

## Short Communication

# Advancing the Risk Analysis for Alien Taxa (RAAT) framework

Sabrina Kumschick<sup>1,2</sup>, Llewellyn C. Foxcroft<sup>1,3</sup>, John R. U. Wilson<sup>1,2</sup>

1 Centre for Invasion Biology, Department of Botany & Zoology, Stellenbosch University, Private Bag X1, Matieland 7602, South Africa

2 South African National Biodiversity Institute, Kirstenbosch Research Centre, Cape Town, South Africa

3 Scientific Services, South African National Parks, Private Bag X402, Skukuza 1350, South Africa

Corresponding author: Sabrina Kumschick ([sabrinakumschick@sun.ac.za](mailto:sabrinakumschick@sun.ac.za))

## Abstract

The Risk Analysis for Alien Taxa (RAAT) framework was developed to collate scientific information and interpret it in the context of South African regulations on biological invasions. Feedback from the past four years has shown RAAT to be a valuable tool for making evidence-based, transparent recommendations, but one that can be improved. We describe the changes made in creating RAAT v2.0. We note several issues that we suspect will apply to many similar processes, namely the need to i) clarify descriptions; ii) remove superfluous questions; and iii) add questions to fully justify recommendations. We also stress what RAAT v2.0 does not do—the framework does not summarise management best practices nor does it, or South Africa's regulatory lists, provide sufficient information to prioritise management resources. We strongly recommend that explicit feedback mechanisms are set up to ensure that similar such frameworks can be improved over time.

**Key words:** Biological invasions, decision making, regulations, risk assessment

## Introduction

Risk analyses for alien taxa cover many aspects of biological invasions, such as the likelihood of introduction, establishment, spread, and impacts, management options as well as risk communication. Risk analysis frameworks are essential for the development of evidence informed regulation of alien species, with many new frameworks published in recent years (Sankaran et al. 2023). While some general standards for risk analyses have been identified (Roy et al. 2018), different regulatory frameworks often have slightly different requirements, which can explain the large variety of frameworks available (e.g., Verbrugge et al. 2010; Kumschick and Richardson 2013). For example, the European Union (EU) Regulation on Invasive Alien Species considers a selection of invasive species, all of which must be controlled in all member states (European Union 2014). In South Africa, however, the general approach is to list all invasive species that pose a risk of causing harm, with specific details of how to control taxa outlined in national management plans (Department of Environmental Affairs 2020), i.e., taxa are listed regardless of whether control programmes are likely to be feasible or effective. Regardless of the exact purpose of a risk analysis framework, it is important that the framework is evaluated, tested, and amended based on lessons learnt during its application. In particular, users can uncover inconsistencies, or highlight aspects that might be



Academic editor: Wolfgang Rabitsch

Received: 30 August 2024

Accepted: 24 December 2024

Published: 4 March 2025

**Citation:** Kumschick S, Foxcroft LC, Wilson JRU (2025) Advancing the Risk Analysis for Alien Taxa (RAAT) framework. *NeoBiota* 97: 319–324. <https://doi.org/10.3897/neobiota.97.135975>

Copyright: © Sabrina Kumschick et al.  
This is an open access article distributed under terms of the Creative Commons Attribution License (Attribution 4.0 International – CC BY 4.0).

ambiguously worded; the science underpinning the frameworks advances; and the regulatory requirements might change (e.g., Weed Risk Assessment table in Kumschick and Richardson 2013; Kumschick et al. 2024).

### **South African regulation of alien species**

In South Africa, the National Environmental Management: Biodiversity Act (NEMBA, Act 10 of 2004) Alien and Invasive Species Regulations (hereafter called the NEMBA A&IS Regulations; Department of Environmental Affairs 2020), list alien taxa that need to be managed. It separates taxa into different categories: Category 1a regulated taxa are considered nation-wide eradication targets; category 1b listed taxa require control; category 2 taxa can be used with permits under certain conditions and are 1b outside of permitted uses; category 3 taxa are exempt for certain uses but otherwise need control (i.e., somewhat similar to category 1b and 2, but no need for permits to keep existing individuals). There is also provision for a list of prohibited taxa, i.e., taxa which are not yet present and may not be imported into the country, although such a list was not included in the 2020 version of the regulations. For a detailed discussion of the NEMBA A&IS Regulations and the listing categories see Wilson and Kumschick (2024).

### **Development of the RAAT framework and application**

The Risk Analysis for Alien Taxa (RAAT) framework was developed to provide robust, scientifically based evidence to support the listing of alien taxa under the NEMBA A&IS Regulations. The framework provides a structured, transparent approach for the evaluation of the risks a taxon poses. The first version of RAAT (v1.0) was developed in 2017 in response to the need from government for a transparent framework to underpin the regulation of alien species. The framework underwent minor updates based on the initial experiences and was published as a preprint in 2018 (v1.1). In 2020, a trialled, tested, and revised version of RAAT was peer-reviewed and published in *NeoBiota* (Kumschick et al. 2020; see Suppl. material 1: table S2 for discussion on all the versions of RAAT to date). The framework has since been applied to various taxa as published in the scientific literature (Keet et al. 2020; Canavan et al. 2021; Matthys et al. 2022; Mbobobo et al. 2022), and, as of 30 April 2024, has been applied to 123 of the 560 taxa regulated in South Africa and 17 taxa that are not currently regulated (Wilson and Kumschick 2024).

