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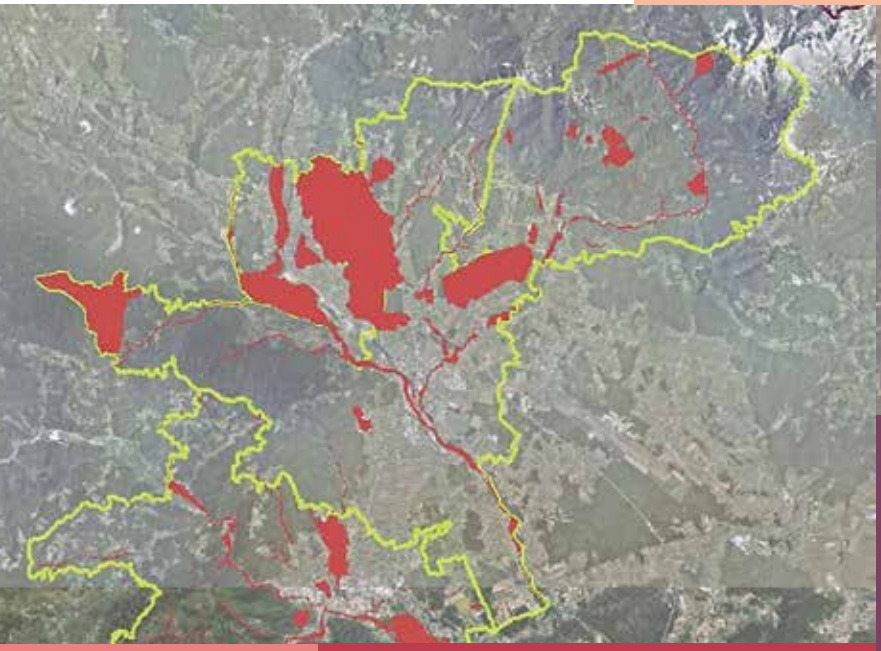

Manual

for site-specific risk assessment of non-native tree species in the Alpine Space

D.T1.5.2

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Manual for site-specific risk assessment of non-native tree species in the Alpine Space

Site-specific risk assessment manual for non-native tree species in the Alpine Space

Project Activity: D.T.1.5.2
Prepared by: Anja Bindewald (FVA) & Katharina Lapin (BFW)

Summary

Non-native tree species (NNT) are used in forestry across the Alpine Space for their growth performance, valuable timber, and resistance to drought and pest or pathogen damage. Yet, cultivating NNT may pose risks to biodiversity and associated ecosystem services, and several NNT are evaluated as invasive in some regions in the Alpine Space. Such conclusions typically follow the results of a risk assessment, which do not adequately consider site-specific variations in impacts and the extent of the affected area. Here, we present a new methodological framework to mitigate risks associated with NNT while taking advantage of the ecosystem services that certain tree species can provide. The framework is based on a stratified assessment of risks posed by NNT that distinguishes between different ecosystem types or sites and considers the effectiveness of available management strategies to mitigate negative effects. The method can be applied to both existing and not-yet-existing NNT in a given area of interest. The framework is divided into 8 steps and the first steps are based on relevant existing knowledge. If adequate site-specific knowledge on NNT does not yet exist, the aim of the other steps is to gain new evidence, for example by analysing monitoring data, or applying ecological models to simulate the potential distribution of selected NNT. To test the application of the SSRA methodology, the eight steps were applied in the Gorenjska region of Slovenia to assess the risks of the NNT *Ailanthus altissima*, *Quercus rubra*, *Rhus typhina*, *Aesculus hippocastanum* and *Pseudotsuga menziesii*.

Introduction

Non-native tree species (NNT) are used in Alpine Space forests because of their specific wood properties, fast growth rates or to improve forestry and diversify the portfolio of suitable native tree species. Especially when native trees are no longer able to fulfill crucial forest functions due to increasing global temperature, NNT better suited to future climate could be planted to adapt forest ecosystems and to mitigate negative effects of climate change. Yet, large-scale cultivation of certain NNT can entail risks for biodiversity and related ecosystem services, and therefore some tree species require a dedicated risk assessment of invasive potentials. Particularly when NNT may spread into areas of high conservation value their use close to protected areas can conflict with nature conservation objectives. Such controversial NNT often cause debates over how existing and future forest stands should be managed and if new stands should be promoted. Therefore, it is important to assess any risk associated with the usage of NNT to identify species with low risks that can be integrated into forest management.

In general, a "risk assessment" can be defined as the standard evaluation of (potential) negative impacts associated with the introduction, establishment, and spread of a NNT (see Glossary of key terms). In the INTERREG Alpine Space project ALPTREES, we developed a new methodological framework of a "site-specific risk assessment" (hereafter SSRA) during several workshops with the project partners and observers (Bindewald et al. 2021). Although a plethora of methods do exist, in comparison to already existing methods, the SSRA novelty is based on a stratified assessment of risks posed by NNT that distinguishes between different ecosystem types or sites. The assessment method therefore enables to consider the regional context as well as the effectiveness of available management strategies to mitigate negative effects in the area of interest. It serves as a decision support system for the selection of sites, NNT, and silvicultural methods for limiting potentially associated risks, while taking advantage of the ecosystem services of potentially beneficial NNT.

