÁSOVÁ Gabriela, KOBZA Marek: Ošetrenie stromov na Slovensku - platné právne normy = Treatment of trees in Slovakia - effective legal standards. In: Rights of trees and methods of their valuation. Association of Hungarian Arborists, Budapest, Hungary. Oral presentation

KRIŠTÍN Anton: Food and foraging of insectivorous birds: theories, methods and applications. In: Invited Plenary lecture at the 9th Congress of European Ornithologist Union, 27.-31.8.2013, Norwich, Great Britain. Oral presentation

KRIŠTÍN Anton: Diet and foraging behaviour of insectivorous birds: theories and applications. In: Invited Plenary lecture at the 40. Conference of Czech and Slovak ethological Society, 14.-17.11. 2013, Košice. Oral presentation

KUKLA Ján, KUKLOVÁ Margita: Pôsobenie abiotických stresorov na rastliny a ekosystémy = Effect of abiotic stressors on plants and ecosystems. In: Influence of abiotic and biotic stresses on properties of plants 2013. Czech University of Life Sciences Prague, Plant Crop Research Institute, v.v.i. 13.-14.2. 2013 Prague-Ruzyne, Czech Republic. Oral presentation.

BLAŽENEC M. Aktuálne problémy zdravotného stavu lesa v nadväznosti na vybrané stresové vplyvy = Current problems of forest health status following selected stress impacts In: Influence of abiotic and biotic stresses on properties of plants 2014. ÚEL SAV Zvolen, 10. – 11. 9. 2014. Oral presentation

KLUVÁNKOVÁ-ORAVSKÁ T.: Zkušenosti s ekosystémovým učetnictvím na Slovensku Experience with ecosystem accounting in Slovakia. In: Professional training workshop – Current approaches to modelling and accounting of ecosystem services, land use and biodiversity, 14. 10. 2014, Prague, Czech Republic, (organiser: Commission for environment, Academy of Sciences of the Czech Republic), Oral presentation

KLUVÁNKOVÁ-ORAVSKÁ T.: Ecosystem Service Governance: Behavioural Change to Sustainability, in section 2 Governance of Ecosystem Services, Česko-islandský Workshop, 20. - 21. 10. 2014, Praha, Česká republika, prednáška

KLUVÁNKOVÁ-ORAVSKÁ T., GEŽÍK V., BRNKAĽÁKOVÁ S., MACO M.: Experimenting with the governance of the commons: Implications of payments of ecosystem services. In: ESA European meeting, 3. - 6. 9. 2014, Prague, Czech Republic, (organiser: Labolatory of Experimental Economy LEE), Oral presentation

MACO M., KLUVÁNKOVÁ-ORAVSKÁ T.: Urban Gardening as Producer of Ecosystem Services (Cultural Services and Microclimate Regulation), in section Urban Ecosystem Services, Czech-Iceland Workshop, 20. - 21. 10. 2014, Prague, Czech Republic, Oral presentation

STREBEROVÁ E.: Experimental Role board game Pollination, in section 2 Governance of Ecosystem Services, Czech-Iceland Workshop, 20. - 21. 10. 2014, Prague, Czech Republic, Oral presentation

ŠIMÚTH Jozef, BÍLIKOVÁ Katarína, GÁL L., KRAKOVÁ T., YAMAGUCHI Yoshi: Proteomics of Royal Jelly proteins – from empiricism to scientific applications of beech products in apitherapy. In: First Congress, Expo and Workshops of the International Federation of Apitherapy, Brasov, Romania

BOLVANSKÝ M.: Vplyv teplotných a zrážkových extrémov na vznik a šírenie chorôb pri vybraných druhoch lesných drevín = Impact of temperature and precipitation extremes on the occurrence and the spread of diseases in selected forest tree species. In: The influence of abiotic and biotic stressors on plant qualities, 16.-17.9.2015, Proceedings of peer-reviewed scientific papers, Prague: Czech University of Life Sciences Prague, Czech Republic, Oral presentation

BUBLINEC E.: Quantification of some components geobiochemical elements cycles in forest ecosystems. In: Cycles of bioelements in forest ecosystems. International scientific conference, LDF Mendel University in Brno, Czech Republic, Oral presentation

KLUVÁNKOVÁ T.: Climate change challenges: from risk management to opportunity seizing? In: Global Change: A Complex Challenge, 22.-24.3.2015, Brno, Czech Republic, Oral presentation

MAREK M.V., KLUVÁNKOVÁ T., BRNKAĽÁKOVÁ S.: Carbon forestry wellbeing of mountain regions? In: Fuzzy Responsibility - Multi-actors Decision Making under Uncertainty and Global Changes. The 2015 AESOP PhD Workshop, 6.-11.7.2015, Stará Lesná, Vysoké Tatry, Oral presentation

MACO M., KLUVÁNKOVÁ T., FINKA M.: Experimenting with Commons: Management of Semi-Public Urban Spaces. Designing CPR Regimes for Urban Microclimate Regulation. In: Fuzzy Responsibility - Multi-actors Decision Making under Uncertainty and Global Changes. The 2015 AESOP PhD Workshop, 6.-11.7.2015, Stará Lesná, Vysoké Tatry, Oral presentation

SANIGA M.: Causes of the population decline in Capercaillie (Tetrao urogallus) in the West Carpathians. In: IX International Symposium on Wild Fauna, 15.-19.9.2015, Košice, Oral presentation

STREBEROVÁ E., MACO, M.: Green infrastructure and urban climate regulation. In: Fuzzy Responsibility - Multi-actors Decision Making under Uncertainty and Global Changes. The 2015 AESOP PhD Workshop, 6.-11.7.2015, Stará Lesná, Vysoké Tatry, Oral presentation

2.3.12. List of researchers who served as members of the organising and/or programme committees

RNDr. Ľubica Ditmarová, PhD.
Mgr. Peter Kaňuch, PhD.
RNDr. Anton Krištín, DrSc.
Ing. Ján Kukla, CSc.
Ing. Margite Kuklová, CSc.

- **Position of individual researchers in a national context**

2.3.13. List of invited/keynote presentations at national conferences, as documented by programme or invitation letter

JUHÁSOVÁ Gabriela, ONDRUŠKOVÁ Emília, ADAMČÍKOVÁ Katarína, KOBZA Marek, JUHÁS Dušan, KÁDASI HORÁKOVÁ Miriam: Choroby a škodcovia sadovnícky významných drevín = Diseases and pests of major landscaping tree species. In: Professional workshop. Plantago spol. s.r.o. člen skupiny zares. 29.3.2012, Veľký Biel. Oral presentation

KAŇUCH Peter: Tok génov a adaptácia v prostredí (príklady z Orthoptera) = Gene flow and adaptation to environment (examples from Orthoptera). In: Molecular methods in animal ecology. 20.6.2012, workshop, Prešov University, Prešov. Oral presentation

KRIŠTÍN Anton: Koevolúcia pôvodnej a nepôvodnej flóry a fauny v Makaronézii = Co-evolution of native and non-native flora and fauna in Macaronesia. In: Slovak national museum – Museum of Andrej Kmeť Martin, 30.11.2012. Oral presentation

KLUVÁNKOVÁ T. a kolektív SEA (organizátor): RegPol² Introductory Event “Basic Understanding on core-periphery relations in Central and Eastern Europe: Implications for research and methodology” STU in Bratislava, 3. – 7. 11. 2014, Bratislava, Slovakia.

SHIOYA M.: Adaptive Management to Enhance Resilience in Sustainable Land Use, In: spa-ce.net in 11th Network Conference on Empirical Evidence of Urban Resilience in Central, Eastern and South-Eastern Europe, 18. - 19. 9. 2014, Bratislava, Slovakia, Oral presentation

BUBLINEC E.: Zodpovedné pôdohospodárstvo v kontexte klimatických zmien a erózie pôdy = Reliable Responsible agriculture in the context of climate change and soil erosion. In: Land as a gift of God and its responsible use in the world today. Scientific conference organised by the Environmental Commission of KBS and Byzantine Catholic Archeparchy of Prešov, Oral Presentation

2.3.14. List of researchers who served as members of organising and programme committees of national conferences

Mgr. Katarína Adamčíková, PhD.
Ing. Marek Barta, PhD.
Ing. Peter Ferus, PhD.
Doc. Ing. Gabriela Juhásová, CSc.
Mgr. Peter Kaňuch, PhD.
Mgr. Marek Kobza, PhD.

Ing. Jana Konôpková, PhD.
RNDr. Anton Krištín, DrSc.
Ing. Ján Kukla, CSc.
Ing. Margite Kuklová, CSc.
RNDr. Ján Kulfan, CSc.
Ing. Jozef Váľka, CSc.
Ing. Peter Zach, CSc.

