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Editorial

Towards a better early detection and rapid response system against invasive alien species in forests

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Forests are one of the most species diverse biomes on this planet and provide many different ecosystem services (Mori et al. 2017). Along with climate change and habitat destruction, invasive alien species (IAS) are one of the largest threats to the natural and semi-natural forests (Lockwood et al. 2013). IAS have strong effects on biodiversity, the economy and health (Olson 2016; Schindler et al. 2015; Vila et al. 2011). To deal with this problem, one of the main targets of IAS management in Europe is the development of an early detection and rapid response (EDRR) system for IAS. Such an EDRR system will enable the detection (and removal) of IAS early enough so that they do not become harmful to other species and (forests) ecosystems (Clout and Williams 2009). As most European Union (EU) member countries are only in the beginning stages of developing EDRR systems, it is of utmost importance that experts, policymakers and practitioners communicate and cooperate on these issues.

The project LIFE ARTEMIS – Awareness, training and measures on IAS in forests (LIFE15 GIE/SI/000770) ran from 2016 to 2020 in Slovenia. The aim of this project was to contribute to the reduction of the harmful impacts of IAS on biodiversity by increasing public awareness and by setting up an effective EDRR framework for IAS in forests. One of the main activities was the final conference "Detection and control of forest invasive alien species in a dynamic world", which was organized from September 25-29 2019 in Ljubljana, Slovenia. During the conference, experts, policymakers and practitioners had the opportunity to present their activities regarding their work on IAS. There were 57 diverse presentations and posters which were balanced between topics such as plant health and other IAS and covered different taxa such as fungi, plants, insects, birds and mammals.

This special issue contains eight papers on different topics regarding EDRR against potential IAS in forests. De Groot et al. (2020) discusses the challenges surrounding the early detection and rapid response system. Smerdu et al. (2020) and Hoch et al. (2020) present methods used in EDRR. Furthermore, there are examples of addressing problematic species such as *Dothistroma* species presented (Ghelardini et al. 2020). Two papers deal with citizen science in EDRR systems (Crow et al. 2020; Pocock et al. 2020). Also, the human component related to the importance of public awareness of IAS is addressed by Šipek and Šajna (2020). The last article is an example of good practice for invasion management regarding the invasive grey squirrel (*Sciurus carolinensis*) in the UK (Shuttleworth et al. 2020).

The first article is about challenges and solutions in EDRR systems in forests (de Groot et al. 2020). This article is the outcome of the three workshops held during the conference, in which many international IAS experts participated. During the workshops, four model species were chosen to identify the challenges in EDRR: American pokeweed (*Phytolacca americana*), grey squirrel, the emerald ash borer (*Agrilus planipennis*), and *Geosmithia morbida*, the causal agent of the thousand canker disease. The similarities and challenges of EDRR and communication across the species were identified. One of the main outcomes was that collaboration between institutions dealing with plant health pests and IAS of EU concern can lead to the control of both groups of unwanted organisms in forests.

Two articles focus on methods which are used in the detection of IAS in forests. Smerdu et al. (2020) present techniques to detect Japanese knotweed (*Fallopia japonica*) from aerial photos and satellite images. The method was tested in Ljubljana, Slovenia and was checked by experts. They concluded that 83% and 90% of detected *Fallopia* stands were correctly detected from the aerial photos. This could therefore be a useful tool for the detection of this highly invasive species, which could enhance its management. Hoch et al. (2020) tested a multiple-lure approach to detect a wide variety of longhorn beetles (Coleoptera, Cerambycidae) in high-risk areas for the introduction of invasive tree pests. As a result, they detected species of different subfamilies, which shows that this way of surveillance could be an effective way of detecting potential IAS.

In forests there are many IAS with harmful effects. Ghelardini et al. (2020) present in their paper the status of an infectious disease of pine trees, *Dothistroma pini* and *D. septosporum*. They show that the distribution and the host range is much larger than previously reported, which could have a strong impact on the management of these species.

For the detection of IAS, not only experts are needed, but citizens and the citizen science approach would be very helpful, because more people searching increases the probability of finding potential IAS. In the article by Crow et al. (2020), the results of two citizen science projects in plant health were discussed: Observatree in the UK and LIFE ARTEMIS in

Slovenia. Both projects invested a great deal in awareness-raising and species recognition. In both countries, citizen scientists became a part of the tree health monitoring system.

But involving citizen scientists in monitoring systems also raises ethical questions, which are discussed in Pocock et al. (2020). They discuss dilemmas arising from the consequences of detection. They present plant health citizen science and their experiences with these types of dilemmas. It is important to know that in order to have the support of citizen scientists, stakeholders should communicate among each other, especially if citizen science will be used for the early detection of tree pests and diseases.

It is therefore important to understand the public's attitude towards IAS and the possible implications of their actions. Šipek and Šajna (2020) conducted an extensive research on attitudes towards plant IAS and management of waste disposal in urban forests, which is an important pathway for the introduction of invasive plants. They found out that people who were aware of IAS problems were less likely to dispose of garden waste. This means that awareness-raising is an important factor in the prevention of introduction. Furthermore, previous knowledge on species recognition could lead to better use of early detection by citizens.

