DOI: 10.35595/2414-9179-2020-1-26-80-93

Diana Dushkova[1], **Dagmar Haase**[2], **Peer von Döhren**[3], **Olga Chereshnya**[4], **Vladimir Megorsky**[5]

"AN INTERDISCIPLINARY PERSPECTIVE ON ECOSYSTEM SERVICES AND HUMAN WELL-BEING": RESULTS AND POTENTIALS OF GERMAN-RUSSIAN COOPERATION WITHIN THE PROJECT

ABSTRACT

Programs of international cooperation between universities and scientific centres aim to promote not only the achievements in science and education but also contribute to intercultural understanding, as well as to development of efficient human resources, research and innovation. The aim of this paper is to explore the potential of international cooperation in research and higher education between Russia and Germany by examining selected German-Russian projects and their outcomes. In particular, it highlights the experience of summer schools on "An Interdisciplinary Perspective on Ecosystem Services and Human Well-being", an annual event started in 2014. It is organized under the umbrella of the German Academic Exchange Service (Program of Eastern Partnership), the International Office and Geography Department of Humboldt University of Berlin and the Faculty of Geography at Lomonosov Moscow State University in strong cooperation with other universities, research centres and NGOs from both countries. The summer school addresses relevant contemporary environmental issues of urbanization with special emphasis on ecosystem services, green infrastructure and nature-based solutions and their importance for well-being of the urban population. In this paper we present our experience from this project by providing the theoretical-methodological aspects of such joint educational and training programs and report outcomes, which emerged from them, thereby highlighting the difficulties and advantages and suggest lines of further development and cooperation. It also highlights how geographical perspective can provide new important and critical insights into the place-based approaches to ecosystem assessment and how it relates to the current trends in human-environmental research.

KEYWORDS: international educational programs, ecosystem services, human well-being, Germany, Russia

INTRODUCTION

Ecosystem services (ES) belong to the most fascinating topic of modern geographical research [*Haines-Young, Potschin*, 2011]. There is increasing recognition of the significance of "ecosystem services and human wellbeing" concept in the environmental health education programs worldwide [*Dushkova, Haase,* 2018; *Krasny et al.,* 2013; *Kudryavtsev,* 2012; *Lane et al.,* 2005; *Stevenson et al.,* 2012]. Much of the current interest in ecosystem services was stimulated by the Millennium Ecosystem Assessment [2005], an initiative sponsored by the United Nations.

[1] Humboldt University of Berlin, Unter den Linden, 6, 10099, Berlin, Germany;
e-mail: **diana.dushkova@geo.hu-berlin.de, dagmar.haase@geo.hu-berlin.de**
[2] Humboldt University of Berlin, Unter den Linden, 6, 10099, Berlin, Germany;
e-mail: **dagmar.haase@geo.hu-berlin.de**
[3] Humboldt University of Berlin, Unter den Linden, 6, 10099, Berlin, Germany; *e-mail:* **doehrenp@hu-berlin.de**
[4] Moscow State University named after M.V. Lomonosov, Leninskie Gory, 1, 119991, Moscow, Russia;
e-mail: **cherry.purplerain@gmail.com**
[5] Centre for Human Adaptation in the Arctic of the Kola Science Centre of Russian Academy of Sciences, Fersman str., 41a, 184209, Apatity, Russia; *e-mail:* **megorsky@ya.ru**

A great number of research has addressed the challenge of applying the ecosystem services approach empirically [*Burkhard et al.*, 2010; *Elmqvist et al.*, 2013; *Everard*, 2017; *Haase*, 2012; *Haase et al.*, 2019] and several definitions and classifications [*Fisher et al.*, 2009; *de Groot et al.*, 2010; *Haines-Young, Potschin*, 2012] as well as frameworks to link ecosystem services and human well-being [*La Notte et al.*, 2017; *Rendón et al.*, 2019; *Steger et al.*, 2018] have been developed. ES are essential for multiple aspects of human health and well-being, but many current assessments of the functioning of ecosystems under different land use models as well as understanding of risks posed by environmental change and the best practice of the management of ecosystems are lacking a unified conceptual basis [*Everard*, 2017]. A variety of methods and terms are widely used nowadays, but their meaning is understood in many different ways depending on scientific paradigms, context, user needs and experience of researchers. Our reviews of research on ecosystem services [*Haase et al.*, 2014; *Dushkova, Haase*, 2018] revealed that these studies differ in terms of local contextual and methodical aspects. It is difficult to judge their individual scientific, political and educational value. In order to address these concerns, an interdisciplinary approach is needed which implies highlighting and reducing the differences between ecosystem services studies in all their aspects. Only then can we achieve meaningful results that may help ecosystem services studies guide local land management, lead to better insight into knowledge transfer and help to address current societal challenges. In this regard, programs of international cooperation between universities and scientific centres can provide the interdisciplinary research approach, promote the achievements in science and education as well as significantly contribute to intercultural understanding and to development of efficient human resources, research and innovation [*Steger et al.*, 2018; *Terhart*, 2017].

Teaching about ecosystem services and human well-being in Europe and especially in post-socialist countries is often fragmented as there is currently no common syllabus among different geographical schools about how to teach the multi- and interdisciplinary approach of urban landscape ecology, environmental management and their relationship with human health and well-being. From this situation arose the need for an international, integrated, multidisciplinary training for students with specialization in landscape ecology and environmental management, which has prompted the establishment of several research and education cooperation activities. This paper presents results of such international cooperation project in education and research on ecosystem services and human well-being between the Humboldt University of Berlin (HU) and Moscow State University named after M.V. Lomonosov (MSU). In particular, it provides the insights from bilateral summer schools on “An Interdisciplinary Perspective on Ecosystem Services and Human Well-being” organised annually started from 2014 in order to advance the conceptual basis for ecosystem analysis and management in a rapidly changing world and the meaning of ecosystem services for the health of urban population. The paper also focuses on the recent development and methodical approach of these summer schools as an international, integrated, undergraduate ecology course for geography students in the important pre-graduation phase of their studies. It endeavoured from the training and research network of universities, research institutes and partners from practice and government. The overall goal of the paper is to explore how collaborative research and education programmes can support current research on ecosystem services and human well-being, contribute to better understanding of their complex relationships as well as to highlight the lessons learnt (difficulties and advantages of such cooperation) and suggest lines of further development and cooperation.