Glossary of key terms

- **NNT:** *"non-native", "alien", "introduced", "exotic", "non-indigenous", or "allochthonous" tree species whose presence is the result of human activity (Krumm and Vítková 2016).*

- **IAS:** *invasive alien species, i.e. non-native species "whose introduction and/or spread outside their natural past or present distribution threatens biological diversity" (COP VI/23 CBD 2002).*

- **Negative impacts of NNT:** *undesired ecological or socio-economic effects associated with NNT. In Europe, four environmental impact mechanisms have been related to NNT (Pötzelsberger et al. 2020): competition, hybridization, disease transmission, and alteration of the structure and function of ecosystems (Blackburn et al. 2014).*

- **Risk**: *the likelihood of negative impacts associated with NNT introduction, establishment, and/or spread and the magnitude of their consequences (ISPM 2, FAO 2007). Includes uncertainty regarding the actual effects, even for NNT for which data is considered adequate.*

- **Risk assessment (RA):** *a standard method for evaluating (potential) negative impacts associated with the introduction, establishment, and spread of a non-native species. RA serves as the information basis for prioritization of risk management and risk communication (ISPM 11, FAO 2017).*

- **Risk management:** *a method for analysis, identification, implementation, and communication of appropriate management options to reduce the risk posed by invasive alien species (ISPM 11, FAO 2017).*

- **Site**: *a location, habitat, or ecosystem type characterised by a specific assemblage of species, a specific abiotic environment (e.g. Bland et al. 2018), and a specific objective of management (Nyssen et al. 2016).*

- **Site-specific risk assessment (SSRA)**: *a stratified assessment of risks posed by NNT that distinguishes between different sites.*

Principles

The manual is guided primarily by the following principles:

1. **Transparency and tracking of uncertainty:** All underlying data used to assess risks associated with NNT must be prepared and discussed in terms of their quality, robustness, and relevance to the area being studied to provide a solid evidence base for further communication.
2. **Evidence-based decision support:** The evaluation should be based as much as possible on the analysis of quantitative data to contribute significantly to research and ensure reliability and repeatability.
3. **Site-specific nature:** The results of the SSRA are applicable to the respective site only (as defined here) and cannot be transferred or generalized to any other site without evaluation of the corresponding site-specific information.
4. **Time-bound nature:** The dynamics of spatial distribution of NNT may change in future, for example due to unpredicted alterations under climate change, disturbance, or pest and disease damage.

The SSRA Manual

The manual consists of a step-by-step guidance to provide (forest) research institutes, forest enterprises, local and national authorities with an end-user friendly framework to manage NNT sustainably. The overall aim of SSRA is to help decide where and how and which NNT can be used to limit potentially associated risks in a specific area of interest. The SSRA is structured in 8 steps and for each step, certain target information need to be collated by the assessor(s). Figure 1 provides an overview of the individual steps and the respective aim (see Bindewald et al. 2021 for a comprehensive overview of the individual steps).

Different management scenarios following SSRA of NNT

The outcome of the SSRA is to classify NNT into four different risk-related groups following the SSRA decision tree (see Figure 2 for decision tree):

(a) NNT for which the information is too scarce to arrive at a conclusive assessment of the risks.

NNT for which there is no information on their life strategies, taxonomic status, adaptability to eco-climatic factors, or other characteristics that affect their ability to establish and disperse unintentionally represent unknown risks. To improve the information base, more data should be collected on such species under low-risk conditions.

(b) NNT that currently pose no risks.

If no negative impacts could be identified for the NNT concerned, the use of these species can currently be considered safe. The Mediterranean Lebanon cedar (*Cedrus libani* A.Rich), which has seen only little use in forestry in the Alpine space so far, is an example of a NNT currently involving no or low risks. Due to its scarce occurrence in the Alpine region (except for ornamental plantation), nothing has been reported yet about the Lebanon cedar's invasive potential; it is assumed to be low due to the species' characteristics, however. Therefore, there is no need to take urgent measures, but the species should be carefully monitored for any change in its behaviour.

(c) NNT that can pose risks only in some environmental contexts, and such risks can be kept at low level.

NNT with potential negative impacts on sensitive ecosystems and native species communities may still be relatively safe to use, if management practices exist that exclude or strongly control such risks. For example, Douglas fir (Pseudotsuga menziesii (Mirb.) Franco) is considered important because of its high productivity and drought tolerance but it can also pose risks on certain sites of high conservation value. Because Douglas-firs can be controlled with relatively little effort by way of stem removal in adult trees, cutting of seedlings and establishing buffer zones around protected areas, the species can still be used sustainably.

(d) NNT expected to always pose high risks and that cannot be controlled by specific management measures.

If the negative impacts caused by the NNT are not reversible or cannot be excluded by cost-effective management measures, the use of these NNT should be discontinued. For example, the black cherry (*Prunus serotina* Ehrh.) poses risks to a range of different ecosystems in the Alpine space. From a nature conservation perspective, establishment of the species in semi-natural habitats such as grasslands or open forests is particularly problematic. However, the species is widespread and abundant across a range of ecosystems in the Alpine space, and complete eradication in the entire region is therefore no longer feasible. Moreover, long-distance dispersal by birds makes it difficult to implement effective buffer zones. In addition, black cherry trees resprout intensively after disturbances, making it challenging to get rid of the species, at least in the short term. Therefore, the black cherry should no longer be promoted and the risk of further spread into endangered areas kept as low as possible.

In terms of sustainable land use, silvicultural strategies should therefore focus on tree species in categories 2) and 3) while continuously improving the information base for risk assessments.

An example of the application of the eight SSRA steps in Slovenia can be found in the following section.

