
APPROACHES TO INCREASE AWARENESS AND INVOLVEMENT OF CITIZENS IN THE SCIENCE OF INVASIVE ALIEN SPECIES IN BULGARIA

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Abstract: Invasive alien species (IAS) threaten or adversely affect biodiversity and ecosystem services and in addition cause significant economic losses. It is widely accepted that the prevention of the introduction of alien species is considerably more cost-effective than measures taken following their establishment in a new location. The good awareness of the general public about the negative impact and the management options for IAS is crucial for the prevention of their introduction and spread. The COST Action CA 17122 ‘Increasing understanding of alien species through citizen science’ (Alien CSI), which started in 2018, has addressed multidisciplinary research questions in relation to developing and implementing citizen science, advancing scientific understanding of alien species dynamics while informing decision-making. To facilitate the implementation of this COST Action in Bulgaria, two projects supported by the National Science Fund of Bulgaria have been launched in 2019.

This article presents information about different approaches for IAS awareness raising and engaging of different stakeholders and the general public with science related to IAS implemented recently in the framework of different IAS projects in Bulgaria. Among them, we present the ‘Green Academy’, an awareness raising initiative of the University of Forestry for sustainable use of biological resources; the campaigns of the IBER-BAS for promoting and demonstration of the smartphone application ‘Invasive Alien Species Europe’ among different stakeholder groups; IAS questionnaire surveys. publication of IAS awareness raising materials; preparation of IAS exhibition; organisation of IAS trainings, scientific forums, and networking.

The projects and initiatives focusing on IAS conducted during the last five years in Bulgaria contributed to an establishment of a core group of IAS experts in Bulgaria dedicated to the study of IAS, as well as to the implementation of IAS awareness raising, citizen science and networking activities among a wide range of stakeholders (scientists, teachers, decision-makers, managers, students, and the general public). Our results have shown that despite the efforts of scientists most of the non-professionals are still not aware of the IAS negative impact, pathways of introduction, as well as the risk posed by trade and keeping of exotic plants and pets, and their intentional or unintentional release into the environment. A national IAS campaign is needed for changing of the public attitude towards IAS, in order to prevent their introduction and spread in Bulgaria. Local authorities can play a key role in helping to address the risks associated with biological invasions and can contribute to IAS awareness raising among decision-makers and citizens.

Key words: Invasive alien species, citizen science, smartphone application, awareness rising

1. INTRODUCTION

Invasive alien species (IAS) threaten or adversely affect biodiversity and ecosystem services, and in addition, cause significant economic losses. It is widely accepted that the prevention of the introduction of alien species is considerably more cost-effective than measures taken following their establishment in a new location (CBD 2002, Genovesi and Shine 2004). Most of the pathways of introduction and spread of the IAS are associated with human activities. Horticultural and pet and aquarium escapees are one of the most frequent pathways for introduction of IAS. Other common pathways are the transport of species as contaminants with stocking and fish-farming materials, as well as the stowaway transport with vessels and equipment. The good awareness of professionals and the general public about the negative impact and the management options for IAS is crucial for the prevention of their introduction and spread.

Citizen science (CS) is the involvement of volunteers in the collection and/or analysis of data. The citizen science has become an increasingly popular approach to undertake science and conduct monitoring on biodiversity and the environment (Pocock et al. 2014a, Pocock et al. 2014, Roy et al., 2012, Tweddle et al. 2012). Although IAS information, including data on occurrence of species, has been undertaken by professionals, including academics and governmental employees, it has been reported that there is potential to widen participation through involvement of volunteers in citizen science (CS) initiatives (Roy et al. 2018). There are many such projects and initiatives undertaken recently at EU level. To increase the IAS awareness and involvement of citizens, a smartphone application ‘Invasive Alien Species Europe’ has been developed by the Joint Research Centre of the European

Commission (EC JRC). The COST Action CA 17122 ‘Increasing understanding of alien species (AS) through citizen science’ (Alien CSI), which started in 2018, has addressed multidisciplinary research questions in relation to developing and implementing citizen science, advancing scientific understanding of alien species dynamics while informing decision-making (<https://alien-csi.eu>).