Establishing strategic partnerships with leading research universities worldwide is part of the internationalization strategy of both HU and MSU. The objective of this partnership is to allow for comprehensive networking and collaboration on all university levels, i.e. regarding the sustainable support of young researchers, the initiation and implementation of innovative research cooperation, the development and establishment of future-oriented teaching and the structured exchange of researchers, students and staff.

The collaboration between HU and MSU in the field of education and science is premised on interuniversity and faculty agreements, memorandums and work programs [https://www.msu.ru/en/intcoop/partners.php[1], https://www.international.hu-berlin.de/en/international-profile[2]]. Cooperation agreement No ОФ-1-1991 / OF-1-1991 is concluded at the university level in 1991. Collaboration between the both universities is coordinated by the departments of international cooperation, together with the international relations offices at the educational and scientific subdivisions of MSU and HU.

The project "Urban ecosystem services and their assessment: exchange of experiences between Germany and Russia" was started in 2014 on the initiative of German and Russian researchers of HU and MSU with great support of International Office of HU. They have organised five 2-week-long summer schools on "An Interdisciplinary Perspective on Ecosystem Services and Human Well-being". The inaugural summer school was organized in 2014 within the HU-MSU cooperation project on "Urban ecosystem services and their assessment: exchange of experiences between Germany and Russia" (2014–2020), and attracted students and young researchers specialized in landscape ecology, environmental management and environmental health research.

As experience worldwide shows [*Craciun, Bunoiu*, 2019; *Egron-Polak, Hudson*, 2014; *Terhart*, 2017], in recent years, international summer schools have become an effective tool and a kind of supplementary education programs. These schools are short-term academic events which combine practice-oriented learning and knowledge transfer between different scientific school and approaches. Summer schools are, first of all, an attractive and competitive educational environment for international youth professional communication. The success of such schools depends on whether a university can create an attractive environment for attendees, from comfortable living conditions to an exciting cultural program. They also help to develop and promote the positive image of the countries involved as well as the educational programs of universities and enhance their recognizability by helping them to develop bilateral contacts with partner organizations. All this improves academic reputation of universities and determines their prestige.

The HU/MSU summer school on "An Interdisciplinary Perspective on Ecosystem Services and Human Well-being" aims to provide an innovative atmosphere for thinking about and resolving sustainability challenges, and to promote interdisciplinary approaches as well as to encourage new understanding of the links between ecosystem services and human well-being.

During these HU/MSU summer schools, students and young scientists have worked intensively with experienced researchers, practitioners and a team of coordinators in order to discuss a broad range of views on topics of ecosystem services assessment, analysis of the consequences of land-use change for ecosystem services and human health and well-being.

Among the main partners in Russia involved in the organisation of the educational and training process are the Institute of Industrial Ecology Problems of the North of Kola Scientific Centre of the Russian Academy of Sciences, the Centre for Human Adaptation in the Arctic of the Kola Science Centre of Russian Academy of Sciences, the Polar-alpine Botanical Garden and Institute of the Kola Science Centre of Russian Academy of Sciences in Murmansk Oblast, the Institute of Geography of Russian Academy of Sciences in Moscow and the State Forest-Technical University in Saint Petersburg. In Germany the main contribution to the organisation of the event came from the Helmholtz Centre for environmental research — UFZ Leipzig, the Leibniz Institute for Regional Geography (IfL Leipzig), the Institute for Geography at University of Leipzig, the Institute for Geography and Geosciences at Martin Luther University Halle-Wittenberg (Halle), Ökolöwe — Umweltbund Leipzig e.V. (NGO), BUND e.V. Sachsen (Friends of the Earth Saxony), Annalinde e.V. and the Naturkundemuseum (Museum of Natural Science) Leipzig.

[1] Moscow State University collaboration with foreign organizations in the field of education and science. Web resource: https://www.msu.ru/en/intcoop/partners.php (accessed 12.01.2020)

[2] The international profile of Humboldt-Universität zu Berlin. Web resource: https://www.international.hu-berlin.de/en/international-profile (accessed 12.01.2020)

MATERIALS AND METHODS OF RESEARCHES

The methodical concept of the summer school was established in 2014 and undergoes annual revisions in terms of the course composition and current conceptual issues [*Dushkova, Haase,* 2018]. We support the hypothesis that the integration of different teaching modalities supports the development of analytical thinking and decision making in a multidisciplinary research field such as ecology and environmental management.

The course covers the following skills and competencies:

- judging the relevance of the topic through evidence-based knowledge and literature on ecosystem services, urban green infrastructure, nature-based solutions;
- formulating targeted research questions;
- explaining and arguing methodology.

Additionally, students have to develop a specific research design, apply and implement their methodical approach in the project in order to address questions relevant to thematic issues. Interaction with lecturers provides a research-stimulating atmosphere in which professional mentors and professors act as role models for scientific thinking.

Course design

The aim of the summer school is to familiarize students with general modern concepts in the relation "environment — human health and well-being" such as concepts of ecosystem services, urban green infrastructure and nature-based solutions, as well as to teach them about environment-related problems in both countries (Germany and Russia). Students learn about landscape ecology research in combination with new theoretical and practical approaches in environmental technology. Program candidates are undergraduate geography students (Bachelor- and Master students / Geography (6–8 / 9–12 semesters) interested in landscape ecology, environmental management, and the cultivation of international contacts. Participation is limited to ten students from each university (HU and MSU) per year.

It focuses on the concept of ecosystem services (ES), which connects biodiversity and ecosystems in general with human well-being (MA, 2005). Gaps remain in understanding the causal relationships between drivers/pressures and changes in biodiversity, their impact on ecosystem services and social systems. Given the persistent decline in biodiversity, improved documentation and evaluation of changes in biodiversity is urgently needed to better understand the links between biological diversity, ecosystem functions and resilience [*Haase*, 2012]. The ecosystem service concept offers a methodology to assess these links and is applied in the current project.