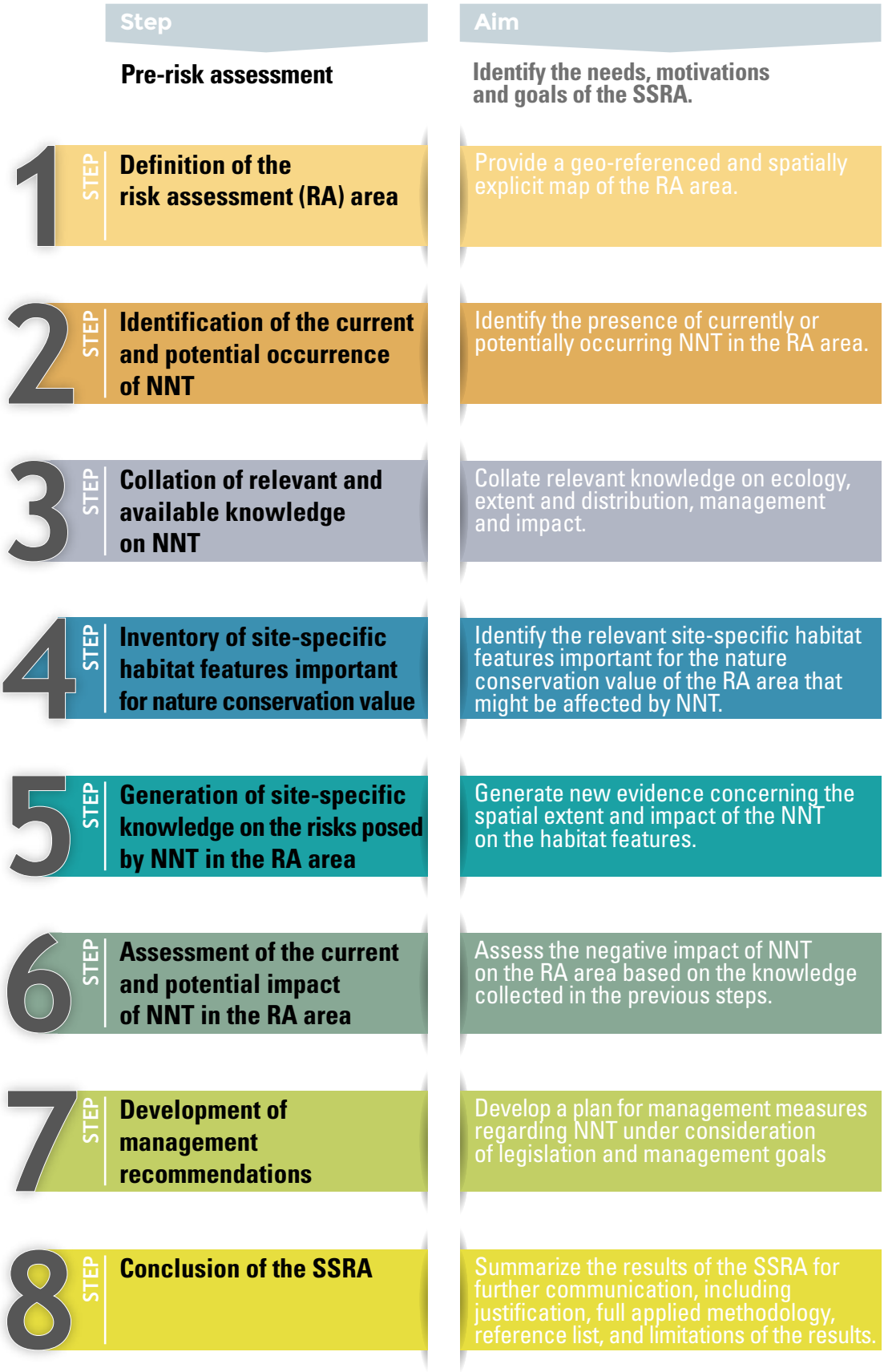

Figure 1: *Overview of the steps of the site-specific risk assessment (SSRA) to assess risks and management options associated with NNT (adapted from Bindewald et al. 2021).*