This article presents different approaches for IAS awareness raising and assessment of the motivation of different categories of the general public to participate in the early detection of IAS, and identifies the most appropriate approaches for engaging them with IAS citizen science in Bulgaria.

2. MATERIALS AND METHODS

The awareness raising activities aiming to provide relevant information about IAS among a wide range of stakeholders and to facilitate the implementation of the Regulation (EU) No 1143/2014 have been conducted in Bulgaria in the framework of the following projects: (1) ‘Development of bio-resources extension service’ (BIOREX) at the University of Forestry, funded by the America for Bulgaria Foundation; (2) COST Action FP1401 ‘A global network of nurseries as early warning system against alien tree pests (Global Warning)’; (3) COST Action FP1002 ‘Pathway Evaluation and pest Risk Management In Transport - PERMIT’; (4) ‘East and South European Network for Invasive Alien Species: A tool to support the management of alien species in Bulgaria’ (ESENTAS-TOOLS) (2015-2017), and (5) ‘Improving the Bulgarian Biodiversity Information System’ (IBBIS) (2015-2017), both funded by the Financial Mechanism of the European Economic Area 2009-2014, Programme BG03 Biodiversity and Ecosystem Services; and (6) ‘Support for the Development of Scientific Capacity at the University of Forestry’ funded by the Science and Education for Smart Growth Operational Programme (2014-2020).

Some of the implemented projects have explicitly aimed at the involvement of citizens in the IAS science, e.g. ‘A pilot-study (data collection) on invasive alien species in the Danube Region with a smartphone application developed by the JRC’ (Danube-IASapp) (2016-2017), funded by the EC JRC. Two projects supported by the National Science Fund of Bulgaria have been launched in 2019 to facilitate the implementation of the COST Action CA17122 ‘Increasing understanding of alien species through citizen science’ (Alien CSI) in Bulgaria: (1) ‘Increasing understanding of alien species (AS) through citizen science: Approaches to citizen science, data management and standards in Bulgaria’ № KP-06-COST-13 and (2) ‘State and perspectives of citizen science for invasive alien species in Bulgaria’ № KP-06-COST-14.

3. RESULTS AND DISCUSSION

The following approaches to increase IAS awareness and involvement of citizens in the science of invasive alien species have been applied in Bulgaria during the last five years: IAS information and awareness raising initiatives and campaigns; publication of IAS awareness raising materials; preparation of IAS exhibition; organisation of IAS trainings, scientific forums, and networking.

‘Green Academy’ awareness raising initiative. The ‘Green Academy’ information days concept was developed as part of a joint project between the University of Forestry and Oregon State University, Corvallis, USA, funded by the America for Bulgaria Foundation. The objectives of the ‘Green Academy’ were: (1) to create the conditions and environment for direct contact between academia, practitioners and administration, business and the local public, and (2) knowledge and technology transfer and awareness raising of general public about management and sustainable use of biological resources.

The information day ‘Green Academy’ included various elements to raise awareness, such as presentations, demonstrations, competitions, promotion and distribution of various information materials. Within a small stand, participants, businesses, NGOs and local administrations were given the opportunity to present their activities, initiatives or products. Information days were held at different places, depending on the interest shown by the local partners in organising the event. Conducting an event in a particular settlement was preceded by the dissemination of surveys to identify the needs of the settlements for information or to solve specific problems. Based on the analysis of the conducted survey, lecturers were identified on a specific topic and a specific programme for the particular settlement was prepared.

During the info days, presentations related to the five main thematic areas of BIORES: Forests, Forest Products and Services, Environment and Biodiversity, Mountain Agriculture and Livestock, Home and Garden, Food and Health were presented. In addition, presentations on and specific to the village topics were presented. Local partners and administrative structures were provided with an opportunity to present their activities and familiarise the audience with new activities and regulations/ policies, etc. A special focus of these events was the involvement of pupils and students, for which various competitions, demonstrations and other activities were organised.