The concept of "ecosystem services" (the flow of benefits from nature to people) provides a novel framework for advancing this vision [*Dushkova, Haase,* 2018]. This concept is inherently transdisciplinary — involving an integration of the natural sciences, social sciences, and humanities — and its implementation is multifaceted, requiring innovation in business, law, and governance [*Elmqvist et al.*, 2013; *Haase et al.*, 2019]. Accordingly, this course is intended for diverse students and will focus on teamwork, learning from peers, and integrating knowledge across disciplines to analyse real-world cases. It uses the common approaches of urban landscapes as learning arenas for biodiversity and ecosystem services [*Krasny et al.*, 2013; *Haase,* 2012; *Everard*, 2017] and presents the different frameworks linking ecosystem services and human well-being [*Potschin, Haines-Young*, 2011; *La Notte et al.*, 2017; *Rendón et al.*, 2019].

The course has been designed, developed and tested by various institutes and universities involved in the above-mentioned cooperation where multidisciplinary teams have an expertise in the analysis of environmental problems, land use management and research on ecosystem services with the links to human well-being. The team is also engaged in inter- and transdisciplinary work with society and policy, tackling environmental problems in the urban zones, aiming to improve ecological sustainability, economic efficiency, and social equity.

Design of the summer school course program is presented on the fig. 1.

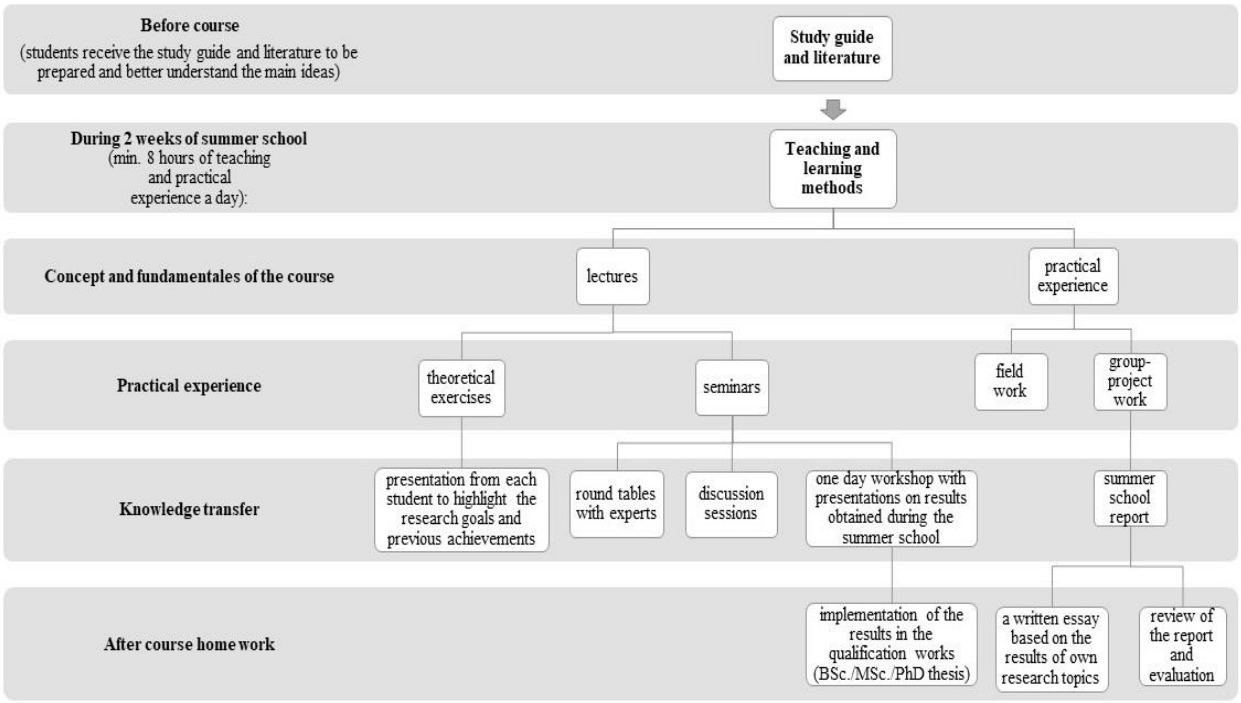

Fig. 1. The concept of the summer school

It is comprised of three parts: theoretical part, practical research, own expertise within the project:

- *Theoretical part* — the goal is to familiarize students with general modern concepts in the relation "environment — human health and well-being" such as concepts of ecosystem services, urban green infrastructure, nature-based solutions, and to teach them about environment-related problems in both countries (Germany and Russia). Students are introduced to different facilities, departments and laboratories and attend lectures by experienced researchers and professionals from different backgrounds.
- *Practical research* — the goal is to introduce the various aspects of the interdisciplinary approach to research on ecosystem services and human well-being.
- *Own expertise within the research project* — the goal is to provide the knowledge check within the preparation of the own report. The main conceptual idea is that students should not perceive themselves as students with no experience in the topic, but rather as experts who comes to this course to actively improve and broaden the knowledge and skills they already possess and exchange them with their course partners.

The teaching is based on inter- and multidisciplinary faculties and a multimodal educational approach to address different learning styles. The learning success was assessed by evaluation of students' reports as well as presentation of results within a one-day workshop.

The study area (fig. 2) in Germany (relevant for MSU-students) includes Berlin as well as Leipzig in Saxony and Halle in Saxony-Anhalt, both close to Berlin, and is the destination for the excursions. The study area has a very diverse landscape, characterized by biodiversity, but also threatened by various anthropogenic and natural drivers. The study area in Russia (relevant for HU-students) includes a variety of different natural zones with different climatic conditions, experiencing different pressures of anthropogenic impact and climate change — from pristine ecosystem to anthropogenic bad lands situated in tundra and taiga zones at the Kola Peninsula (Murmansk, Apatity, Kirovsk, Monschegorsk etc.) to mixed forest in Central Russia (Moscow and Moscow region). It is planned to extend the study area in 2019 to the south to Caucasus Mountains in order to research in the semi-arid and mountain landscapes thereby representing the whole amount of natural zones and belts Russia has to offer.