- **Supplementary information and/or comments documenting the international and national status of the Institute**

N/A

2.4. Tables of project structure, research grants and other funding resources

- **International projects and funding**

2.4.1. Major projects within the European Research Area and other important project – Framework Programmes of the EU, ERA-NET, European Science Foundation, NATO, COST, INTAS, etc. (here and in items below please specify: type of project, title, grant number, duration, total funding and funding for the institute, responsible person in the institute and his/her status in the project, e.g. coordinator "C", work package leader "W", investigator "I"),

	Project title	Typ / Project number	Duration in months	Funding for the Institute (EUR)	Role of the Institute / Responsible person
2012	Climate Change and Forest Mitigation and Adaptation in a Polluted Environment	COST / FP0903	09/2009 – 05/2013	4 000	I / Miroslav Blaženec
	Forest LAnd Ownership Changes in Europe: Significance for Management And Policy	COST / FP1201	11/2012 – 11/2016	0	I / Tatiana Kluvánková-Oravská
	Endophytes in Biotechnology and Agriculture	COST / FA1103	04/2012 – 12/2015	3 000	I / Marek Barta
	Ecological Funkcion and Biodiversity Indicators in European Soils	7FP / 264465	01/2011 – 12/2014	2 071	I / Tatiana Kluvánková-Oravská
2013	Fraxinus dieback in Europe: elaborating guidelines and strategies for sustainable management	COST / FP1103	04/2012 – 04/2016	5 000	I / Katarína Adamčíková
	Determining invasiveness and risk of Dothistroma	COST / FP1102	12/2011 – 12/2015	4 000	I / Katarína Adamčíková
	Climate Change and Forest Mitigation and Adaptation in a Polluted Environment	COST / FP0903	09/2009 - 05/2013	1 500	I / Miroslav Blaženec
	Studying Tree Responses to Extreme Events: a Synthesis	COST / FP1106	04/2012 – 04/2016	0	I / Ľubica Ditmarová
	Tourism, Wellbeing and Ecosystem Services	COST / IS1204	09/2012 – 08/2016	4 500	I / Veronika Gežik
	Forest LAnd Ownership Changes in Europe: Significance for Management And Policy	COST / FP1201	11/2012 – 11/2016	4 667	I / Tatiana Kluvánková-Oravská
	Enhancing the resilience capacity of SENSitive mountain FORest ecosystems under environmental change	COST / ES1203	07/2013 – 06/2016	1 665	I / Jozef Váľka
	European Information System for Alien Species	COST / TD1209	05/2013 – 05/2017	2 667	I / Peter Zach
	Endophytes in Biotechnology and Agriculture	COST / FA1103	04/2012 – 12/2015	4 000	I / Marek Barta

	Ecological Funkcion and Biodiversity Indicators in European Soils	7FP / 264465	01/2011 – 12/2014	16 554	I / Tatiana Kluvánková-Oravská
2014	Fraxinus dieback in Europe: elaborating guidelines and strategies for sustainable management	COST / FP1103	04/2012 – 04/2016	4 000	I / Katarína Adamčíková
	Determining invasiveness and risk of Dothistroma	COST / FP1102	12/2011 – 12/2015	4 000	I / Katarína Adamčíková
	Endophytes in Biotechnology and Agriculture	COST / FA1103	04/2012 – 12/2015	3 478	I / Marek Barta
	Studying Tree Responses to Extreme Events: a Synthesis	COST / FP1106	04/2012 – 04/2016	4 000	I / Ľubica Ditmarová
	European Information System for Alien Species	COST / TD1209	05/2013 – 05/2017	6 806	I / Peter Zach, Peter Ferus
	Tourism, Wellbeing and Ecosystem Services	COST / IS1204	09/2012 – 08/2016	4 000	I / Veronika Gežik
	Innovations in Climate Governance: Sources, Patterns and Effects	COST / IS1309	06/2014 – 06/2018	4 369	I / Tatiana Kluvánková-Oravská
	Forest LAnd Ownership Changes in Europe: Significance for Management And Policy	COST / FP1201	11/2012 – 11/2016	4 000	I / Tatiana Kluvánková-Oravská
	Enhancing the resilience capacity of SENSitive mountain FORest ecosystems under environmental change	COST / ES1203	07/2013 – 06/2016	4 000	I / Jozef Váľka
	NETWORK FOR SUSTAINABLE ULTRASCALE COMPUTING (NESUS)	COST / ICT1309	11/2013 – 11/2017	3 333	I / Urban Kováč
	Ecological Funkcion and Biodiversity Indicators in European Soils	7FP / 264465	01/2011 – 12/2014	44 095	I / Tatiana Kluvánková-Oravská
2015	Pine pitch canker - strategies for management of Gibberella circinata in greenhouses and forests	COST / FP1406	05/2015 – 05/2019	2 667	I / Katarína Adamčíková
	Fraxinus dieback in Europe: elaborating guidelines and strategies for sustainable management	COST / FP1103	04/2012 – 04/2016	4 000	I / Katarína Adamčíková
	Determining invasiveness and risk of Dothistroma	COST / FP1102	12/2011 – 12/2015	4 000	I / Katarína Adamčíková
	A global network of nurseries as early warning system against alien tree pests (Global Warning)	COST / FP1401	06/2015 – 12/2018	2 333	I / Marek Barta
	Endophytes in Biotechnology and Agriculture	COST / FA1103	04/2012 – 12/2015	4 000	I / Marek Barta
	Studying Tree Responses to Extreme Events: a Synthesis	COST / FP1106	04/2012 – 04/2016	4 000	I / Ľubica Ditmarová
	European Information System for Alien Species	COST / TD1209	05/2013 – 05/2017	8 000	I / Peter Zach, Peter Ferus
	Tourism, Wellbeing and Ecosystem Services	COST / IS1204	09/2012 – 08/2016	4 000	I / Veronika Gežik
	Innovations in Climate Governance: Sources, Patterns and Effects	COST / IS1309	06/2014 – 06/2018	4 000	I / Tatiana Kluvánková-Oravská
	Forest LAnd Ownership Changes in Europe: Significance for Management And Policy	COST / FP1201	11/2012 – 11/2016	4 000	I / Tatiana Kluvánková-Oravská
	NETWORK FOR SUSTAINABLE ULTRASCALE COMPUTING (NESUS)	COST / ICT1309	11/2013 – 11/2017	3 333	I / Urban Kováč
	Enhancing the resilience capacity of SENSitive mountain FORest ecosystems under environmental change	COST / ES1203	07/2013 – 06/2016	4 000	I / Jozef Váľka
	European Long-Term Ecosystem and socio-ecological Research Infrastructure	H2020 / 654359	06/2015 – 06/2019	0	I / Milan Barna
	Integrated Spatial Planning, land use and soil management Research Action	H2020 / 642372	04/2015 – 02/2018	2 667	I / Tatiana Kluvánková-Oravská

2.4.2. Other international projects, incl. total funding and funding for the institute

Common natural treasure: European chestnut (HUSK/2.2.1/0230) (project duration 10/2012 – 01/2015)

Methods for analysis of immunity of honeybee colony using hemolymph markers - HematoBeeTest Project, pilot project for an upcoming Horizon 2020 (project duration 09/2013 – 08/2016)

Molecular and physiological properties of honeybee royal jelly proteins (funding for the institute 20 000 €) (project duration 04/2014 – 03/2017)

Dynamic modelling of risks of bark beetle outbreaks on landscape scale (2014-10-15-0004, funding for the institute 1 392 €) (project duration 01/2015 – 12/2015)

2.4.3. Other important, international projects and collaborations without direct funding (max. 10 projects)

Comparative phylogeny and phylogeography of five widespread bird species: implications for shared and vicariant genetic structures in Eurasia (NSFC 421-10)

Study of semiochemical-based technology to control aggressive spruce bark beetles in province Qinghai – China

Production, energy accumulation and physiological characteristics of selected herb species in relation to ecology of beech phytocoenoses (SK-CZ-0213-11)

The assessment of risk of the health status, structure and necrotisation in beech dendrocoenoses depending on changing anthropogenic conditions in Central ans South-Eastern Europe (B1)

Communities of ladybird beetles in changing climate and introduction of a new species Harmonia axyridis (SK-CZ-0200-11)

Regulation of invasivetree-of-heaven (Ailanthus altissima) by its native pests Eucryptorrhynus brandti and E. chinensis in the Middle Europe

What does change when plants become invasive? Differences in reproduction biology and stress tolerance of Slovak and Argentinian honey locust (Gleditsia triacanthos L.) populations (PPP SAS-CONICET Argentina)

Altitudinal changes in ladybird communities (SK-CZ-2013-0155)

Structure, health status and regeneration capability of dendrocoenoses destructed by wind invasion in Rila - Rodopi massif, Vitosha Mt and Low and High Tatras Mts.

Alien plants: population dynamics and risk of new species introduction (SK-RO-0013-10)

- **National projects and their funding**

2.4.4. Projects supported by the Slovak Research and Development Agency (APVV)

Role of the Institute e.g. coordinator “C”, investigator “I”.