The information days ‘Green Academy’ have been part of the information campaign of the University of Forestry - Sustainable use of biological resources. They have been organised by the Biological Resources Extension Service

Office of the University of Forestry BIORES. In the last two years, the information days were organised in fulfillment of Activity No 2 ‘Promotion of research in the field of management and sustainable use of biological resources’ of the project ‘Support for the Development of Scientific Capacity at the University of Forestry’.

In recent years, the ‘Green academy’ format has established itself as a trademark of the University of Forestry for raising the awareness of a wide range of professionals and non-professionals. The format has proved to be extremely useful in that it provides an opportunity to meet and communicate with various stakeholders, such as representatives of educational and scientific institutes, state and municipal administration, non-governmental organisations, professional associations, private business, local general public, who usually do not have professional contact with each other. During the events different participants receive new information, exchange ideas, which is a prerequisite for changing their well-being and realising future initiatives.

All green academies conducted so far addressed the topic of IAS and the role of citizen science for IAS. Some of the ‘Green academies’ conducted in the last two years were especially dedicated to IAS. For example, the main focus of the ‘Green Academy’ in Ruse 2019 was ‘Citizen Science and Invasive Alien Species in the Danube Region’. The objectives of this meeting were: (1) to inform the audience about the problems of IAS and the measures taken at European, regional and national level, (2) to discuss the possibilities of citizen science in the monitoring of alien species in the Danube basin, (3) to present the IAS programme of the JDS4 for Bulgaria, and (4) to present the smartphone application ‘Invasive alien species in Europe’, updated for the Danube River Basin, and its demonstration in the field. The info day held in Pernik 2019 focused on the IAS threats to human health and biodiversity. The green academies, mainly dedicated to the IAS, were held in partnership with experts from the Institute of biodiversity and ecosystem research with the Bulgarian Academy of Sciences. Key partners were the local authorities, such as the Regional inspectorates of environment and water, representatives of protected areas in the region, etc.

Promotion and demonstration of the smartphone application ‘Invasive Alien Species Europe’ as a tool for citizen science. The practical use of the application was tested under the Danube-IASapp project, within the frame of the Danube Region Invasive Alien Species network (DIAS), in order to complement environmental monitoring and early warning of IAS in the Danube River Basin. The study was carried out in three countries in the Lower Danube Region – Bulgaria, Romania and Serbia. The leading institution was IBER-BAS, Bulgaria.

The study approach included the following steps: 1) Identification of suitable test sites and related stakeholders; 2) Planning and organisation of information and field testing campaigns with stakeholders at the identified sites; 3) Documenting the practical experience about the use of the app, collection of data, and users’ feedback; 4) Summary of lessons learned, and recommendations for possible operational use of the app. Nine campaigns were organised in Bulgaria as individual events or together with other scientific activities (e.g. during the ESENIAS-TOOLS Project Information Day with a Field Trip, the Forty-Eight National Assembly of the Association of Municipal Environmental Experts in Bulgaria, and the student practices). Sometimes the information campaigns were organised separately (on different dates) from the field testing campaigns, depending on the number and availability of participants, but usually they were held together (on the same dates). Presentations and posters were delivered to participants during the information campaigns. Additionally, the following supporting materials were prepared and distributed among participants in electronic or printed format:

- General information about IAS and information about the project;
- A list of the 37 IAS of EU concern, with pictures and information about characteristic features, distribution and impact of the species;
- Instructions to install and use the smartphone application ‘Invasive Alien Species in Europe’.