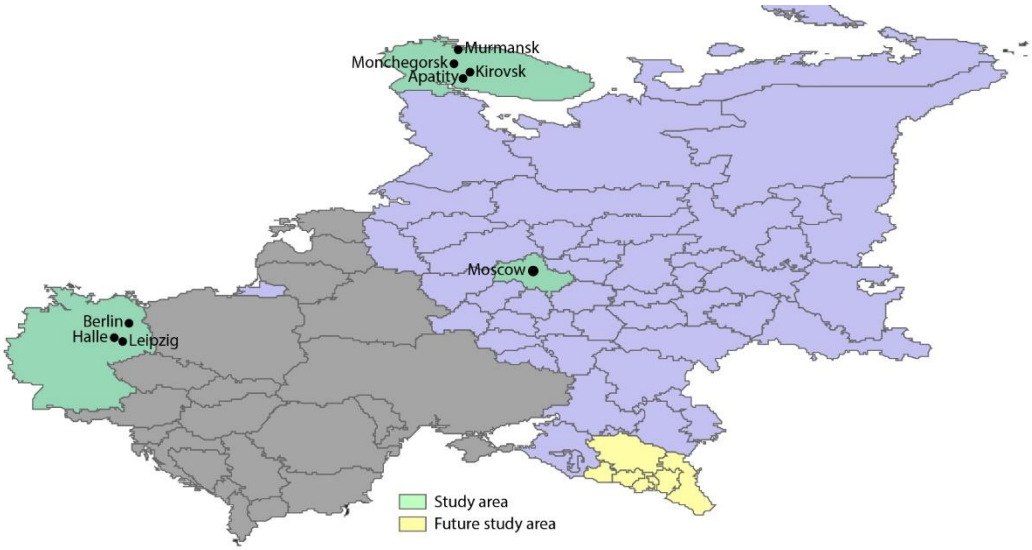

Fig. 2. Study area

The science basis for the summer school curriculum

The summer school's working groups were made up of qualified participants with basic experience from German and Russian universities, scientific centres, research organisations, NGOs mentioned above. This enabled the active promotion of mutual learning; one of the school's main strengths.

The organizing committee consists of internationally acclaimed experts: ecologists, geographers and environmental health specialists involved in teaching. PhD students and Postdocs from the HU, MSU, IfL Leipzig, Kola Scientific Centre of the Russian Academy of Sciences and State Forest-Technical University in St. Petersburg are also recruited to help students with general organization, field research and social programs. All courses are held at the HU Berlin, MSU Moscow and Kola Scientific Centre of the Russian Academy of Sciences.

One of the basic ideas is implementation of the methodical approach to problem solving named "design thinking" which allows better understanding for multidisciplinary and international teams and fosters a unique working culture and an iterative learning process. It also ensures small groups and intensive support by highly trained team coaches. Participants are supported in their research and field work by coaches experienced in the successful implementation of innovative projects, having worked in research projects devoted to the Study area ("Perception and social construction of cultural landscapes drawing on case studies from Germany and Russia" supported by Leibniz DAAD, 2012–2014; "Landscape and human well-being: analysis, assessment and communication in the field of landscape services", SS_AbgH/10/, 2014–2016, supported by the Parliament of Berlin; "Mathematical-cartographic assessment of medico-ecological situation in cities of European Russia for their integrated ecological characteristics" supported by Russian Foundation of Basic Research, research project 18-05-00236, 2018–2020) as well as EU projects, such as "Connecting Nature — COproductioN with NaturE for City Transitioning, INnovation and Governance" (No 730222, 2017–2021), EU FP7 GREEN SURGE — Green Infrastructure and Urban Biodiversity for Sustainable Urban Development and the Green Economy (2013–2017), and two research projects URBES — Urban Biodiversity and Ecosystem Services (2011–2014) and ENABLE — Supporting Green and Blue Infrastructure in Urban Areas (2017–2019) funded by BiodivERsA.

RESULTS OF RESEARCHES AND THEIR DISCUSSION

During each summer school, over a period of two weeks, students were immersed in a "hands-on" course addressing different topics on ecosystem services, urban green infrastructure and nature-based solutions not only through ecological theory but also by conducting own surveys on socio-ecological issues. They had the opportunity to consider both how environmental (e.g. urban landscape) change is driven by society (with an emphasis on land-use change) and how society benefits from ecosystem services.

As a pre-module all students were requested to send an abstract upfront with a topic related to summer school thematic, a summary of their previous work and a cover letter to the host institution (chairs of the summer school). On-site students presented a paper on the topic of their abstract and gave a short oral presentation. All abstracts, cover letters and presentations were reviewed by faculty members of host universities (HU and MSU). The aim of the abstracts and presentations during the summer school was, besides learning about ecosystem services, green infrastructure and other environmental health issues in different countries, to learn how to prepare abstracts and cover letters, and how to deliver presentations at an international meetings and conferences.