Last but not least, Shuttleworth et al. (2020) showed good practices in the management of the grey squirrel in Europe. This species is already widespread in the UK and threatens biodiversity. Their article presents how setting up volunteer groups can be helpful in the detection and the removal of this species. They showed the lessons learned during the whole process of the removal of the grey squirrel in certain areas of Europe.

Altogether, the LIFE ARTEMIS conference was a great success bringing together many interesting presentations and stimulating lively debates about IAS management in forests. This special issue contains a collection of the articles which we hope will reflect the content and spirit of the conference. The many lessons learned during the conference and in the articles will hopefully be useful for the future management of IAS in forests.

References

Clout MN, Williams PA (2009) Invasive Species Management, A Handbook of Principles and Techniques. Oxford University Press, Oxford, 308 pp

Crow P, Perez-Sierra A, Kavčič A, Lewthwaite K, Kolšek M, Ogris N, Piškur B, Kus Veenvliet J, Zidar S, Sancisi-Frey S, de Groot M (2020) Using Citizen Science to monitor the spread of tree pests and diseases: Outcomes of two projects in Slovenia and the UK. *Management of Biological Invasions* 11: 703–719, https://doi.org/10.3391/mbi.2020.11.4.06

de Groot M, O'Hanlon R, Bullas-Appleton E, Csóka G, Csiszár Á, Faccoli M, Gervasini E, Kirichenko N, Korda M, Marinšek A, Robinson N, Shuttleworth CM, Sweeney J, Tricarico E, Verbrugge L, Williams D, Zidar S, Kus Veenvliet J (2020) Challenges and solutions in early detection, rapid response and communication about potential invasive alien species in forests. *Management of Biological Invasions* 11: 637–660, https://doi.org/10.3391/mbi.2020.11.4.02

Ghelardini L, Aglietti C, Loria F, Cerboneschi M, Gionni A, Goti E, Maresi G, Moricca S, Marchi G (2020) Dothistroma Needle Blight in protected pine forests in Italy. *Management of Biological Invasions* 11: 689–702, https://doi.org/10.3391/mbi.2020.11.4.05

Hoch G, Connell J, Roques A (2020) Testing multi-lure traps for surveillance of native and alien longhorn beetles (Coleoptera, Cerambycidae) at ports of entry and in forests in Austria. *Management of Biological Invasions* 11: 677–688, https://doi.org/10.3391/mbi.2020.11.4.04

Lockwood JL, Hoopes MF, Marchetti M (2013) Invasion ecology. John Wiley & Sons, New Jersey, 466 pp

Mori AS, Lertzman KP, Gustafsson L (2017) Biodiversity and ecosystem services in forest ecosystems: a research agenda for applied forest ecology. *Journal of Applied Ecology* 54: 12–27, https://doi.org/10.1111/1365-2664.12669

Olson LJ (2016) The Economics of Terrestrial Invasive Species: A Review of the Literature. *Agricultural and Resource Economics Review* 35: 178–194, https://doi.org/10.1017/S1068280500010145

Pocock MJO, Marzano M, Bullas-Appleton E, Dyke A, de Groot M, Shuttleworth CM, White R (2020) Ethical dilemmas when using citizen science for early detection of invasive tree pests and diseases. *Management of Biological Invasions* 11: 720–732, https://doi.org/10.3391/mbi.2020.11.4.07

Schindler S, Staska B, Adam M, Rabitsch W, Essl F (2015) Alien species and public health impacts in Europe: a literature review. *NeoBiota* 27: 1–23, https://doi.org/10.3897/neobiota.27.5007

Shuttleworth CM, Robinson N, Halliwell EC, Clews-Roberts R, Peek H, Podgornik G, Stinson M, Rice S, Finlay C, McKinney C, Everest DJ, Larsen KW (2020) Evolving grey squirrel management techniques in Europe. *Management of Biological Invasions* 11: 747–761, https://doi.org/10.3391/mbi.2020.11.4.09

Smerdu A, Kanjir U, Kokalj Ž (2020) Automatic detection of Japanese knotweed in urban areas from aerial and satellite data. *Management of Biological Invasions* 11: 661–676, https://doi.org/10.3391/mbi.2020.11.4.03

Šipek M, Šajna N (2020) Public opinions and perceptions of peri-urban plant invasion: the role of garden waste disposal in forest fragments. *Management of Biological Invasions* 11: 733–746, https://doi.org/10.3391/mbi.2020.11.4.08

Vila M, Espinar JL, Hejda M, Hulme PE, Jarošik V, Maron JL, Pergl J, Schaffner U, Sun Y, Pyšek P (2011) Ecological impacts of invasive alien plants: a meta-analysis of their effects on species, communities and ecosystems. *Ecology Letters* 14: 702–708, https://doi.org/10.1111/j.1461-0248.2011.01628.x