A total number of 235 representatives of all identified stakeholder groups – scientists, students, local authorities, non-governmental organisations, companies, and citizens, including the project participants took part in the information and testing campaigns. A total of 50 sites were visited during the project. At most of the sites (in the field) different sampling techniques were applied for collection of the samples and demonstrations, while at some of the sites (botanical garden, zoo, parks) only observations were done. Nine species of EU concern were observed and 37 sightings were recorded with the app. The results from the feedback obtained from participants after the testing showed the urgent need of raising of public awareness on IAS in the region.

The activities on the promotion and demonstration of the IAS smartphone application have been continued and further developed under the ongoing project: ‘Increasing understanding of alien species (AS) through citizen science: Approaches to citizen science, data management and standards in Bulgaria’ (№ KP-06-COST-13). Some of the objectives of this project are: – to explore novel ways to increase the level of participation in IAS related CS and to reach non-traditional audiences of citizen scientists, through translating the app in Bulgarian, including IAS of national/ regional concern, and promoting the app among different stakeholder groups; – to coordinate activities

related to the collection and validation of data with the app in Bulgaria together with the EC JRC and EASIN; and – to facilitate IAS data mobilisation, communication and awareness raising in Bulgaria.

IAS Questionnaire surveys. Although the main task of the questionnaires is to assess the level of awareness of the respondents on a given topic, to a great extent they also raise the awareness of the respondents on the given topic, provoking them to search and analyse information. To assess the public perception and awareness of IAS in Bulgaria self-completion questionnaire surveys were conducted in Bulgaria. In addition to specific questions, each questionnaire contained general questions related to IAS aiming to understand how much the participants are acquainted with the problem. The respondents were asked to make judgements about their own level of knowledge about the impact, pathways, management and regulatory framework related to IAS. The questionnaires developed in the framework of IAS related projects had different objectives and target groups as follows:

- focusing on the level of awareness of tree ‘professionals’ that are individuals with a current livelihood linked to trees, woods or forests on the pathways of introduction and spread of plant pests (PERMIT) (Marzano et al. 2016);
- focusing on the level of awareness of the authorities on the legislation and regulations regarding import of propagation material and establishment of plantings, using imported material of exotic species (Global Warning) (Vettraino et al. 2019);
- focusing on the assessment of IAS citizen science activities (Alien-CSI and KP-06-COST-14);
- focusing on the level of awareness of professionals and citizens about general IAS issues (BIOREX and KP-06-COST-14);
- focusing on the assessment of most appropriate approaches for engaging citizens with citizen science (KP-06-COST-14)
- collecting feedback from participants tested the practical use of the smartphone application ‘Invasive Alien Species Europe’ and the level of their awareness on the IAS, IAS of EU concern, and the Regulation (EU) 1143/2014 on the prevention and management of the introduction and spread of IAS (Danube-IASapp).

Published IAS awareness raising materials. Along with the numerous scientific publications, different flyers and brochures related to IAS have been published as tasks under the above mentioned IAS projects in Bulgaria. All materials are available on-line at <http://www.esenias.org/>. A book ‘Guide to invasive alien species of European Union concern’ (Trichkova et al. 2017a) was prepared and published in Bulgarian. The book contains information about taxonomy, morphology, biological and ecological traits, origin, general distribution, original data about distribution in Bulgaria, habitats, pathways of introduction and spread, and impact of 37 IAS of EU concern listed in the Regulation (EU) № 1143/2014. A mini guide to invasive alien species, developed in the framework of the COST Action Alien-CSI was translated in Bulgarian and has been currently distributed during the public events.

IAS exhibition. Within the frame of the ESENIAS-TOOLS project, a permanent exhibition of IAS was prepared and opened at the National Museum of Natural History – Sofia (NMNHS), the Bulgarian Academy of Sciences. One of the specific objectives of the NMNHS educational programmes is the improvement of the synergies between teachers, parents and children, and active professionals for the implementation of new initiatives in the field of environmental education, especially related to IAS. The exhibition includes specimens of IAS of EU as well as of national concern.