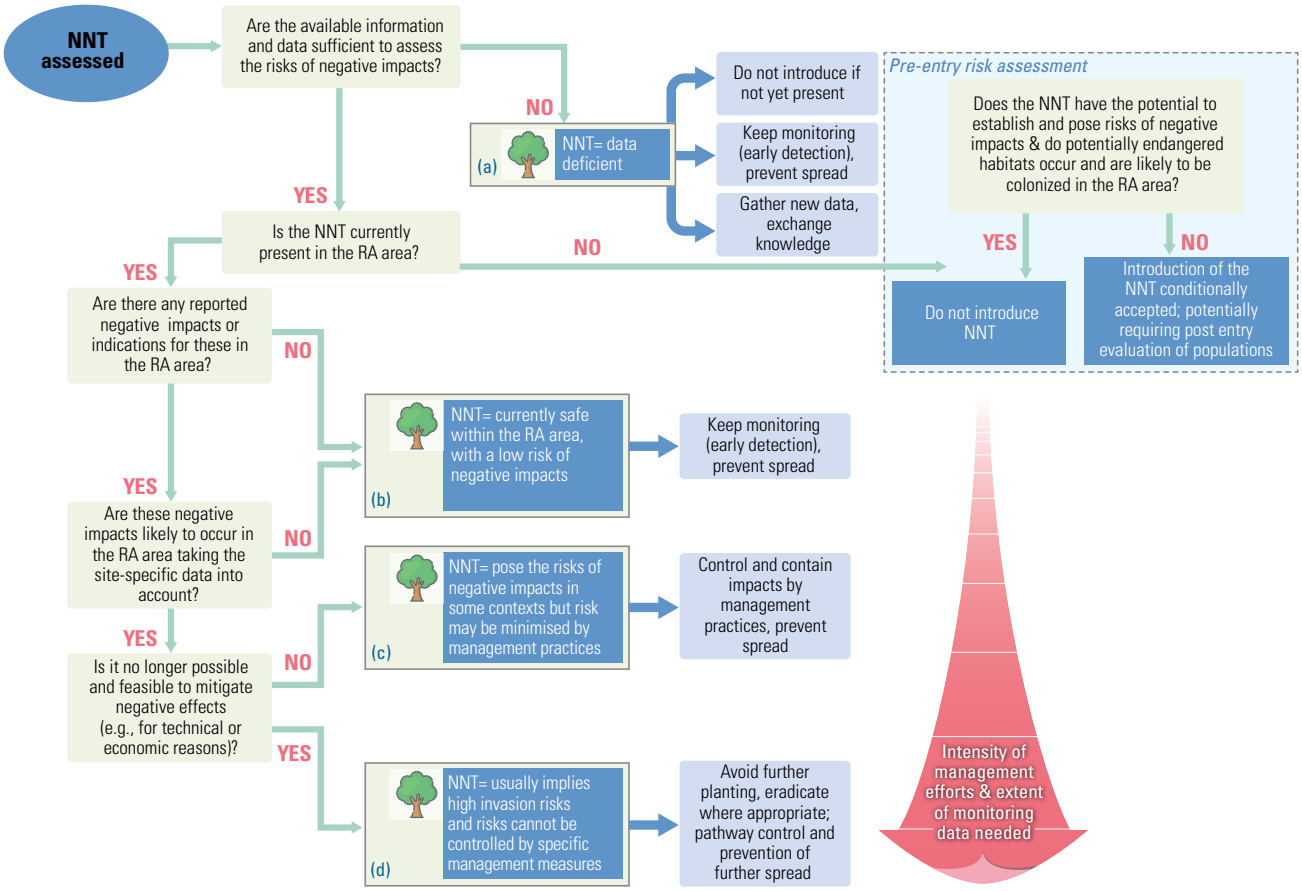

Figure 2: *Decision tree demonstrating practical application of the SSRA (Bindewald et al. 2021).*

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Testing methodology of SSRA in the Alpine Space: Risk assessment of several (potentially) invasive non-native tree species in the Gorenjska region, Slovenia

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Project Activity: D.T.1.5.1
Prepared by: Ana Dolenc, Sonja Rozman and Andrej Štembergar Zupan (all three Institute of the Republic of Slovenia for Nature Conservation), Aleksander Marinšek (Slovenian Forestry Institute) and Darja Barič (Development Agency Sora)

Pre-risk assessment (Step 0)

The objective was to assess the risks of several (potentially) invasive NNT occurring in the Gorenjska region in Slovenia. This region has been pre-selected based on the existing datasets and the effective demonstration of communication and active involvement of policymakers and stakeholders in the assessment process.

The NNT *Ailanthus altissima, Quercus rubra, Rhus typhina, Aesculus hippocastanum* and *Pseudotsuga menziesii,* are used for forestry and/or ornamental purposes and were selected for the SSRA due to their invasive potentials.

Step 1: Defining the risk assessment (RA) area

The SSRA was conducted in four Municipalities in Gorenjska region: Kranj, Škofja Loka, Naklo and Preddvor (Fig. 3).