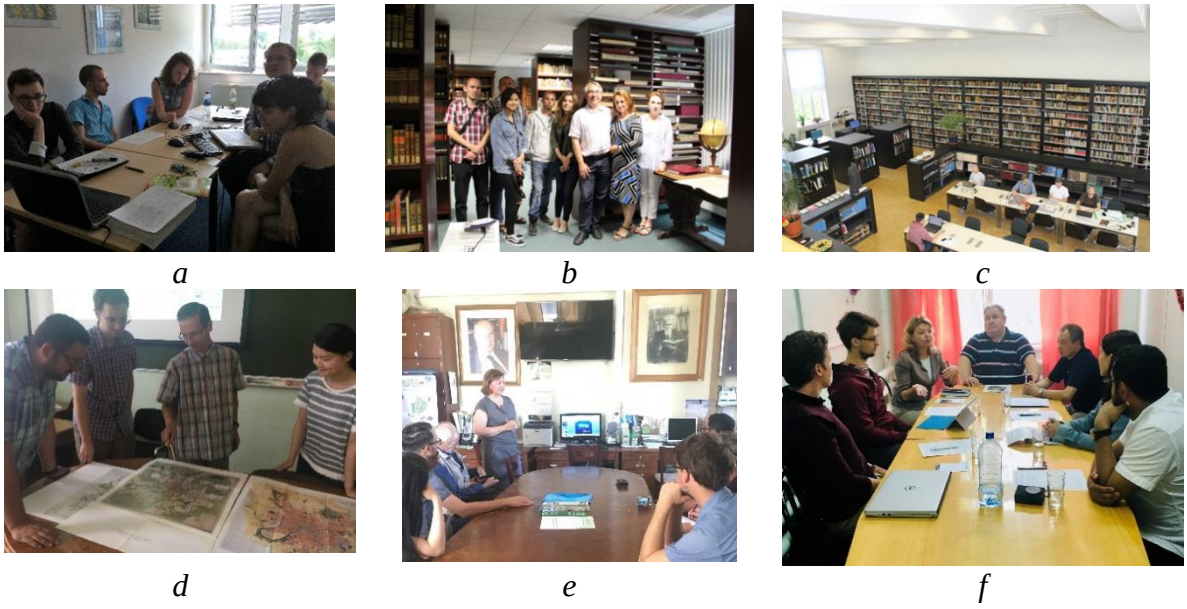

Fig. 3. Lectures and seminars at HU Berlin (a) and in libraries of Leibniz Institue for Regional Geography, Leipzig (b), Martin Luther University Halle (c), Faculty of Geography of MSU (d, e) and Kola Science Center in Apatity (f)

According to the proposed summer school concept, the programme of each summer school consists of: a) keynote and methodological lectures, seminars and exercises; b) hands-on sessions; c) working in small groups lead by an experienced researcher by conducting surveys; d) presentation of the results by participants; e) exchange with experienced researchers within the workshops and round tables; f) field excursions. ***Lectures*** provide an overview of general aspects of ecosystem services and green infrastructure concepts starting with refreshing basic knowledge derived before, fostering associative learning by application of knowledge within specific problems (e.g., diagnostic algorithms) and training of knowledge application in certain cases. The lectures are given by experienced teachers who encourage students to participate in discussions (fig. 3). ***Workshops and round tables*** offer an insight into specific fields of landscape ecology and environmental sciences for each problem-oriented issue. The students have the possibility to get together with small groups familiar with techniques and work flows related to their special interest, including team-

teaching as didactic method and presentation of the results by participants in form of oral presentation and written reports. ***Working in small groups lead by an experienced researcher by conducting surveys*** enabled students to apply the derived knowledge in practice (fig. 4). In addition, ***knowledge checks***, performed right after lectures, supported the information process and learning.

Fig. 4. Field surveys including biotop mapping and socio-ecological analysis in parks of Leipzig (a), Wörlitz (b), Berlin (c), Knibiny Mountains (d), Lappland biosphere reserve (e), Moscow (f)

Research topics ranged from indicators of green-induced policy and urban green infrastructure, assessment of ecosystem services and their contribution for stabilization of urban environment quality and human health, to the analysis of spatial environmental health data (fig. 5).

The acquired knowledge allowed students to accept an advanced variety of environmental technologies, modern methods of environmental management as well as fundamentals of field research. Moreover, decision making in environmental management and urban landscape ecology requires a high level of fundamental theoretical knowledge and the ability to apply it in practice. Based on interdisciplinary team communication and application of main concepts in ecology and human well-being (e.g. of ecosystem services, urban green infrastructure, nature-based solutions) / algorithms in a multidisciplinary setting, the concept of the summer schools enabled all this to be realized.

Students also analyse and discuss the spatial and temporal integration of different ecosystem services in an urban region to determine synergies, trade-offs and losses, by using case studies in Germany (Leipzig, Berlin, Halle, Mansfeld region and surroundings) and Russia (Moscow and Moscow region, Murmansk region and as planed also St. Petersburg).

The other aspects such as understanding the system using Ecosystem Services [*Burkhard et al.*, 2010; *Fisher et al.*, 2009; *de Groot et al.*, 2010; *Haase et al.*, 2014; *La Notte et al.*, 2017; MEA, 2005] and Ecosystem Disservices [*Döhren, Haase*, 2015] approaches and evaluating the management success by different social and ecological indicator systems were addressed as well.

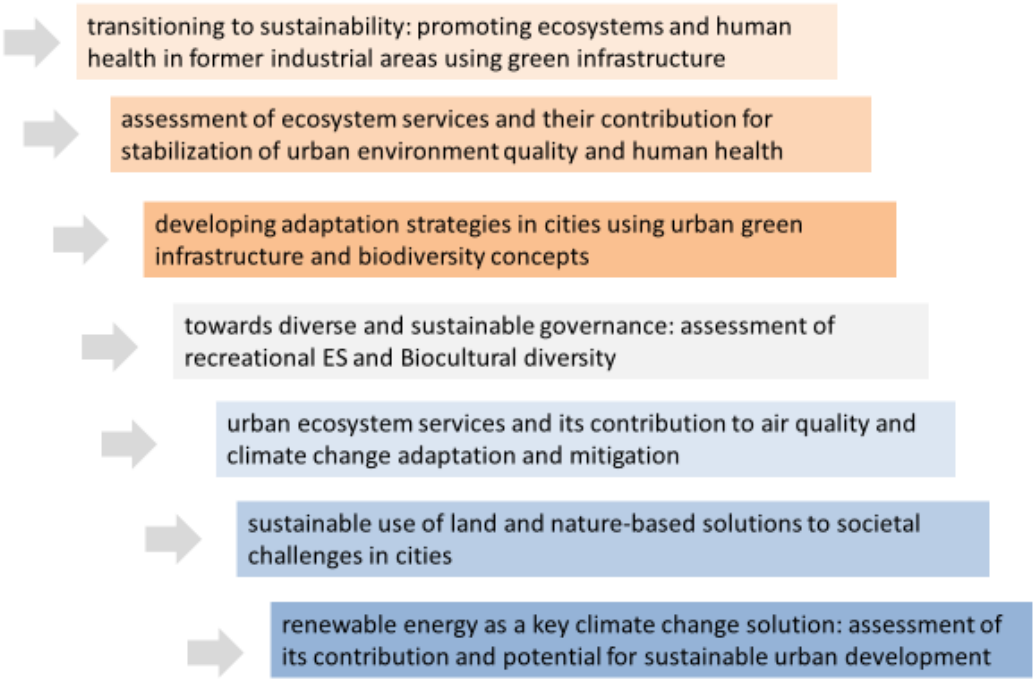

Fig. 5. The topics of the selected individual research projects developed by students

The two weeks (for MSU-students in June, for HU-students in July/August) encompassed an array of interactive lectures and seminars, discussions, presentations, educational field tours and study excursions, individual work and group work as well as a student seminar and a report. Throughout this collaborative work students were able to gain important information and interact with valuable new contacts to help further the discussion on ecosystem services and urban green infrastructure.