IAS trainings. Trainings of different stakeholder groups on IAS related issues were organised in the framework the ESENIAS-TOOLS project. Furthermore, an international training course entitled ‘Impact of invasive alien species on biodiversity and ecosystem services in extreme environments’ was co-organised by the IBER-BAS, Reykjavik University, Iceland, East and South European Network for Invasive Alien Species (ESENIAS) and Danube Region Invasive Alien Species Network (DIAS) under the same project. A total of 11 lecturers from 7 countries (Bulgaria, Iceland, France, R. North Macedonia, Poland, Turkey, and United Kingdom) trained 60 participants from 9 countries (Bulgaria, Iceland, Italy, France, Poland, R. of North Macedonia, Serbia, Turkey, and United Kingdom).

Scientific forums. A key role in the IAS awareness raising among professionals in the region has played the scientific conferences and workshops organised by the ESENIAS and DIAS networks. The conferences have been organised every year by different country in the region and under a specific topic. The most recent forums are as follows:

- The 7th ESENIAS Workshop with Scientific Conference ‘Networking and Regional Cooperation Towards Invasive Alien Species Prevention and Management in Europe’, 28–30 March 2017, Sofia, Bulgaria;
- The 4th Danube Region Invasive Alien Species Network (DIAS) meeting ‘Cooperation towards the IAS Strategy in the Danube Region’, 30 March 2017, Sofia, Bulgaria.
- The Joint ESENIAS and DIAS Scientific Conference ‘Management and sharing of IAS data to support knowledge-based decision making at regional level’ and 8th ESENIAS Workshop, 26-28 September 2018, Bucharest, Romania;

- The 5th Danube Region Invasive Alien Species Network (DIAS) Meeting will be held on 12-13th December 2018, in Sofia, Bulgaria; and
- The Joint ESENIAS and DIAS Scientific Conference and 9th ESENIAS Workshop ‘Species, ecosystems and areas of conservation concern under threat from the invasive alien species’, 03–06 September 2019, Ohrid, Republic of North Macedonia.

Round tables. Three round tables organised recently in the framework of the project ‘Support for the Development of Scientific Capacity at the University of Forestry’ were dedicated to biodiversity, IAS and citizen science: (1) The contribution of citizen science to the sustainable management of biological resources, (2) The role of the university, scientific and governmental institutions in engaging the general public with citizen science, and (3) Wet zones biodiversity and sustainability.

Networking. To meet the necessity of cooperation and coordinated actions related to IAS at regional level, two networks have been established and developed in the region. The ESENIAS network was established in 2011 to facilitate solving IAS issues in the Balkan countries. Currently, 16 member countries have been involved in the ESENIAS activities: exchange and sharing of IAS information, capacity building, research, policy development and harmonisation. One of the main activities of ESENIAS has been promoting of awareness raising and capacity building initiatives on IAS within all countries in the region, by organisation of yearly workshops. In 2014 the Danube Region Invasive Alien Species Network (DIAS) was established within the frames of Priority Area 06 of the European Union Strategy for the Danube Region, International Association of Danube Research (IAD), and ESENIAS. Countries from the Upper, Middle and Lower Danube River basin, as well as adjacent Black Sea region participate in the network. DIAS strategy and work plan have been under development (Trichkova et al. 2017b).

4. CONCLUSIONS

The projects and initiatives focusing on IAS conducted during the last five years in Bulgaria contributed to an establishment of a core group of IAS experts in Bulgaria dedicated to the study of IAS, as well as to the implementation of IAS awareness raising, citizen science and networking activities among a wide range of stakeholders (scientists, teachers, decision-makers, managers, students, and the general public). Despite the efforts of scientists most of the non-professionals are still not aware of the IAS negative impact, pathways of introduction, as well as the risk posed by trade and keeping of exotic plants and pets, and their intentional or unintentional release into the environment. A national IAS campaign is needed for changing of the public attitude towards IAS, in order to prevent their introduction and spread in Bulgaria. Local authorities can play a key role in helping to address the risks associated with biological invasions and can contribute to IAS awareness raising among decision-makers and citizens.

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