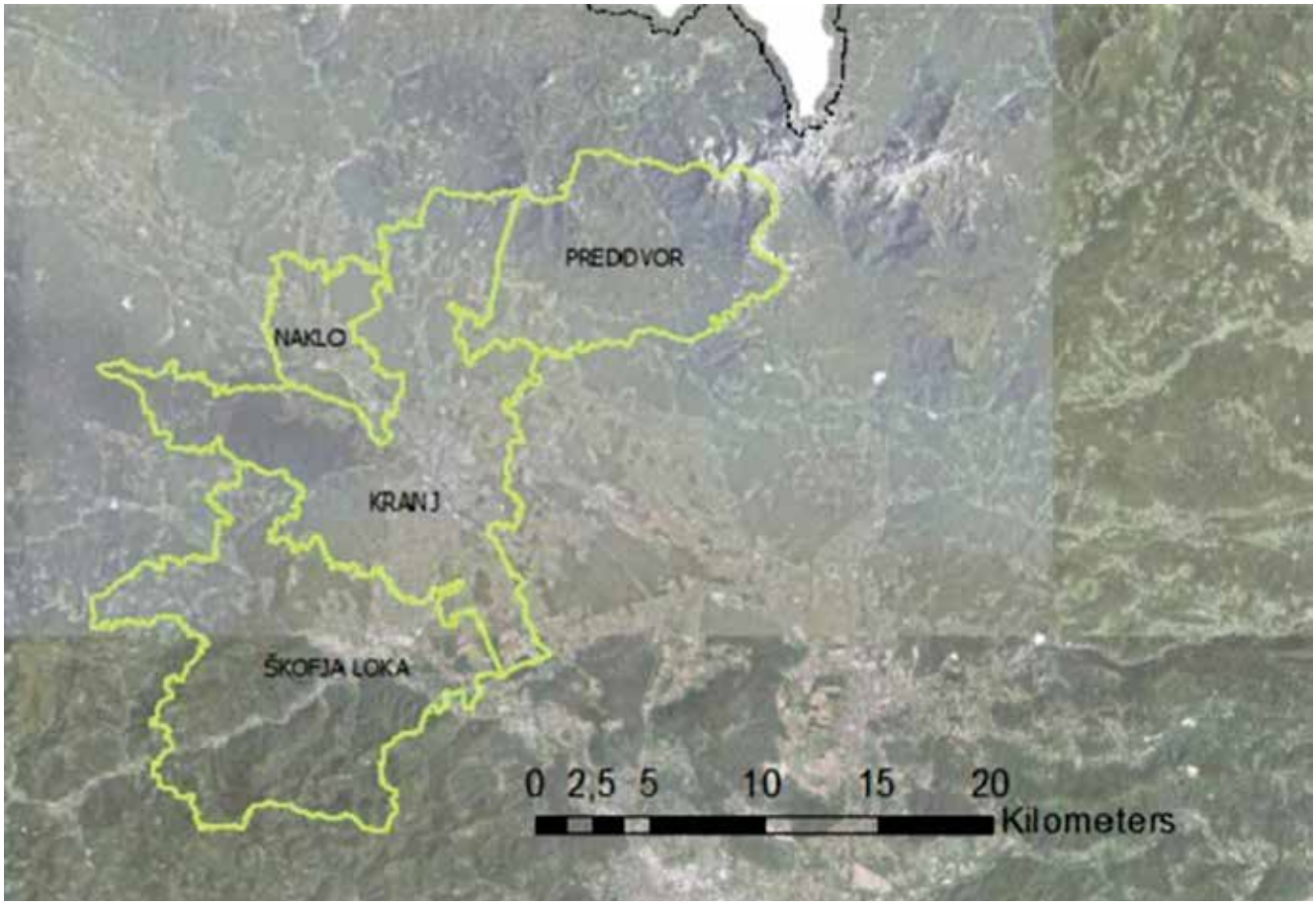

Figure 3: *: Risk assessment area is located in Gorenjska region and consists of 4 pilot municipalities*

Step 2: Identifying the occurrence of NNT in the RA area

Existing data bases, Invazivke and Tree Cadastre of Municipality of Kranj, were revised and all existing location of pre-selected NNT was mapped (Fig. 4). P. menziesii was not recorded in any of before mentioned sources, but we knew of its presence in Preddvor pilot area.

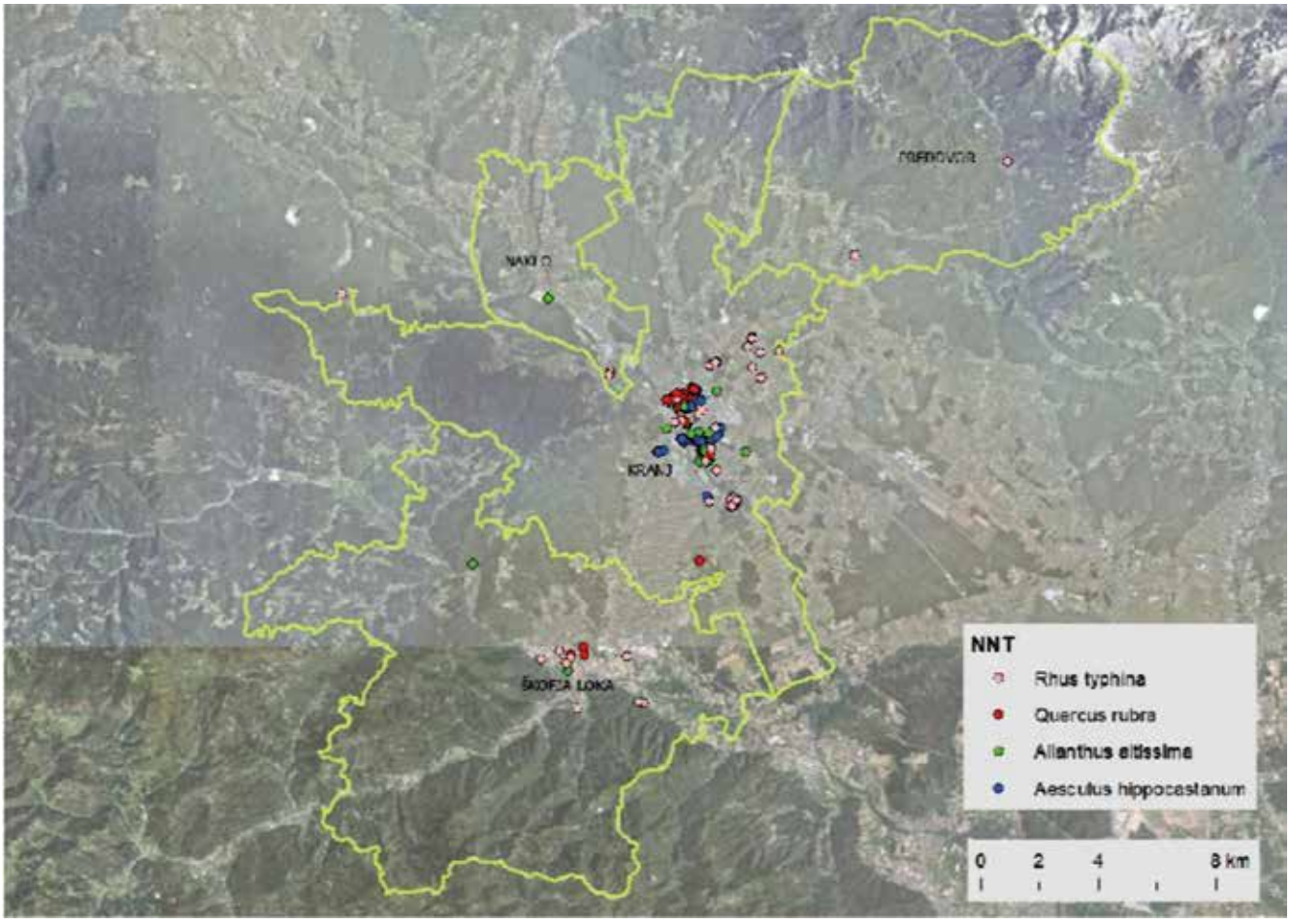

Figure 4: *Occurrence of pre-selected NNT in the pilot areas; registered in Invazivke database and Tree cadastre of Municipality of Kranj.*

Step 3: Collating the relevant and available knowledge on the NNT

Basic relevant and available knowledge on ecology and reproduction was collated. Site-specific knowledge of pre-selected NNT is scarce, in particular for Gorenjska region and even more specific for the four pilot Municipalities. For that reason, we also included in the risk assessment relevant information from experts and professionals in the field of forestry, nature conservation and horticulture, as well as Municipalities and the Ministry of the Environment and Spatial Planning representatives, who attend Alptrees workshops, which were organized in Slovenia, in national and regional level.