	Project title	Typ / Project number	Duration in months	Funding for the Institute (EUR)	Role of the Institute / Responsible person
2012	Ecophysiological and spatial aspects of the impact of the drought on forests in climate change conditions	research project / APVV-0111-10	05/2011 – 10/2014	7 854	I / Miroslav Blaženec
	Influence of water decit on the physiological and growth processes of spruce and beech provenances	research project / APVV-0436-10	05/2011 – 10/2014	39 940	C / Ľubica Ditmarová
	The analysis of natural risk concerning the evolution of landscape ecosystems under the conditions of climate change	research project / APVV-0423-10	05/2011 – 10/2014	12 313	I / Rastislav Jakuš
	Adaptive and non-adaptive changes of phenotype traits evolving in isolated populations	research project / APVV-0497-10	05/2011 – 10/2014	8 500	C / Peter Kaňuch
2013	Ecophysiological and spatial aspects of the impact of the drought on forests in climate change conditions	research project / APVV-0111-10	05/2011 – 10/2014	6 700	I / Miroslav Blaženec
	The study of bark beetle infestation spreading mechanism in spruce forests	research project / APVV-0297-12	10/2013 – 09/2017	7 394	C / Miroslav Blaženec
	Influence of water decit on the physiological and growth processes of spruce and beech provenances	research project / APVV-0436-10	05/2011 – 10/2014	40 315	C / Ľubica Ditmarová
	Adaptive genetic potential of forest tree populations in the context of climate changes	research project / APVV-0135-12	10/2013 – 09/2017	302	I / Ľubica Ditmarová
	Nutrient-energy cycles as disturbance indicators of terrestrial ecosystems	research project / APVV-0480-12	10/2013 – 09/2017	538	I / Ľubica Ditmarová
	The analysis of natural risk concerning the evolution of landscape ecosystems under the conditions of climate change	research project / APVV-0423-10	05/2011 – 10/2014	9 188	I / Rastislav Jakuš
	Adaptive and non-adaptive changes of phenotype traits evolving in isolated populations	research project / APVV-0497-10	05/2011 – 10/2014	7 500	C / Peter Kaňuch
2014	Ecophysiological and spatial aspects of the impact of the drought on forests in climate change conditions	research project / APVV-0111-10	05/2011 – 10/2014	4 623	I / Miroslav Blaženec
	The study of bark beetle infestation spreading mechanism in spruce forests	research project / APVV-0297-12	10/2013 – 09/2017	61 584	C / Miroslav Blaženec
	Influence of water decit on the physiological and growth processes of spruce and beech provenances	research project / APVV-0436-10	05/2011 – 10/2014	31 445	C / Ľubica Ditmarová
	Adaptive genetic potential of forest tree populations in the context of climate changes	research project / APVV-0135-12	10/2013 – 09/2017	11 016	I / Ľubica Ditmarová
	Nutrient-energy cycles as disturbance indicators of terrestrial ecosystems	research project / APVV-0480-12	10/2013 – 09/2017	6 522	I / Ľubica Ditmarová
	The analysis of natural risk concerning the evolution of landscape ecosystems under the conditions of climate change	research project / APVV-0423-10	05/2011 – 10/2014	6 331	I / Rastislav Jakuš

	Adaptive and non-adaptive changes of phenotype traits evolving in isolated populations	research project / APVV-0497-10	05/2011 – 10/2014	1 875	C / Peter Kaňuch
2015	The study of bark beetle infestation spreading mechanism in spruce forests	research project / APVV-0297-12	10/2013 – 09/2017	65 091	C / Miroslav Blaženec
	Adaptive genetic potential of forest tree populations in the context of climate changes	research project / APVV-0135-12	10/2013 – 09/2017	23 959	I / Ľubica Ditmarová
	Nutrient-energy cycles as disturbance indicators of terrestrial ecosystems	research project / APVV-0480-12	10/2013 – 09/2017	14 322	I / Ľubica Ditmarová
	Complex utilization of bark extractives	research project / APVV-14-0393	07/2015 – 06/2019	2 872	I / Jozef Váľka
	Information and warning system for invasive organisms in forest and urban environments	research project / APVV-14-0567	07/2015 – 06/2019	10344	I / Peter Zach

2.4.5. Projects supported by the Scientific Grant Agency of the Slovak Academy of Sciences and the Ministry of Education (VEGA) for each year, and their funding

VEGA	2012	2013	2014	2015
Number	14	19	20	19
Funding in the year (EUR)	108 462	129 746	110 043	134 899

[1]

- **Summary of funding from external resources**

2.4.6. List of projects supported by EU Structural Funds

Centre of excellence of biological forest protection methods (ITMS 26220120008)

Forecasting-information system for increase the efficiency of forest management (ITMS 26220220109)

Dynamic diagnostic and prognostic system of forest ecosystems state (ITMS 26210120015)

Centre of Excellence: Adaptive Forest Ecosystems (ITMS 26220120006)

Completion of the Centre of Excellence: Adaptive Forest Ecosystems (ITMS 26220120049)

[1] Excluding projects for the popularisation of science

2.4.7. Summary of external resources of the EU Structural Funds (ERDF/ESF)

Role of the Institute in the project, e.g. coordinator “C”, work package leader “W”, investigator “I”.

Year	Project title	Project number	Duration in months	Funding for the Institute (EUR)	Role of the Institute
2012	Centre of excellence of biological forest protection methods	ITMS 26220120008	07/2009 - 05/2012	33 088	W, I
	Forecasting-information system for increase the efficiency of forest management	ITMS 26220220109	02/2011 - 06/2015	222 488	C
	Dynamic diagnostic and prognostic system of forest ecosystems state	ITMS 26210120015	11/2012 - 10/2015	0	C
	Centre of Excellence: Adaptive Forest Ecosystems	ITMS 26220120006	07/2009 - 05/2012	17055	I
	Completion of the Centre of Excellence: Adaptive Forest Ecosystems	ITMS 26220120049	06/2010 - 04/2013	0	I
2013	Forecasting-information system for increase the efficiency of forest management	ITMS 26220220109	02/2011 - 06/2015	222 488	C
	Dynamic diagnostic and prognostic system of forest ecosystems state	ITMS 26210120015	11/2012 - 10/2015	0	C
	Completion of the Centre of Excellence: Adaptive Forest Ecosystems	ITMS 26220120049	06/2010 - 04/2013	0	I
2014	Forecasting-information system for increase the efficiency of forest management	ITMS 26220220109	02/2011 - 06/2015	66 041	C
	Dynamic diagnostic and prognostic system of forest ecosystems state	ITMS 26210120015	11/2012 - 10/2015	0	C
2015	Forecasting-information system for increase the efficiency of forest management	ITMS 26220220109	02/2011 - 06/2015	79 443	C
	Dynamic diagnostic and prognostic system of forest ecosystems state	ITMS 26210120015	11/2012 - 10/2015	2 577 120	C

External resources	2012	2013	2014	2015	total	average
External resources (milions of EUR)	0,273	0,222	0,066	2,657	**3,217**	**0,804**
External resources transfered to coooperating research institute (milions of EUR)	0,000	0,000	0,000	0,000	**0,000**	**0,000**

- **Supplementary information and/or comments on research projects and funding sources**

2.5. PhD studies and educational activities

2.5.1. List of accredited programmes of doctoral studies, period of validity

Ecology and biodiversity conservation, General ecology and Ecology of individuals and populations (2011 – 2015)

2.5.2. Summary table on doctoral studies (number of internal/external PhD students; number of foreign PhD students, number of students who successfully completed their theses, number of PhD students who quit the programme*)*

PhD study	31.12.2012			31.12.2013			31.12.2014			31.12.2015		
Number of potential PhD supervisors												
PhD students	number	defended thesis	students quitted	number	defended thesis	students quitted	number	defended thesis	students quitted	number	defended thesis	students quitted
Internal	11,0	2,0	1,0	12,0	3,0	0,0	12,0	2,0	0,0	11,0	2,0	1,0
External	3,0	0,0	1,0	2,0	1,0	0,0	2,0	0,0	0,0	2,0	0,0	0,0
Other supervised by the research employees of the institute	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0

2.5.3. Summary table on educational activities

Teaching	2012	2013	2014	2015
Lectures (hours/year)[2]	168	133	82	118
Practicum courses (hours/year)[2]	162	356	287	169
Supervised bachelor theses (in total)	0	0	0	0
Supervised diploma theses (in total)	27	24	30	14
Supervised PhD theses (in total)	17	14	18	10
Members in PhD committees (in total)	7	7	8	9
Members in DrSc. committees (in total)	1	1	1	1
Members in university/faculty councils (in total)	4	4	4	4
Members in habilitation/inauguration committees (in total)	2	2	1	1

2

2.5.4. List of published university textbooks

N/A

2.5.5. Number of published academic course books

N/A

[2] Do not include time spent with bachelor, diploma or PhD students during their supervising

2.5.6. List of joint research laboratories/facilities with universities

Join research centre and common workplace Centre of Excellence SPECTRA of Institute of Forest Ecology SAS, Institute of Management, Slovak Technical University and Facutly of Management, Comenius University was created in 2013. CE SPECTRA together with the Centre for Trans-disciplinary Study of Institutions, Evolution and Policies (CETIP) have established the Virtual Laboratory of experimental social sciences (VEEL).

- **Supplementary information and/or comments on doctoral studies and educational activities**

The Institute encourages PhD-students get study and research stays abroad. PhD-students gain experience in writing project proposals to receive external finances and learn to work in leading international teams at foreign universities and institutions. In this way, they are actively involved in cooperation with foreign institutions. The most important stays abroad of our PhD-students are as follows:

Centre for Ecology & Hydrology (Wallingford/Oxford, Great Britain); 7 months (2014, 2015); topic: Environmental risk analysis of invasive insect species; PhD-student: Sandra Viglášová

The George Washington University and Smithsonian Institution, National Museum of Natural History, (Washington, USA); 6 months (2015); topic: Adaptation of insects to non-native plants; PhD-student: Michal Parák

University of Ljubljana (Ljubljana, Slovenia); 3 months (2015); topic: Relations between leaf phenology and phenology of cambial productivity; PhD-student: Martin Kubov

University of Oregon (Eugene, Oregon, USA); 14 months (2015, 2016); topic: Spatial simulation of European spruce bark beetle (Ips typographus L.) - host tree (Picea abies) interactions under impact of windthrow, using agent based modeling; PhD-student: Mária Havašová

Masaryk University (Brno, Czech Republic); 3 months (2013); topic: Spiders as potential pest control in winter periods; PhD-student: Ľudmila Černecká

2.6. Social impact

2.6.1. List of the most important results of applied research projects. Max. 10 items

1. Physiological activity of apalbumin1, the major royal jelly protein in honey
Determining honey authenticity based on the proteins secreted by bees when processing nectar to honey is a new approach to determine honey adulteration and evaluate honey quality as physiologically active food. We found that the most important physiologically active component of honey is the major protein of royal jelly - apalbumin1 that is also the main protein in honey and cannot be exchanged for other components or ingredients that may affect the method used for assessing the control of honey authenticity. In order to optimise the method we continued monitoring of albumin1 content in monofloral and polyfloral types of honey provided by the Slovak Beekeepers Association, in honey samples from the market as well as in honey from our foreign partners. The screenings enable providing also the whole information about the quality of Slovak honeys. The International Honey Commission also showed the interest to use our method for determining the honey authenticity and for improving the European standards for honey.
Project: Molecular and physiological properties of honeybee royal jelly proteins
Funding: Japan Rojal Jelly Co. Ltd.