However, every summer school is much more than a series of meetings, presentations and educational field tours. Students can share information with colleagues, and listen to discussions and presentations from leading experts on ecosystem services. In doing so, this educational project provides an opportunity to identify new ways to move forward and to collaborate with a better understanding of the characteristics, spatial distribution, and value of ecosystem services. It is also a venue to synthesize research methods and tools needed to more routinely and effectively incorporate ecosystem services into resource management, conservation, restoration, and development decisions. During every summer school, the broad interdisciplinary nature of research on ecosystem services and the need to combine ecological, geographic, socio-economic and institutional information and models were discussed.

The first research stays focused on the classification, characterization and assessment of ecosystem services along urban-rural gradients. The second research stay focused on the coordination of methodological guidelines for the integrated assessment, valuation and mapping of ecosystem services in urban areas. The third research stay was to coordinate and supervise the analysis of data related to the assessment and valuation of ecosystem services provided by urban gardens, with a focus on the diversity of ecosystem services provided by urban gardens and the perceived importance by ecosystem services beneficiaries. The fourth research stay focused on coordinating and supervising the analysis of data related to the assessment and valuation of ecosystem services in urban areas using multicriteria analysis. Project results include several publications in international journals, workshops and others.

Within the framework of the course composition the participants gained their knowledge through a combination of self-study, small group study and in-class study. The efficacy of the course is well documented by the results of the knowledge checks. The increase of knowledge

about general and specific ecological aspects as well as applying the knowledge regarding the processes within the concepts of ecosystem services, urban green infrastructure and nature-based solutions improved during the summer schools. These results indicate that when teaching complex interdisciplinary topics like environment and human well-being, addressing different learning styles and teaching approaches leads to a great learning success.

The results obtained from the project include publications in international journals, several presentations at national and international conferences, workshops, seminars and symposiums, which increase visibility of the project, results and partnership. The project has certainly created an important added value by: a) strengthening and deepening existing collaboration; b) creating new connections among researchers of the institutions, and c) upgrading individual collaboration between researchers into formal collaboration between institutions of Russia and Germany dealing with the research on ecosystem services, green infrastructure and human health and well-being.

Several events organized during the summer school in Russia in 2017–2019 have particular importance in terms of cooperation with important partners such as Kola Scientific Centre of the Russian Academy of Sciences (in Apatity and Kirovsk, Murmansk Oblast, Russia) and dissemination of knowledge and expertise.

The scientific activity extended over the whole duration of the project. The peaks of activity took place during the several short researches stays in May and August 2018 and 2019 as well as workshops jointly organized at HU Berlin on November 25–29, 2019 and at MSU on December 24–25, 2019.

Studies and training missions and the benefits provided

The activities developed during the summer school programs give the unique opportunity to become acquainted with the scientific schools and cultures of different societies. The institutions involved benefited from the exchange of academic staff who performed knowledge up-dating activities in their fields of expertise, participating as listeners or lecturing courses. For the students participating in the summer schools learning, knowledge transfer and improved understanding of complex urban ecosystems and their relations with urban society, formed the cornerstone of the exchange programme. The effective involvement and participation of non-academic actors (e.g. NGOs, environmental companies, etc.) complemented the training activities for students, enabling them to work in the activities that require a sound practical skill and knowledge.

Students of geography and landscape ecology in both universities were involved in academic studies and training missions. Based on the approaches of [*Novikova et al.*, 2019; *Obst, Buck Sutton*, 2011; *Schenone et al.*, 2017; *Stevenson et al.*, 2012], we revealed a set of benefits provided by the summer schools:

- *at institutional level* — the state education departments may benefit in terms of achieving their goals of enhancing quality (environmental) education through participating in such international education programs;
- *at scientific level* — when carried out periodically, over a period of time a good repository of local environmental information is generated by the students and mentors for their neighbourhood, which help to provide knowledge transfer and facilitate the understanding of different scientific schools, concepts and approaches;
- *at students' level* — students of both universities get sensitised about different environmental issues, socio-economic and cultural backgrounds and ecological relevance.

Difficulties

As the exchange programme was developed involving people from two different countries, each one with its own language, cultural background, customs, political/ administrative system, academic structure, working habits and other factors, it was always prone to operational difficulties that had to be solved through the common sense and international experience of the coordinators from both countries. Communication between the coordinators and summer school participants was carried out in English, Russian and German. In some cases, the German coordinators functioned as an interpreter. A common difficulty is to establish the schedule for the exchange

programme due to different academic calendars in both universities. On the other hand, the above-mentioned differences constitute challenges, which allow the involved participants to develop their intercultural competence far beyond the capacity of solving problems.

Evaluation

In order to analyse the achievements and reveal the challenges, monitoring and evaluation are done. This also ensures that environmental education is an ongoing process. Certain themes are studied in the classroom through lectures and seminars, and all students are involved in practical initiatives (e.g. field trips, surveys, etc.). Summer school participants and staff are encouraged to provide the program evaluation, outlining the environmental values and objectives and what the students / staff are striving toward. After a period of participation, an evaluation of the success of these initiatives and the methodology was undertaken, and the whole programme for every summer school was assessed. All students are awarded with Certificates of attendance, which provide the evaluation of gathered knowledge, skills and research project conducted during the period of the summer school.

The results of inventorying and monitoring of the applied technologies, methodologies, and interdisciplinary approaches are implemented annually to make a progress on the further course development.