Furthermore, we gathered information on legislation, which applies for non-native species in Slovenia. Under the Nature Conservation Act (Official Gazette RS, No. 96/2004), the intentional introduction of non-native plant or animal species is prohibited. The competent ministry may exceptionally permit the introduction of non-native plants, mostly for agricultural and forestry use, when it has been determined during the risk assessment, that the activity affecting nature, shall not endanger the natural balance or biodiversity components. Also, according to Slovenian legislation non-native species in Natura 2000 should not be introduced. Apart from that, one of the objectives for conservation of priority habitat types for Slovenia is also to promote conservation of a typical biocenosis composition for habitat type without non-native species.

Step 4: Inventory of site-specific habitat features for nature conservation value

Inventory of the site-specific habitat features showed that Natura 2000 area is present on approx. 27 % and valuable natural features on approx. 14 % of the RA area (Fig. 5 and 6). Fig. 7 and 8 show forest habitat types of significant importance for nature conservation inside of RA area. The aim of nature conservation is to maintain a favourable conservation status of forest habitats in order to preserve the typical native species communities.

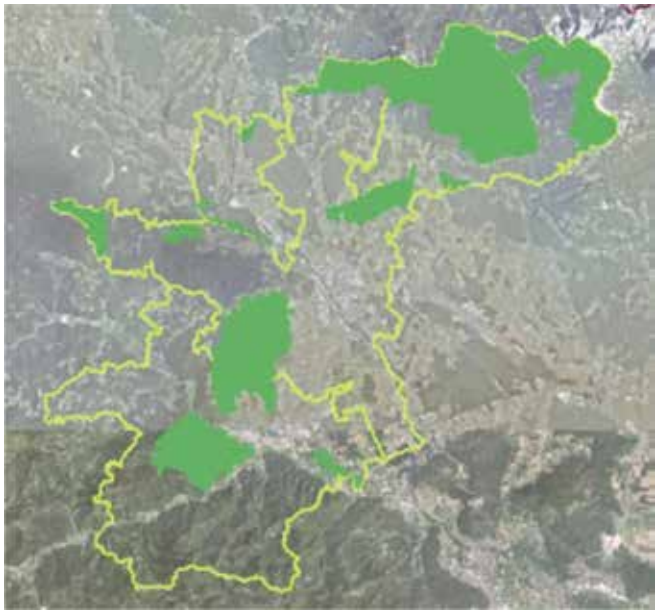

Figure 5: *Natura 2000 sites (green) in the RA area*

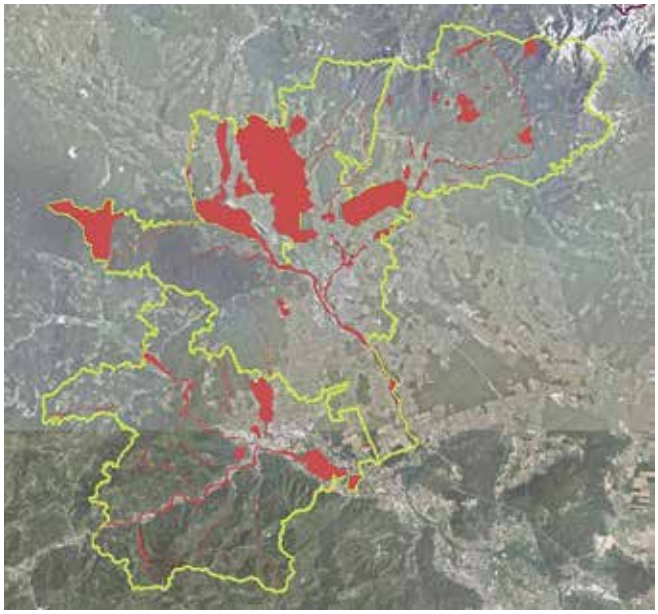

Figure 6: *Valuable natural features (red) in the RA area*

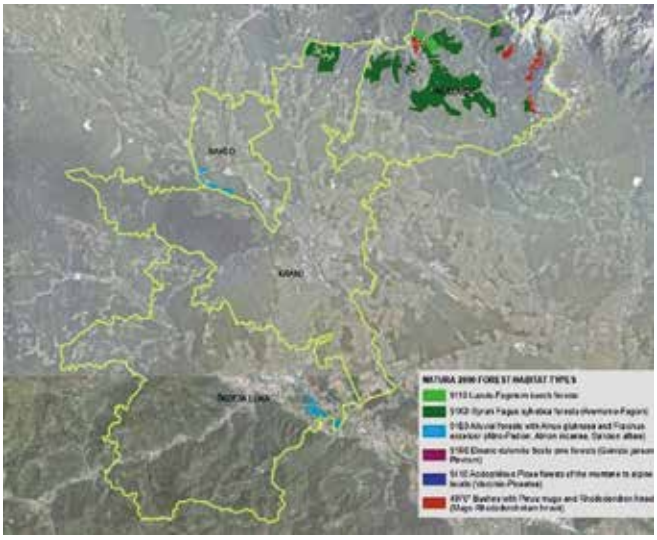

Figure 7: *): Forest habitat types of outstanding conservation value located in Natura 2000 areas in the RA*