2. Cultivation, protection, variability and utilisation of European chestnut
For the effective biocontrol of the chestnut blight hypovirulent isolates were prepared in the laboratory (conversion). The hypovirus was transferred into the virulent isolates obtained from

collected samples in laboratory conditions. For this conversion Hungarian hypovirulent strains were used. The presence of the hypovirus in Slovak isolates was confirmed using molecular methods. Finally the isolates, in which the presence of the hypovirus was confirmed, were used for the treatment of cankers in the field. A special electronic guidebook was prepared to provide the chestnut growers with the current knowledge about cultivation, breeding, propagation, protection and taking care about chestnut trees and orchards.
Project: Our common natural resource: the European chestnut
Funding: Ministry of Agriculture and Rural Development of the Slovak Republic

2.6.2. List of the most important studies commissioned for the decision-making authorities, the government and NGOs, international and foreign institutes

1. Mapping and assessment of Ecosystem Services in Slovakia
The Research team is contributing mainly to working groups on methodological approaches, mapping and assessment of cultural ecosystem services and payments for ecosystem services.
Contractual partner: Ministry of Environment of the Slovak Republic

2. Tree stability assessment
The tree stability assessment using acoustic tomography provides the real picture about the inner structure of a tree without its mechanical damage. The proposals including measures and recommendations to increase tree stability or tree removal in the case of safety risks are developed based on the results of tomographical evaluations. The owners of open public spaces, grammar schools, and especially municipalities expressed a special interest in this evaluation. The knowledge about the trees that threat the safety, health and properties of citizens is substantial for them.
Contractual partners: Local authorities, Municipalities

3. Biomonitoring of insect species of European importance
The occurrences and conservation status of selected species of beetles, bush-crickets and grasshoppers of European importance according to EU Habitat Directive were assessed in protected areas in Slovakia. Proposal of monitoring methods of these species and their habitats and populations were recommended.
Contractual partners: Daphne – Institute of Applied Ecology, State Nature Conservancy of the Slovak Republic

2.6.3. List of contracts and research projects with industrial and other commercial partners, incl. revenues

1. Molecular and physiological properties of honeybee royal jelly proteins
Commercial partner: Japan Rojal Jelly Co. Ltd., Tokyo
Revenue: N/A

2. Information and warning system for invasive organisms in forests and urban areas
Commercial partner: State Enterprise Forests of the Slovak Republic
Revenue: N/A

2.6.4. List of licences sold abroad and in Slovakia, incl. revenues

N/A

2.6.5. List of most important social discourses under the leadership or with significant participation of the institute (max. 10 items)

1. Activities in interactive lecture and workshop room “The Tree World” in Arboretum Mlyňany that offered new experiences with diverse plant materials (twigs, fruits and seeds), aesthetic feeling and environmental awareness of broad public and formed children creative abilities. The essential part of the public education in the arboretum is guided excursions. Around 40000 people visited Arboretum Mlyňany yearly and more than 3000 students from nature-oriented secondary school and universities (Slovak Agricultural University, University of Constantine the

Philosopher, Technical University of Zvolen) attended on social disclosures with practical lessons.
Date: mainly vegetation seasons

2. Professional course for European chestnut growers and skilled public organised under European Regional Development Fund, Cross-border Cooperation Programme
Date: May, July 2014

3. Visit of Mr. Yoshi Yamaguchi, president of Japan Royal Jelly Co. Ltd. and representatives of the Research Centre of JRJ, Co, Ltd. in Slovakia with attendance of representatives from Slovak Technical University, Faculty Chemical and Food Technology and the Slovak Beekeepers Association and Secondary Vocational School Banská Bystrica (study program beekeeper)
Date: September 2014

2.6.6. Summary of relevant activities, max. 300 words

The social impact activities of the Institute are focused mainly on (i) public education in the arboretum, (ii) ecosystem services and biodiversity conservation and (iii) assessment of tree health and security in urban greenery, public and private parks or gardens. The area of the arboretum represents – in respect of its woody plant collections and geomorphology – a unique place in the Central Europe. The contact with the park and the exciting work of numerous generations of gardeners and enthusiasts attract and inspire more and more visitors looking for peace and relax. At present, biological and environmentally friendly methods are getting to the forefront of plant protection. Besides the mechanical control, the biocontrol using a mycovirus against the chestnut blight disease in one of the most extensive European chestnut stands situated in Modrý Kameň, Slovakia represented very successful method in tree healing with direct economic impact. The research about ecosystem services contributed to the development of methodological approaches, mapping and assessment of cultural ecosystem services and payments for ecosystem services.

2.7. Popularisation of Science (outreach activities)

2.7.1. List of the most important popularisation activities, max. 20 items

Books and articles in press/internet

HAVAŠOVÁ, Mária. Making the invisible visible. Scientists and researchers have discovered their secrets (Deti videli neviditeľné. Vedci a výskumníci odhalili svoje tajomstvá). Daily newspaper entitled Plus jeden deň, Slovensko, 12. 11. 2014.

JAKUŠ, Rastislav. It was not possible to *avoid* having trees attacked by *bark beetles* (Lykožrútovej kalamite sa nedalo vyhnúť). Internet medium www.pravda.sk, 22. 10. 2012.

JUHÁSOVÁ, Gabriela. A little fly destroys chestnuts (Gaštany ničí malá muška). Daily newspaper entiled SME, 26. 5. 2012.

KRIŠTÍN, Anton. A Slovak scientist without completed secondary-school education has been cited by the world-known scientists. However, in our country, a lot of people do not know anything about him (Slováka bez škôl citujú svetoví vedci, u nás ho nepoznáme). Internet medium Denník N, https.dennikn.sk, 10. 12. 2015. (Note: The article about the first Slovak ecologist F. J. Turček was the most widely read article over 24 h period).

SANIGA, Miroslav. All „the top...“ on our birds (Všetko "naj" o našich vtákoch). Bratislava: Perfekt, 2015. 271 p. ISBN 978-80-8046-732-6.

SLIACKA, Anna – KULFAN, Ján. A butterfly voluntarily trapped under the snow (Motýľ spod snehu). Forester: the state enterprise Forests of the SR staff's' journal (Lesník: časopis zamestnancov š. p. Lesy SR), január 2015, p. 11.

Appearances in telecommunication media

Private television channel TV Markíza – programme Television news (Televízne noviny). Ladybird war (Vojna lienok), 26. 10. 2014. VIGLÁŠOVÁ, Sandra.

Public-service institution – radio station Rádio Regina Banská Bystrica – programme Quatrefoil (Štvorlístok). A scientist's year: what was the year 2014 for the ornithologist Anton Krištín? (Rok prírodovedca –- rok 2014 očami ornitológa Antona Krištína), 3. 1. 2015. KRIŠTÍN, Anton.

Public-service institution – radio station Rádio Slovensko – programme Night pyramid – night talkshow with interesting quests (Nočná pyramída), 27. 11. 2015. BÍLIKOVÁ, Katarína.

Public-service institution – radio station Rádio Slovensko. European *Chestnut's story*. Part 4 (Príbeh gaštana jedlého. 4. časť), 10. 10. 2013. ONDRUŠKOVÁ, Emília - JUHÁSOVÁ, Gabriela – KOBZA, Marek – BOLVANSKÝ, Milan.

Public-service institution – television station STV 1 – programme Television news (Správy RTVS). Arboretum Mlyňany opened its treasures to public view (Arborétum Mlyňany ukázalo svoje poklady), 10. 11. 2015. HOŤKA, Peter – KONÔPKOVÁ, Jana.

Public-service institution – television station STV 2 – programme Farmer Revue (Farmárska revue). How Slovak scientists became internationally famous in the field of apidiology: contribution on co-operation of Department of Molecular Apidiology of the Institute of Forest Ecology SAS, Faculty of Chemical and Food Technology of the Slovak University of Technology in Bratislava and Japan Royal Jelly Co., Tokyo (Ako slovenskí vedci zahviezdili na medzinárodnom včelárskom nebi, príspevok o spolupráci oddelenia molekulárnej apidológie, Ústavu ekológie lesa SAV, Zvolen, Fakulty chemickej a potravinárskej technológie Slovenskej technickej univerzity, Bratislava a Japan RoyalJellyCo., Tokyo), 29. 11. 2014. BÍLIKOVÁ, Katarína.