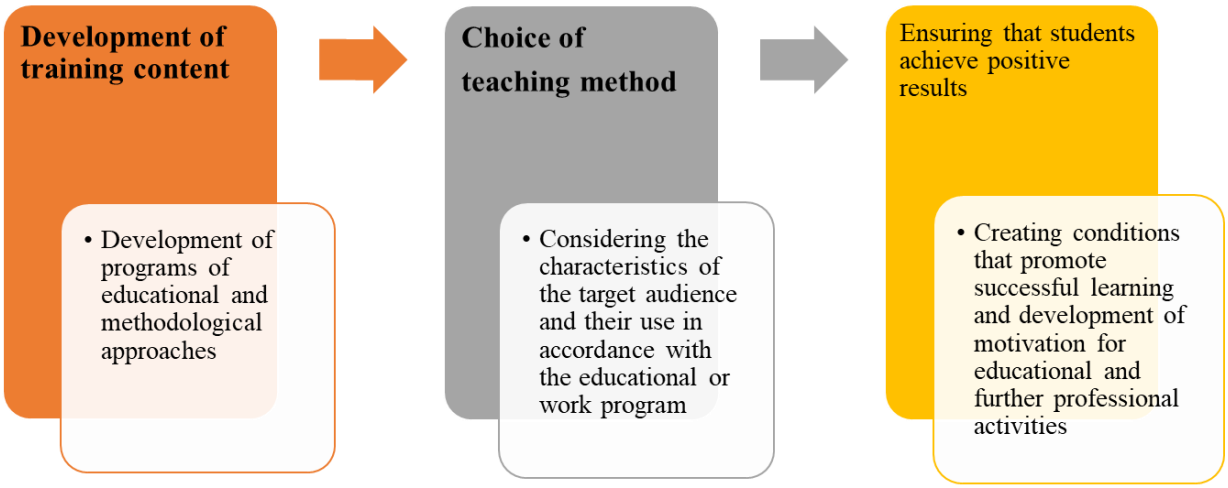

Fig. 6. The main requirements for improving of existing programs of the HU/MSU summer schools and developing of an innovative approach

The results of joint working sessions and discussions, as well as the analysis of the experiences gained during the development of methodological programs and their implementation in the educational process, revealed a number of features. An important component of the new approach to the training program of the above-mentioned summer school, developed jointly within the German and Russian cooperation framework, is the definition of a number of requirements that are aimed at developing new educational and methodological approaches to improve the training program in order to achieve the promised positive results (fig. 6).

CONCLUSIONS

International cooperation projects such as the summer school on "An Interdisciplinary Perspective on Ecosystem Services and Human Well-being" enable students with different educational backgrounds from different scientific schools to learn and practice the value of interdisciplinary team communication as well as the application of modern concepts / algorithms in environmental — human health research. The experiences of these summer schools confirm that

international partnerships are common and effective form of internationalization of higher education. They aim to facilitate institutional development, foster research and innovation, enhance quality of education and create opportunities of resources exchange, including but not limited to information and knowledge, sharing the positive practices and assisting partner institutions in responding to challenges of sustainable development.

The cooperation within the summer schools has decidedly contributed to making sense of research for sustainable development of territories as well as increased and strengthened institutional cooperation at all levels of the education sector and research.

Based on the experience of the Russian-German cooperation within the above-mentioned project, we have highlighted how education and research activities have contributed to the strategic partnerships of the HU and MSU:

- joint support of students and young researchers, particularly through cooperation in trainings (e.g. summer schools) and by integrating the career path model of HU and MSU;
- establishing mobility options for students and researches trough financing provided by DAAD Eastern partnership program, MSU and some institutions involved in the summer school organisation;
- promoting cooperation in teaching, for example in the development and implementation of joint programs strengthening international research collaborations and benefitting from synergies with partner universities;
- promoting joint research projects and knowledge transfer.

Thus, through strategic partnerships between both universities, the presented research and education project promotes targeted use of synergies across as wide a range of academic fields and at as many university levels as possible.

ACKNOWLEDGEMENTS

The authors would like to especially thank all project partners who were in charge of the summer school organisation for the last years as well as all the teachers and students from the HU, MSU and from the collaborating centres in Leipzig, Berlin, Halle, Apatity, Kirovsk and Moscow, for their effort and enthusiasm that made the HU / MSU summer school a success story of this international education program. Our special thanks go to Dr. Annegret Haase, Prof. Dr. Dieter Rink (UFZ Leipzig); Prof. Dr. Alexander Evseev, Prof. Dr. Tatyana Krasovskaya, Dr. Sergey Chalov, Dr. Alla Pakina, PhD candidate Mikhail Antonenko, Mr. Nikolay Besprozvanny, Mr. Aleksander Osetrov (MSU Moscow); Dr. Stefan Karsch, Mrs. Anke Schnetzinger, Dr. Manuel Wolff, Dr. Sebastian Scheuer, Dr. Salman Qureshi, PhD candidate Fernando Castillo (HU Berlin); Dr. Michael Zierdt, Mr. Juri Buchantschenko (MLU Halle); Dr. Isolde Brade, Dr. Nadir Kinossian, Dr. Wladimir Sgibnev, Dr. Lela Rekhviashvili, Prof. Dr. Sebastian Lentz (IfL Leipzig); Dr. Sergey Sandimirov, Dr. Oksana Gontar, PhD candidate Andrey Goryachev, Mrs. Tatyana Mingaleva, Mrs. Tatyana Kotlova (Kola science Center of the Russian Academy of Sciences, Apatity) for their great support during the summer schools' organization.

The study was funded by the German Academic Exchange Service (DAAD Ostpartnerschaftenprogram) within the HU-MSU cooperation project on "Urban ecosystem services and their assessment: exchange of experiences between Germany and Russia" (2014–2020) and by Russian Foundation of Basic Research, grant No 18-05-00236 "Mathematical-cartographic assessment of medico-ecological situation in cities of European Russia for their integrated ecological characteristics" (2018–2020).

REFERENCES

1. *Burkhard B., Petrosillo I., Costanza R.* Ecosystem services — bridging ecology, economy and social sciences. Ecological complexity, 2010. V. 7. P. 257–259. DOI: https://doi.org/10.1016/j.ecocom.2010.07.001.