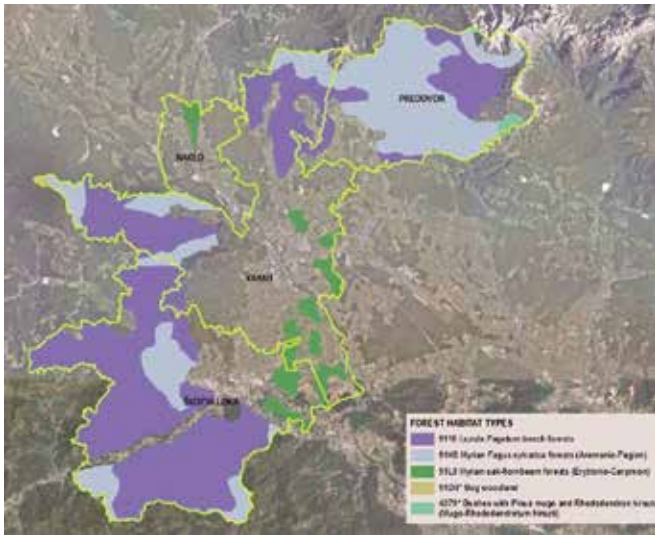

Figure 8: *Priority forest habitat types in Slovenia (Decree on habitat type)*

Step 5: Generating site-specific knowledge on the risks posed by NNT in the RA area

Additionally, data on locations of pre-selected NNT were gathered through Slovenian Forestry Service data on NNT in Slovenia and our inventory of NNT in pilot areas (Fig. 9-12). Analysis of existing and new data showed, that pre-selected NNT are present in 6 habitat types HT-91L0, HT-91K0, HT-9110, HT-91E0*, HT-9180* and HT-3240. In the last three habitat types only *A. hippocastanum* was present.