Public popularisation lectures

130 excursions along with lectures through the Mlyňany Arboretum, carried out in the year 2012. The activities were held annually. HOŤKA, Peter – HOLEČKOVÁ, Daniela – MAŇKA, Peter – BIBEŇ, Tomáš – SLÁDEČEKOVÁ, Katarína.

Guided excursion to the Low and High Tatra Mts for students and teachers of the secondary grammar school in Zvolen with the aim to present themes of the Institute's ecological research, as follows:
– Geological and soil conditions in the High Tatra Mts. Protected areas in Slovakia.
– Forest regeneration after the disturbance event. Influencing the life processes of plants based on edaphic factors.
– Heavy metal-induced stress in plants. Forest development in the High Tatra Mts after the disturbance event in November 2004.
25–26 June 2012. BARNA, Milan – KUKLA, Ján – KUKLOVÁ, Margita – KULFAN, Ján – SLÁDEKOVÁ, Katarína – VEĽKÝ, Marek.

How ornamental plants become dangerous. Lecture for grammar and vocational schools students during the event of „Week of Science and Technology in Slovakia" (WSTS). Mlyňany Arboretum SAS, 12. 11. 2013. FERUS, Peter.
Annually organized WSTS comprised a lot of lectures to the public, open days with presentation of scientific results included. They were presented by Institute's workers in Zvolen and Mlyňany.

Welcoming birds, messengers of spring. Lectures along with bird catching and measuring. Borová hora Arboretum, Zvolen. The event was repeated on a yearly basis in the period from 31 March to 1 April. In 2014, the organizers recorded 268 participants**.** JARČUŠKA, Benjamín – KAŇUCH, Peter – KRIŠTÍN, Anton – NAĎO, Ladislav – SANIGA, Miroslav.

Other activities popularizing nature and ecology

Organizing 11 science cafés and junior science cafés in the city of Zvolen and 32 lectures and excursions for secondary schools students during the year 2012. SLÁDEKOVÁ, Katarína. The activities continued each year.

Researcher‘s Night 2013. Bratislava. CHOBOTOVÁ, Veronika – KLUVÁNKOVÁ –ORAVSKÁ, Tatiana – KOVÁČ, Urban. Researcher‘s Night 2012, 2013, 2014, 2015. Veľká Fatra Mts. SANIGA, Miroslav.

Summer school of the young natural scientists (Letná škola mladých prírodovedcov). Research Station of the Institute of Forest Ecology SAS, the Staré Hory village, 40 participants, summer time 2012. SANIGA, Miroslav. Totally 5 courses ran from 2012 to 2015.

Unconventional teaching procedure in the interactive schoolroom „World of the Trees“ for primary school students. Mlyňany Arboretum SAS, the activities were held annually. ZAHRADNÍKOVÁ, Ester, jr.

2.7.2. Table of outreach activities according to institute annual reports

Outreach activities	2012	2013	2014	2015	total
Articles in press media/internet popularising results of science, in particular those achieved by the Institute	84	56	50	18	208
Appearances in telecommunication media popularising results of science, in particular those achieved by the Institute	162	126	118	26	432
Public popularisation lectures	220	151	105	3	479

- **Supplementary information and/or comments on popularisation activities, max. 300 words**

In order to engage the general public, research staff of the Institute attempted to encourage the interest of people in scientific results and to show benefits of the forest ecology research to the society. Our public engagement activities included popularisation lectures, excursions, science cafés, open days along with articles in print and internet media and appearances in telecommunication media. Information about specific topics was requested very frequently by media representatives. It was highly appreciated that scientists contribute to articles also in daily printed newspapers and main internet news sites in Slovakia (SME, Denník N) and in public service and commercial televisions and broadcasts (RTVS, TA3, Markíza). The article issued in Denník N about František J. Turček, the first Slovak ecologist, a genial self-made man and founder of forest ecology, was the most frequently read over a period of 24 hours. Institute’s PhD students were also engaged in communication about forest ecology to general public and schoolchild and they organised institutional open days yearly. As the researchers became

involved in media activities, along with their scientific knowledge they could present their enthusiasm, what was well accepted by public. This is the case especially of Institute's worker Miroslav Saniga that is nationally famous popularizer of nature and nature protection, awarded five prizes for his work, and is seen in media every week. The Institute is known for organising science cafés in Zvolen since 2007. Limited financial sources for our popularisation activities were available from the Scientific Grant Agency of the Ministry of Education, Science, Research and Sport of the Slovak Republic (VEGA) and projects and the Slovak Society for Agricultural, Forestry, Food and Veterinary Sciences at the Slovak Academy of Sciences in Bratislava.

2.8. Background and management. Human resources and implementation of recommendations from previous assessment

2.8.1. Summary table of personnel

Personnel	2012	2013	2014	2015
All personnel	118,0	115,0	110,0	112,0
Research employees from Tab. Research staff	70,0	68,0	62,0	65,0
FTE from Tab. Research staff	52,820	57,110	57,010	58,240
Average age of research employees with university degree	39,2	40,3	39,8	43,4

2.8.1.1. Professional qualification structure (as of 31.12. 2015) FEMALE

FEMALE	AGE								
Number of	**< 30**	**31 - 34**	**35 - 39**	**40 - 44**	**45 - 49**	**50 - 54**	**55 - 59**	**60 - 64**	**> 65**
DrSc. / prof.									
II.a / Assoc. prof.				2		1	1	2	
Other researchers PhD./CSc.	2	4	4	1	1	1			
doc. / Assoc. prof.					1				

2.8.1.2. Professional qualification structure (as of 31.12. 2015) MALE

MALE	AGE								
Number of	**< 30**	**31 - 34**	**35 - 39**	**40 - 44**	**45 - 49**	**50 - 54**	**55 - 59**	**60 - 64**	**> 65**
DrSc. / prof.								1	1
II.a / Assoc. prof.			1	1	3	2	1	1	2
Other researchers PhD./CSc.	2	3	4	1	2				
doc. / Assoc. prof.				1		1			

2.8.2. Postdoctoral and mobility scheme

2.8.2.1. Postdoctoral positions supported by national and international resources

Ing. Eva Pšidová, PhD.
Main focus: Identification of stressful conditions caused by drought on the base of the physiological parameters within the scope of the experiments with provenances of tree species.
Post-doctoral positions supported by national sources since 01.09.2012 (APVV-0436-10, APVV-0480-12)

Ing. Jana Majerová, PhD.
Main focus: Analysis of the impact of stress factors, particularly drought and temperature, on tree species using selected physiological methods (mainly gasometry, analysis of stress hormones).
Post-doctoral positions supported by national sources since: 27.08.2014 (APVV-0135-12)

Mgr. Júlia Jankuvová, PhD.
Main focus: Chemical communication between trees and bark beetles, semiochemicals in management of bark beetles populations (attractants, anti-attractants).
Post-doctoral positions supported by national sources since 03.09.2013 (APVV-0297-12)

Ing. Pavel Mezei, PhD.
Main focus: Bark beetle population dynamics and impact of disturbancies on ecosystems, impact of natural hazards on individual trees and stands and the factors affecting the bark beetle attack on trees using statistical methods and GIS.
Post-doctoral positions supported by national sources since 01.09.2012 (ITMS 26220220109 , APVV-0297-12)

Michal Parák
Main focus: Determination of factors influencing occurrence of herbivorous and predatory insects on woody plants within development of an information and warning system of invasive organisms in forests and urban areas.
Post-doctoral positions supported by national sources since: 1.10.2015 (APVV 14-0567)

2.8.2.2. Postdoctoral positions supported by external funding

N/A

2.8.2.3. SAS stipends and SASPRO stipends

N/A

2.8.2.4. Internal funding - the Slovak Academy of Sciences Supporting Fund of Stefan Schwarz

Ing. Pavel Mezei, PhD.
Main focus: Bark beetle population dynamics and impact of disturbancies on ecosystems, impact of natural hazards on individual trees and stands and the factors affecting the bark beetle attack on trees using statistical methods and GIS.
Post-doctoral positions supported by national sources since 01.01.2015

2.8.3. Important research infrastructure *(max. 2 pages)*

Workplace Zvolen:

For the diagnostics of condition of terrestrial ecosystems using terrestrial methods in laboratory conditions and in the field, the infrastructure consists of climate-chambers (KBWF-720, Binder, Germany) and air-conditioned rooms enabling to simulate various normal and stress (drought) weather conditions and to study their influence on plants and animals. Photosynthetic rate, respiration and stomatal conductivity are measured with an open gasometrical system Li-6400XT (Li-cor, USA). Chlorophyll fluorescence parameters – important indicators of stress impact related to water and heat stress – are measured with a Mini-PAM or PAM-2500 (Walz, Germany), Handy PEA (Hansatech, VB). Concentration of assimilatory pigments and osmotically active substances are assessed spectrophotometrically (CINTRA 6.5, GBS, Australia). Chlorophyll index, an alternative suitable mainly for field conditions, is measured with a chlorophyll-meter Cl-01 (Hansatech, VB). Transpiration rate at level of adult trees is assessed by Sap Flow Module EMS 51 (EMS Brno, Czech Republic). The water loss in seedlings or plants in controlled conditions is quantified with a scale with continual recording FEJ 17K 0,1 IPM (Kern, Germany). Water and osmotic potential in leaves are determined psychrometrically (Psy Pro, Wescor, USA). Continual measurements of growth parameters are carried out with digital automatic dendrometers DRL 26 (EMS Brno, Czech Republic). The contact-free evaluation of tree health condition and fitness is done based on temperature with a thermo-camera type Flir T650sc (FLIR Systems, Inc., Sweden). The weather conditions are recorded by meteorological stations with remote data transmission. Spatial conditions and changes in forest structure are monitored with a 3D terrestrial laser scanner ILRIS HD (Optech Inc., Toronto, Canada). The output data representing point clouds (clusters) (x,y,z, reflect intensity) serve for generating digital models of terrain (DMT) and 3D models of the interest territory, these models can be used for various spatial analyses and for obtaining spatial characteristics of individual trees. Canopy closure and solar radiation analyzer WinSCANOPY (Regent, Canada) we use for light condition analyses in forest ecosystems. Dendrochronological analyses are done using dendrochronological measuring device WinDendro (Regent, Canada).