2. *Craciun D., Bunoiu M.* Learning science outside the classroom: a summer school experience. AIP Conference proceedings, 2019. 2071(1):050002. DOI: 10.1063/1.5090086.
3. *Döhren P., Haase D.* Ecosystem disservices research: a review of the state of the art with a focus on cities. Ecological indicators, 2015. V. 52. P. 490–497.
4. *Dushkova D., Haase D.* The concept of ecosystem services in theory and practice. Study guide for 4th HU-MGU Summer school 2018 "An interdisciplinary perspective on ecosystem services and human well-being". Berlin: Department of Geography, Humboldt University of Berlin, 2018. 158 p.
5. *Egron-Polak E., Hudson R.* Internationalization of higher education: growing expectations. Fundamental values IAU 4th Global Survey, 2014. Web resource: http://www.iau-aiu.net/sites/all/files/IAU-4th-GLOBAL-SURVEY-EXECUTIVESUMMARY.pdf (accessed 10.11.2019).
6. *Elmqvist T., Fragkias M., Goodness J., Güneralp B., Marcotullio P.J., McDonald R.I., Parnell S., Schewenius M., Sendstad M., Seto K.C., Wilkinson C.* Urbanization, biodiversity and ecosystem services: challenges and opportunities. A global assessment. Berlin: Springer, 2013. 755 p. DOI: https://doi.org/10.1007/978-94-007-7088-1.
7. *Everard M.* Ecosystem services: key issues. London: Routledge, Taylor & Francis, 2017. 200 p. DOI: https://doi.org/10.4324/9781315531816.
8. *Fisher B., Turner R.K., Morling P.* Defining and classifying ecosystem services for decision making. Ecological economics, 2009. V. 68. P. 643–653.
9. *de Groot R.S., Alkemade R., Braat L., Hein L., Willemen L.* Challenges in integrating the concept of ecosystem services and values in landscape planning, management and decision making. Ecological complexity, 2010. V. 7. P. 260–272.
10. *Haase D.* The importance of ecosystem services for urban areas. Valuation and modelling approaches. UGEC Viewpoints, 2012. V. 7. P. 4–7.
11. *Haase D., Larondelle N., Andersson E., Artmann M., Borgström S., Breuste J., Gomez-Baggethun E., Gren Å., Hamstead Z., Hansen R., Kabisch N., Kremer P., Langemeyer J., Rall E.L., McPhearson T., Pauleit S., Qureshi S., Schwarz N., Voigt A., Wurster D., Elmqvist T.* A quantitative review of urban ecosystem service assessments: concepts, models, and implementation. AMBIO, 2014. V. 43. P. 413–433. DOI: https://doi.org/10.1007/s13280-014-0504-0.
12. *Haase D., Haase A., Rink D., Quanz J.* Shrinking cities and ecosystem services: opportunities, planning, challenges, and risks. Atlas of ecosystem services. Berlin: Springer, 2019. P. 271–277. DOI: 10.1007/978-3-319-96229-0_42.
13. *Haines-Young R., Potschin M.* CICES Version 4: response to consultation. Nottingham: Centre for environmental management, University of Nottingham, 2011. 17 p.
14. *Krasny M.E., Lundholm C., Shava S., Lee E., Kobori H.* Urban landscapes as learning arenas for biodiversity and ecosystem services management. Urbanization, biodiversity and ecosystem services: challenges and opportunities. Dordrecht: Springer, 2013. P. 629–664. DOI: https://doi.org/10.1007/978-94-007-7088-1_30.
15. *Kudryavtsev A.* Urban environmental education and sense of place. PhD dissertation. Ithaca, New York: Cornell University, 2012. 250 p.
16. *Lane R., Lucas D., Henry S., Coates I.* 'Committing to place' at the local scale: the potential of youth education programs for promoting community participation in regional natural resource management. Australian Geographer, 2005. V. 36. P. 351–367.
17. *La Notte A., D'Amato D., Mäkinen H., Paracchini M.L., Liquete C., Egoh B., Geneletti D., Crossman N.D.* Ecosystem services classification: a systems ecology perspective of the cascade framework. Ecological indicators, 2017. V. 74. P. 392–402.
18. Millennium ecosystem assessment (MA). Ecosystems and human well-being: synthesis. Washington, DC: Island Press, 2005. 137 p.
19. *Mocior E., Kruse M.* Educational values and services of ecosystems and landscapes — an overview. Ecological indicators, 2016. V. 60. P. 137–151. DOI: 10.1016/j.ecolind.2015.06.031.

20. *Novikova E., Mityagina V., Walter S.* University international cooperation: project-based translation training. Higher education in Russia, 2019. V. 28. No 6. P. 75–85. DOI: 10.31992/0869-3617-2019-28-6-75-85.
21. *Obst D., Buck Sutton S.* The changing landscape of international partnerships. Developing strategic international partnerships models for initiating and sustaining innovative institutional linkage. New York: Institute of International Education, 2011. P. 13–23.
22. *Potschin M.B., Haines-Young R.H.* Ecosystem services. Progress in physical geography, 2011. V. 35. No 5. P. 575–594. DOI: 10.1177/0309133311423172.
23. *Rendón O.R., Garbutt A., Skov M.* A framework linking ecosystem services and human well-being: saltmarsh as a case study. People and nature, 2019. V. 1. P. 486–496. DOI: 10.1002/pan3.10050.
24. *Schenone C., Brunenghi M.M., Pittaluga I., Hajar A., Kamali W., Montaresi F., Rasheed M., Wahab A.A., El Moghrabi Y., Manasrah R.* Managing European cross border cooperation projects on sustainability: a focus on an MESP Project. Sustainability, 2017. V. 9. No 1. 112. DOI: 10.3390/su9010112.
25. *Steger C., Hirsh S., Evers C., Branoff B., Petrova M., Nielsen-Pincus M., Wardropper C., van Riper C.J.* Ecosystem services as boundary objects for transdisciplinary collaboration. Ecological economics, 2018. V. 143. P. 153–160.
26. *Stevenson R.B., Brody M., Dillon J., Wals A.E.J.* International handbook of research on environmental education. London: Routledge, Taylor & Francis, 2012. 592 p.
27. *Stöhler C.* Projektmanagement im Studium. Vom Projektarbeit bis zur Abschlusspräsentation [Project management in study process — from work on the project to final presentation]. Wiesbaden: Springer, 2016. 152 p.
28. *Strategic framework — education and training 2020*. Web resource: http://eurlex.europa.eu/legal-content/EN/ALL/?uri=CELEX:52009XG0528(01) (accessed 30.10. 2019).
29. *Terhart E.* Interdisciplinary research on education and its disciplines: processes of change and lines of conflict in unstable academic expert cultures: Germany as an example. European educational research journal, 2017. V. 16. No 6. P. 921–936.