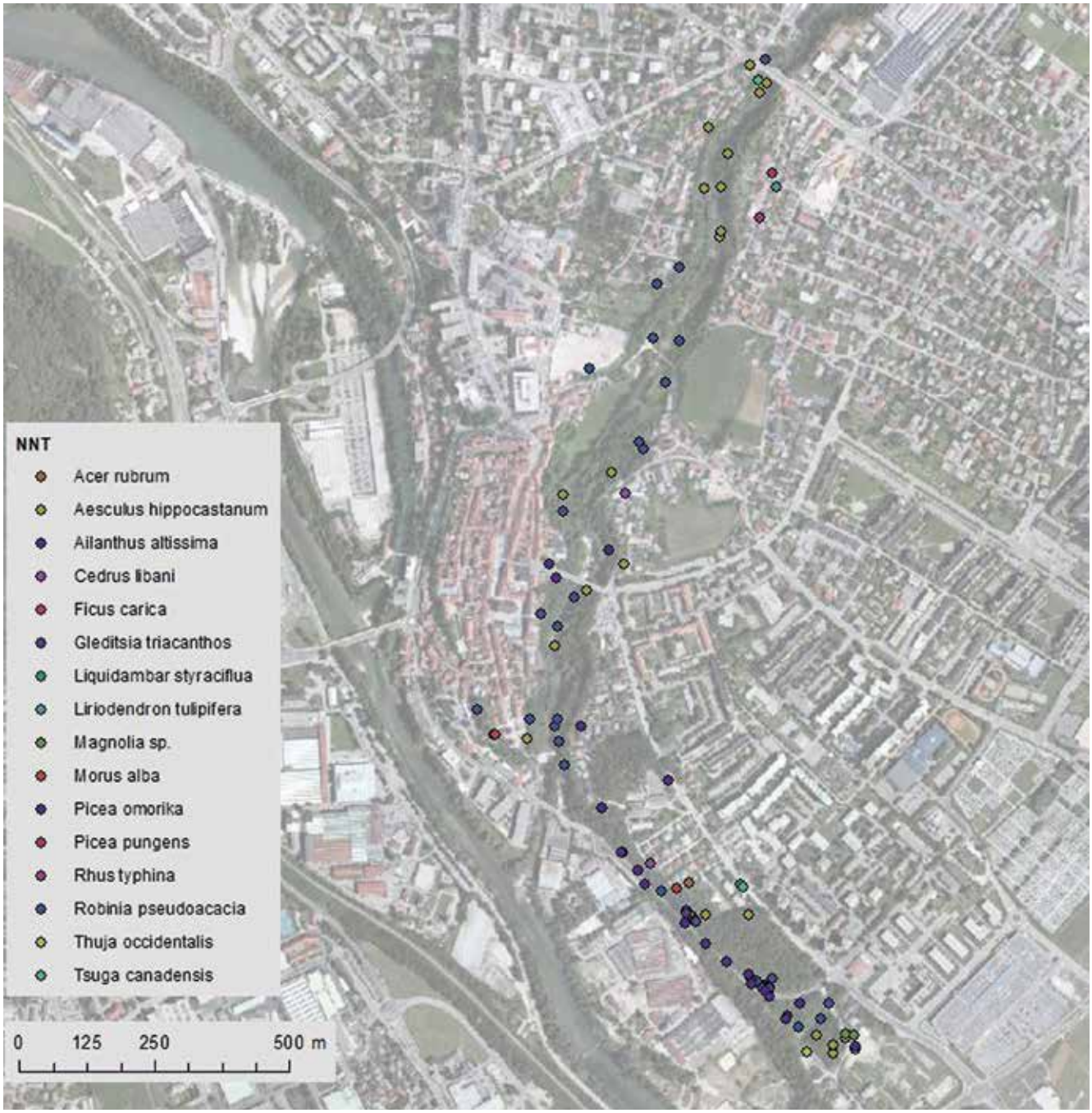

Figure 9: *Results of inventory conducted in Kranj pilot area*

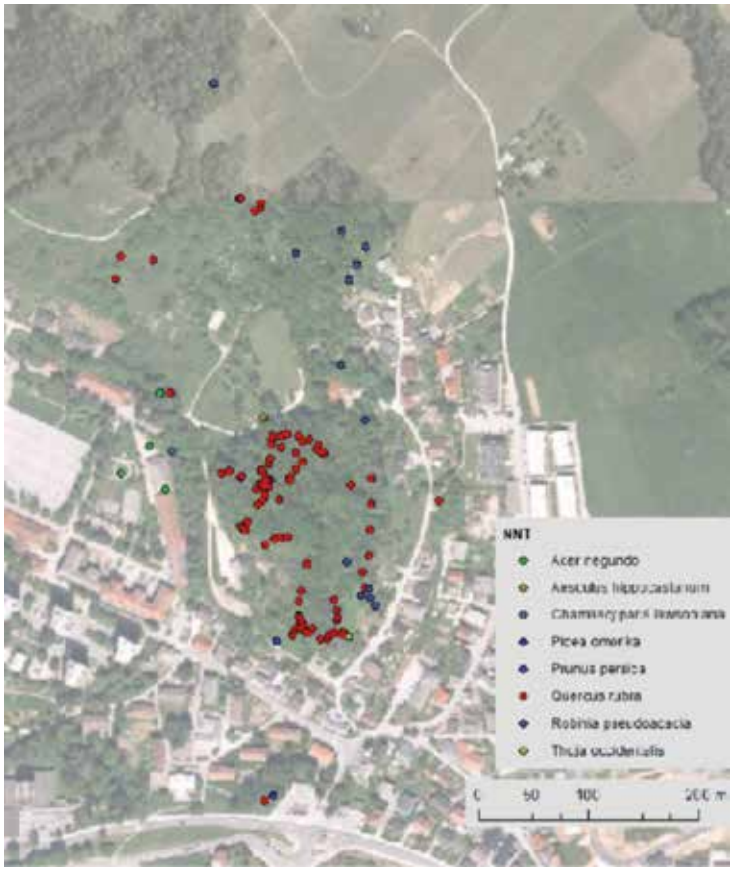

Figure 10: *Results of inventory conducted in Škofja Loka pilot area – Kamnitnik*

Figure 11: *Results of inventory conducted in Škofja Loka pilot area – river Sora*

Figure 12: *Results of inventory conducted in Preddvor pilot area*

Step 6: Assessment of the current and potential impact of NNT in the RA area

In the RA area *A. altissima* is mostly present in urban areas, degraded areas, and urban forests (largely on the forest edge). As this NNT is invasive and on the list of IAS of Union concern, the assessed risk of invasion is high for these areas. *Q. rubra* is one of the most common NNT in Slovenia. It is often used in urban areas, in parks, gardens and other green areas. In the past, it was also planted in forest stands. In the RA area *Q. rubra* is mainly present in urban areas and urban forests. As *Q. rubra* is intensively rejuvenating in forest areas inside the RA area and can replace native species, the assessed risk is of invasion is high for these areas. *P. menziesii* is present in forest areas and it was used in the past as an ornamental tree in the RA area. Site-specific data on the current or potential impact of *P. menziesii* on forest habitat types and their typical biocenosis is to scarce for a conclusive assessment of the risks. *R. typhina* is mostly planted by individuals in their gardens from where it has been escaping to urban areas and also to forest edges. The species is reproducing vegetatively and can spread quickly. It can cause problems in urban areas, occupying green areas as a nuisance vegetation. Inside RA area, *R. typhina* can pose risks in some environmental contexts. In Slovenia *A. hippocastanum* was widely used in the past as an ornamental tree in parks and tree lines. In the RA area it is present mainly in urban areas. Additionally, we found it growing in riverine forests. *A. hippocastanum* has a potential to spread in forests, but for now it seems it only grows individually. This NNT currently pose no risk inside the RA area.

Step 7: Management recommendations based on the legislation framework and management goals

Management recommendation differ depending on the pre-selected NNT species. *A. altissima*, *R. typhina* and *A. hippocastanum* are mostly present in the urban area. Invasive *A. altissima* is very difficult to remove once it has established. It is included on the list of IAS of Union concern; therefore, all the EU members are obligated to permanently remove or manage it. Management plan for this widely spread species is in the preparation on the state level. In the Municipality of Kranj, where *A. altissima* is most widely spread inside the RA area, the Municipality is already removing all trees, which are growing on public area. The most effective way to deal with IAS is to identify them as early as possible and attempt to eradicate or at least control them before they are widely spread. *R. typhina* is one of alien species which is still not widely spread and is potentially invasive, therefore it should be removed where possible. *Q. rubra* is present in urban and forest area. It is intensively rejuvenating in the forest area inside the RA area. Based on its invasive potential, we do not recommend further planting of this NNT in any type of forest and outside the urban areas. The existing stands should be managed to prevent further spreading. *A. hippocastanum* has a potential to spread in forest, but for now it seems it only grows individually. Due to ample presence of the species and the climate change, we recommend monitoring of potential spreading. *P. menziesii* is on the other hand mostly present in the forest. Due to its capacity of rejuvenation and data deficiency, we recommend systematic monitoring of the existing stands. Planting new trees of *P. menziesii* in natural forest, especially in forest with high conservation value (e.g.: Natura 2000, valuable natural features, forest reserves, etc.) should be avoided, since Gorenjska region is one of the best-preserved areas in Slovenia in terms of the tree species composition and NNT are not desired in these forests by several stakeholders.

Step 8: Conclusion of the SSRA

This is the first attempt of doing site-specific risk assessment in the pilot areas. For more reliable assessment, a better-quality data on habitat types and more data on spatial extent of NNT are needed. Site-specific risk assessment is more accurate for smaller areas, as we can do additional field survey to fill potential data gaps. Especially in areas of high conservation value, field survey is highly recommended. If deciding on intentional introduction of NNT in the forests, their impact on the whole ecosystem (including other plants, animals and fungi) should be carefully assessed. In the case of Gorenjska region, NNT are not desired in forests, especially in naturally well-preserved forest.