For the analysis of metabolic substances and processes running in plants and animals under different stress levels we use gas and liquid chromatography and spectrophotometry. The content of abscisic acid (ABA) in model woody plants subject to stress is assessed using the method of two-dimensional liquid chromatography (2D-HPLC, Agilent Technologies, USA). Phenolic substances are determined by the method of reverse chromatography (colonies C8-C18, ACN/water, MeOH/water) HPLC (Agilent Technologies, Agilent 1260 Infinity LC), terpenes by the gas chromatography (Agilent Technologies, GC) and colonies type HP-5 (5 %-phenyl-methyl siloxane, apolar, broad implementation range, high temperature limit) and type DB-WAX (polyethylene glycol, high polar colony). Unique equipment is GC linked with electoantenography for detecting insects' response to volatile active substances (plant metabolic substances) usable in management of insect populations in forestry and agriculture – pheromones, attractants, anti-attractants, anti-feedants.

For determination of ecologically and environmentally important chemical elements (plant nutrients, microelements, heavy metals) in rock, soil, water, flora and fauna we use the AAS GBC SensAA Dual spectrophotometer (GBC Scientific Equipment, USA).

For the diagnostics of state and development of terrestrial ecosystems, with the aid of RS (remote sensing) and GIS (geographic information systems), the infrastructure enables data collection with the aid of UAV (Dragon 50, SwissDrones Operating AG) with a hyperspectral scanner (AisaKESTREL 10, Specim, Finland) and a laser scanner (GL-70, Geo Info, China, which use the Riegel Vux-1 lidar, Austria), thermovision system for digital thermography (DigiTherm, IGI Germany), digital camera system with capacity of taking infrared photos (RCD 30, Leica, Switzerland), processing own data and data from other sources (satellite data, data assembled by sensors in aeroplanes and other carriers). The data assembled serve for analyses and for model building, publishing information on the internet and various web applications, including interactive models for developmental trends in terrestrial ecosystems (HP server with data storage and high-efficiency workstations with necessary software).

For the study of genetic variability, structure and gene flow among populations we use molecular genetics laboratory. In this lab we are able to extract DNA from different tissues using 96-well thermo-block TS-100 (Biosan) and centrifuge Heraeus Megafuge 16 (Thermo Scientific)

and Scanspeed MINI (LaboGene). We then run PCR reactions in order to amplify fragments of selected genes using PCR box UVC/T-M-AR (Biosan) and Termocycler TAdvanced 96 SG (Biometra). PCR products are controlled and visualised using gel electrophoresis by Midi plus-1 a Midi plus-2 with source Mini Pro (Major science) and photo-documenting system DigiGenius (Synoptics/Syngene) and prepared for further analyses. Concentration of DNA template and PCR products is measured by the spectrophotometer NanoDrop 2000 (Thermo Scientific). This lab is equipped also with other small and additional instruments as shakers and mixers, ddH2O maker Smart2 (Barnstead) and various mechanical and electronic pipettes.

Workplace Nitra:
For processing the geographical co-ordinates data, spatial analysis and geoprocessing output of hosts, pathogens and examined samples we use GIS ESRI ArcGIS 3.9, GPS receiver Ashtech Mobile Mapper 10 software Topol Mobile 3.0. For microscopic observations and analyses of the studied objects we use light microscope Olympus BX 51, stereomicroscope Olympus SZ41 with software (Quick Micro Photo 2.3, Deep Focus 3.1). For isolation and cultivation of pathogens and routine laboratory work in sterile conditions we use ESCO Laminar Flow Cabinet, High Pressure-Laboratory autoclave PS 20A, Chamber Sanyo MLR351H. For molecular laboratory work we use standard equipment Thermocycler- Whatman Biometra T personal, Micro Centrifuge Micro 200R Hettich, Fume Hood - Merci M 1200, Chest freezer Arctico ULTF 80 (-80°C), Gel documentation system Quantum ST4 Vilber Lourmat, Microliter pipettes - Thermo Scientific Finnpipete and Eppendorf, Biosan Thermo Shaker TS 100C. To evaluate the health state of trees, to measure electrical quantities and internal structure of tree trunks and determine the extent of damage - rot, cavity we use acoustic tomograph ArborSonic 3D, automatic multimeter Axiomet AX-174 True RMS.

Workplace Mlyňany Arboretum:
For measuring leaf stomatal conductivity we use leaf porometer SC-1 (Decagon Devices Inc., USA), for leaf/branch water potential analysis we use Scholander pressure chamber M-600 (PMS Instrument Company, USA), for colorimetric analyses of plant metabolites level we use spectrophotometer Jasco V-600 (Jasco Co., Japan). For determining xylem sap flow rate we use sap flow meter EMS-62 (EMS, Czech Republic), and for soil moisture dynamics recording we use 10HS moisture sensors (Decagon Devices Inc., USA) with MicroLog V3A datalogger (EMS, Czech Republic)

Workplace Bratislava:
Department of Molecular Apidology is equipped for common methods of biochemistry (e.g. isolation and purification of native proteins and peptides by chromatographic methods, dialysis, electroelution, ultracentrifugation, extraction); proteomics (e.g. characterization of the molecular properties of proteins and peptide, determination of protein concentration, molecular mass determination, separation of the proteins and peptides on polyacrylamide gel electrophoresis under native and denaturation conditions, pI determination, Isoelectrophocusing, determination of optical density, conductivity, measuring of UV/VIS spectra, determination of dry matter); molecular biology (e.g. isolation of DNA from different tissues, isolation of plasmid DNA, DNA analysis on agarose gels, PCR analysis, preparation of recombined proteins and peptides by cloning of the gene of interest in appropriate cloning systems), biotechnology (e.g. expression of recombined proteins and peptides, their purification); microbiology (e.g. test of antimicrobial activity against honeybee and other bacteria using growth inhibition by diffusion assay on agar plates, as well as by growth inhibition in liquid medium) and immunology (e.g. preparation of polyclonal antibodies, western blott analysis, Elisa, immunodiffusion, immunoprecipitation, kinetic of enzymatic reaction).

2.8.4. Description of how the results and suggestions of the previous assessment were taken into account

Suggestions of the previous assessment as given by the Evaluation Panel for Agricultural, Veterinary and Ecological Sciences (26th Sept 2012):

1) It is advisable to focus publication strategy on high quality international peer reviewed journals.

Response: In the last four years we focused our publication strategy on the renowned journals with higher Impact factors (IF). While in the period 2007–2011 we published our papers in journals with the mean IF = 1.026, in the recent period 2012–2015 we reached the mean IF = 1.656. Hence, the increase of IF of journals where we published our results exceeded 61%.

2) It is advisable to prepare carefully candidates for DrSc degree.

Response: The Institute of Forest Ecology SAS chairs the stable Commission for defence of DrSc. theses in the field "Ecology" 010520-010530. Institute's co-worker RNDr. Anton Krištín, DrSc. was elected and nominated by the Slovak Minister of Education, Research and Sport of the Slovak Republic as a chairman of this international Commission in Slovakia in 2010. He has recently been nominated for the second five-year period. It is in our high interests to prepare further candidates for DrSc. degree. Currently, we have three candidates, who nearly fulfil the criteria (based on the data from the Web of Science Core Collection database) for the achievement of this degree and we expect they will defend their DrSc. theses within the next four years (e.g. Peter Kaňuch, WOS publ/citat = 43/178, h = 7, 39 y.; Rastislav Jakuš, WOS publ/citat = 27/201, h = 10, 47 y.; Ján Kulfan, WOS publ/citat = 36/161, h = 7, 59 y.). Each of them has his own research team, PhD students and national as well international projects and cooperation.

3) The future research topic and visions should be discussed and developed by permanent discussions the institute.

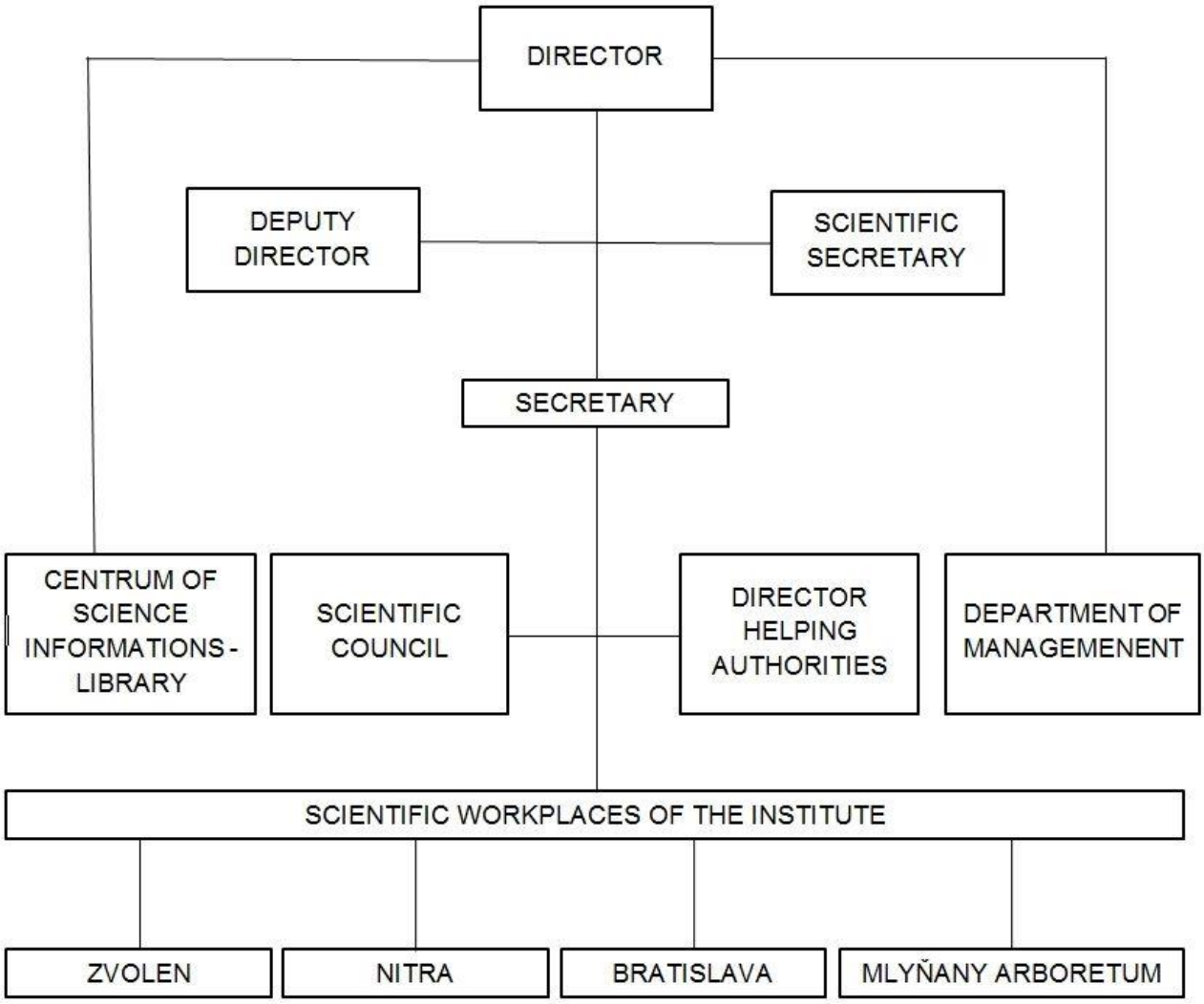
Response: During the last accreditation period there was an intensive communication between the management of the institute, project teams and researchers aimed at identifying perspective research directions, which would be attractive for science and society. Our ideas are in context of European and worldwide research trends (current European strategy on forest research development aimed at sustainability and multi-functionality of forests under the conditions of global changes and also European strategy on biodiversity). Therefore in that respect it will be necessary to pay attention of our research mainly to:

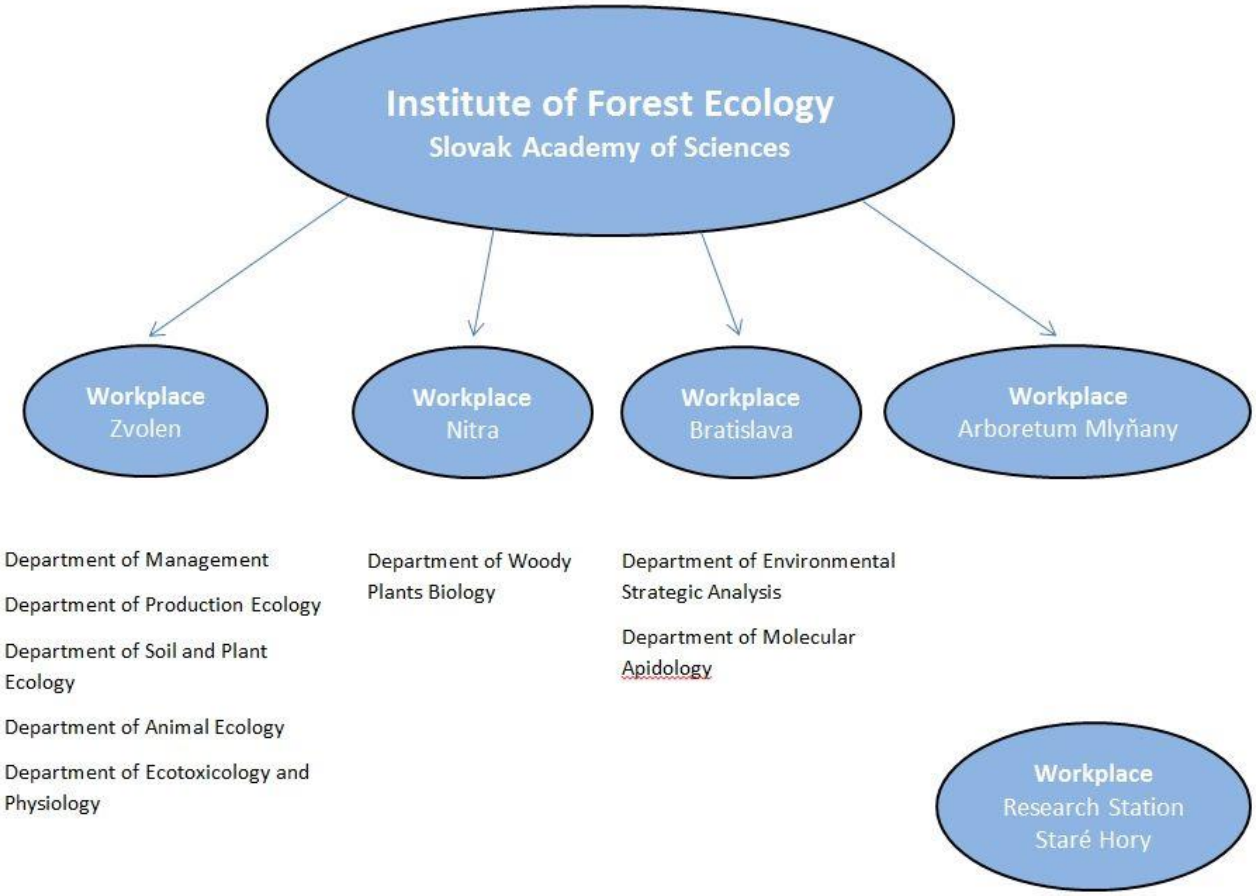
- Interdisciplinary research of the impacts of global changes on forest ecosystems and the related social aspects, development and innovations of technologies reducing the reactions and mitigating the impacts of global changes.
- We will also continue in creating a system of specialised laboratories, which will analyse, evaluate and predict the development of forest ecosystems in the conditions of global changes at different levels (starting from the molecular level, through structures, organisms up to forest ecosystems) and also from the point of management of decision-making processes and ecosystem services.
- The support of development of new research programmes and elements of infrastructure will also be important. Our infrastructure is already unique and of good quality. This creates good conditions to use the infrastructure to its maximum and most efficiently by either top experts involved in the development of new techniques and methodologies, or other experts from national and foreign institutions or postgraduate students of the postgraduate study program, which we guarantee.

- Last but not least, further development and enhancement of our research infrastructure will be needed to enable the realisation of a wide spectrum of new scientific methods (observation of nutrient and energy flows in forest ecosystems, metabolomics, genetics of tree species, stress physiology of tree species, Earth remote sensing, and many other methods related to the current research scope of the institute). This will be possible by our active participation in calls of the Research Agency and European programmes (particularly Horizon 2020), etc.

- Supplementary information and/or comments on management, research infrastructure, and trends in personnel development

Organisation structure of the Institute of Forest Ecology, Slovak Academy of Sciences





The Institute has 108 employees (at 31 December 2015). From the point of the professional scientific qualification structure there was one person with the degree “Doctor of Science” and 46 workers with PhD. degree. From the point of pedagogical activities, the Institute has employed one professor and three associate professors during the assessment period.
The personnel policy of the organisation is aimed at high proficiency and qualifications of scientists, age balance of scientific departments, motivation to improve work quality and efficiency, and increasing the share of young scientists in project management. Currently, the Institute has a favourable age structure of employees (average age is 43.5 years) and an appropriate gender ratio. A continuous replacement of retired scientific workers is ensured by selecting from the best doctoral students trained at the workplace. Since the wage fund is limited by budgetary resources, post-doctoral grants of SAS (Fund of Stefan Schwarz) and national grant schemes (mainly APVV grants) are also used. The institute has project teams, which prepare projects for specific calls in the area of science and research. The success of the project teams is indicated by a number of supported projects in recent years, and also by the research results presented at national and international forums, as evidenced by the publication activity of the Institute.

3. Research strategy and future development of the institute for the next five years (2016-2020) (Recommended 3 pages, max. 5 pages)

3.1. Present state of the art in both the national and the international contexts

At the institute we aim at excellent problem solving and basic research related to traditional and also to newly emerging strategic interests. During the last century, forest environment in Europe has been considerably changed due to massive human exploitations and/or natural disturbances. Nowadays, great vulnerability of ecosystems, increased impact of anthropogenic and natural stress on organisms, spreading of diseases, pests and invasive species, threatened survival and isolation of native populations and negative social and economic aspects are associated with ongoing global changes. The research and development activities will thus focus mainly on forest ecosystems and woody plants in a changing environment, and on the area of biodiversity, biotechnologies and evolutionary biology. There are four main research areas of our institute that cover processes in ecosystems, responses and adaptations of organisms and human aspects with regard to global changes. Although the scope of the presented research strategy is relatively broad, all identified strategic topics are more or less linked to these changes.
The strategy and future development of research at the institute is based on and is closely related to the most important research activities that were pursued by the institute during the assessment period. Thus this strategy should result in several follow-up research activities that were already established in the previous years. Moreover, recent large financial investments into new technologies and laboratories suggest promising improvement of future scientific outputs. Thanks to recent and hi-tech equipment, methods of aimed research are therefore mostly innovative and original with prospects of future growth in quality of scientific outputs (along with papers in renowned peer-reviewed journals we also intend to apply for some patents).
Our research strategy is in close connection with European and worldwide trends in research, namely, we follow current EU Forestry Strategy focusing on sustainability and multi-functionality of forests under global changes as well as EU Biodiversity Strategy. At the national context, we fulfil the Strategy in Adaptation of the Slovak Republic for Unfavourable Impacts of Climatic Change. Thus the research of human dimension of global environmental change impacts will be a social extension of our strategy toward political and economic implementations of our scientific results.

3.2. Research strategy of the institute in the national and the international contexts, objectives and methods

A) Effects of global changes on forest ecosystems and woody plants

Effects of global changes on forest ecosystems and disturbance regimes
Using current hi-tech infrastructure we plan to shift the level of knowledge to a qualitatively new level. We plan to conduct the research on the factors affecting the state of forest ecosystems and its components in the laboratory and in field conditions. In climate boxes and chambers we will examine the impact of various factors of the simulated environmental conditions on host plants, in particular the changes in the production of metabolites that are related to defence capability and predisposition to attacks by bark beetles, but also the population of bark beetles. Under field conditions, we will use terrestrial and airborne laser scanners to map the structure of ecosystems, to obtain the reactions of trees to the specific conditions using terrestrial and aerial thermal imaging cameras and a hyperspectral scanner. Airborne sensors will be carried by an unmanned aerial vehicle (UAV) and all detailed information obtained from them will be qualitatively new inputs (resolution in millimetres to centimetres) into the decision support systems developed for the management of spruce ecosystems. Time series of satellite data (Landsat, Sentinel 2) are going to be used to assess long-term ecosystem dynamics. The analysis of semiochemicals (substances used for chemical communication between individuals of the same species or between species) under laboratory and field conditions, particularly in the host – phytophage communication system will be supported by gas chromatography with mass spectrometry coupled with electroantenography capable of detecting insect responses to volatile biologically active compounds. This data will be useful for the management of insect populations.

Stress factors and adaptive potential of forest trees
Understanding the responses of tree species and their adaptability to new environmental conditions arising from on-going climate changes associated with more frequent extreme weather events is increasingly important. Therefore, our objectives are to track changes in photosynthetic productivity, chlorophyll fluorescence and bioenergetics and functioning of forest tree photosystems affected by biotic stress factors. Physiological research on forest tree populations, their productivity (photosynthetic activity estimated by chlorophyll fluorescence, plant gas exchange measurement, etc.) and their resilience will provide most effective approach to determine and predict potential effects of various stress factors. We will focus mainly on spruce and other economic forest tree species (e.g. poplar clones) which provide important ecosystem services in central Europe.

B) <u>Biodiversity, invasive species and evolutionary biology</u>

Responses of animals to changed conditions and biological invasions
Further research will be focused on climatically and human induced changes in forest ecosystem structure at the level of microhabitats, habitats and ecosystems. Multivariate analyses will enable determination of factors that influence spatial and temporal dynamics of species, mostly herbivorous insects and their predators. Habitat selection of target animal species will be studied along environmental gradients while special attention will be paid to key biodiversity species, so-called umbrella and flagship species and their long term population dynamics. Field experiments will be combined with laboratory studies simulating effects of environmental factors on animals. Original data about exotic animal species with special reference to their spread in forest ecosystems and urban areas will be collected. Risk of damage to woody plants and timber by invasive species will be determined. Non-native species will be studied both locally and globally, in cooperation with foreign researchers and by participating in international projects.

Parasitic fungi and woody plants interactions
The main objective of our research will be to examine how to mitigate the adverse effect of fungal pathogens on some woody species. Our research will aim at determining the extent and the intensity of different species dieback, and the host range of species attacked by pathogenic fungi and the level of their pathogenicity (tested by artificial inoculations). We will also perform spatial modelling of potential disease occurrence in long-term horizon under recently changing environmental conditions.

Behavioural algorithms for solving complex tasks
From an evolutionary perspective, we use two very different study systems (tree-dwelling bats and nuptial gift-giving insects) which are, however, tailored to our main objectives: (i) interdisciplinary study of social self-organisational behaviour with the aim to develop a new meta-heuristic method capable of space exploration, and (ii) study of possible factors (environment, phenotype, genetics) and their effects on the degree of species polyandry as an adaptive survival strategy. The presented research topics will be examined under natural and controlled laboratory conditions using experimental setups with automated tracking techniques, standard molecular tools, statistical modelling and simulations.

C) <u>Biotechnology</u>

Genomics and proteomics of honeybee royal jelly proteins and peptides
In future, we will continue in the research of physiologically active compounds of honeybee products. Some of royal jelly proteins and antimicrobial peptides and/or their variants will be prepared using biotechnological methodology in different expression systems. Purified recombinant proteins/peptides will be tested for antibiotic activity against honeybee pathogens as well as against human pathogenic bacteria. The immune-stimulation and anticancer activity of the recombined proteins/peptides will be tested on the base of their ability to induce the death of leukemia cells. Purified substances of natural origin as well as their recombined equivalents will be directly applicable in beekeeping, and will offer possibilities for protecting honeybee colonies

against pathogens with reduced burden on the environment. Moreover such proteins directly increase the quality of human food and they can be potentially applied as protein antibiotics against multiresistant human bacteria, as well as in the therapy against civilisation diseases. Screening of apalbumin1 content in honey samples from all over the world, in cooperation with partners of the International Honey Commission, will provide a platform for the improvement of EU standards for honey authenticity and quality, and thus will protect consumers against honey adulteration, which is a serious problem on the commercial markets.

Biotechnologies for protection of trees in urban ecosystems
We aim to develop new methods in integrated forest and tree protection incorporating the use of entomopathogenic fungi. The main goal of our projects will be to find new biological products for the biological control of selected forest pest species, which could effectively substitute the chemicals. From the biotechnological perspective, the assemblage of non-native (especially evergreen) woody plants that grow in our arboretum represents a valuable novel source for the research on endophytic microorganisms with unknown biochemical and biological activities. Along with that, we will focus on ornamental plants as sources of bioactive compounds with important therapeutic effects. Furthermore, due to massive introduction of exotic and alien species, our research will focus also on acclimation potential of novel woody plant species to global climate change. Therefore, we will study the actual occurrence, key driving forces of spreading as well as an effective elimination method and biomass exploitation opportunities of such species.

D) <u>Interdisciplinary research</u>

Human dimension of global environmental changes and ecosystem services
Our future research interests will target on social innovations to ensure rural and urban sustainability and adaptation to global change. In particular we are concerned with (i) ecosystem service governance and business innovations for sustainable supply of forest ecosystem services (ii) socio-technological innovations in forestry and rural development to support climate-smart forestry under the impact of global change (iii) the role of resource regimes for management effectiveness, in particular whether self-management and self-governance can increase innovation capacities and (iv) trans-disciplinary approaches to involve stakeholders in decision making under the global (multilevel) arena.

Project proposals submited to 7RP or H2020	2012	2013	2014	2015
Institute as coordinator				
Institute as participant			3	4

4. Other information relevant for the assessment

Forests and other woody habitats in urban zones cover almost half of the territory of Slovakia and forest ecosystems provide the most important environmental functions with significant economic context in this terrestrial country. Moreover, local forests are mostly native or natural and some of them are even rare relics of primeval forests in Europe (included also in UNESCO World Heritage List as Primeval Beech Forests of the Carpathians). The Institute of Forest Ecology SAS was founded in the heart of Slovakia and in the mecca of forest research there. About dozen of different forest institutions, including university education and specialized government institutes, are located in Zvolen – Town of Forestry (a Memorandum of Cooperation among forestry institutions was signed this year). However, the Institute of Forest Ecology SAS is the only one which has appointed the basic research on forest ecosystems as the main mission. Scientific knowledge about an impact and magnitude of current global changes, predictions of possible evolution and suggestions of evidence-based practices for suitable management in incoming climatic conditions are highly needed nowadays. Therefore we believe that our daily scientific contributions in various aspects of forest ecology also with the help of recently improved technical infrastructure (e.g. remote sensing technologies) and well established and broad international cooperation (the Institute is a member of independent non-governmental network organisations conducting and cooperating international forest research as the International Union of Forest Research Organizations | IUFRO and the European Forestry Institute | EFI) will facilitate necessary adaptation of human being in the Anthropocene.