In many cases, assessors, reviewers, and the Alien Species Risk Analysis Review Panel [ASRARP, an independent scientific body which oversees the review process, see Wilson and Kumschick (2024) for details], broadly agreed both with the scoring of particular sections and with the final recommendations. Changes suggested during review were almost always agreed upon and the additional information provided a more solid basis on which recommendations were built. The main exception was that conflict taxa (i.e., taxa which cause negative impacts through invasions but have benefits to some sectors of society), could often not be confidently assigned to a regulatory category. Conflict taxa in South Africa include invasive freshwater fishes used for recreational angling that have caused the extirpation of native fish populations through predation, animals used as pets that can escape captivity and pose a threat to native species, and various ungulates introduced to

game farms that can pose a threat to the genetic integrity of native taxa (see also Zengeya et al. 2017). Additional information was also deemed necessary to justify why certain exemptions were specified in the regulations or to justify conditions under which permits could or could not be issued. Furthermore, some information requested by the RAAT framework (e.g., on management best practice) was found not to affect the decision of whether and how to list a taxon. Certain sections were also not easily applied across taxonomic groups [e.g., propagule persistence can be critical to determine the feasibility of eradicating an invasive plant population (Panetta and Timmins 2004), but is less meaningful for many animals]. Therefore, after more than two years of applying and testing the framework, we re-evaluated the RAAT. This re-evaluation was based on the experience conducting assessments, reviewing assessments as part of the ASRARP, and teaching courses on how to apply RAAT (the later by S Kumschick).

Here we provide an overview of the main issues and gaps encountered with v1.2 of the RAAT, how they are addressed in v2.0, and flag general issues that might be useful for those who are revising similar such risk analysis frameworks.

## Changes made between RAAT v1.2 and v2.0

We identified three broad issues: i) the need to clarify some descriptions in the guidelines; ii) some information requested was superfluous to classifying taxa or developing recommendations; and iii) additional information was needed to justify the recommendations. The following paragraphs present an overview of these issues, with details of the changes made between RAAT v1.2 and v2.0 (for full details see Suppl. material 1).

### i) Clarifications of descriptions

The guidelines for RAAT v1.2 were published as an appendix to a scientific paper which contained details required for the assessments (Kumschick et al. 2020), however we found that many of the issues discussed in detail in the scientific paper (but not in the guidelines) were not routinely addressed by those conducting risk analyses. To ensure the documentation was consolidated and more readily accessible, all the relevant information was added to the guidelines document (see Suppl. material 1: table S2 for links to documents on Zenodo). Furthermore, some questions and response options were frequently misinterpreted and needed to be rephrased to reflect their true intention. For example, the term “propagules” is mainly used for plants, but given the cross-taxon nature of RAAT it needed to be clarified for other taxa (e.g., life cycle stages). Also, it was clarified that information on impacts of congeners should only be included if justified by their similarities to the taxon.

### ii) Information removed

RAAT v1.2 included a section with four questions on life history traits and other factors which could determine how easy the management of the taxon would be. While these questions are relevant for developing management plans and identifying eradication targets (Wilson et al. 2017), they are less relevant for deciding the appropriate listing category under South African regulations, and thus they were removed. Often only through a detailed evaluation of management feasibility (that

will require some trial management) can a robust decision be made on the most appropriate management goal (in particular whether eradication is feasible). We strongly support calls for adaptive management (Zengeya and Wilson 2023)—a lack of information should not be an excuse for inaction and decisions should also be updated as new information is collected as part of control operations. The aim of RAAT is to support listing decisions, and so the information presented is a very small and select part of that needed to prioritise management resources. It is important to stress that the RAAT should not be used as a primary tool for management prioritisation. The RAAT is a tool to collate information needed to decide between broad management goals (i.e., Is regulation needed? Has an analysis explored the feasibility and desirability of attempting eradication? And are there any contexts where exemptions or permitting might be appropriate?).

### iii) Information added

ASRARP, in their role of reviewing risk analyses before they are submitted to the department responsible for the NEMBA A&IS Regulations (see also Wilson and Kumschick 2024), often requested that further information be added in cases where exemptions were recommended, or where benefits were identified and permits allowed. In RAAT v1.2 a section was included where assessors could provide further information necessary to make decisions. As it was not clear what was needed, this section was often left blank. A new structured section on recommendations has been added to RAAT v2.0 to ensure the justification behind specific recommendations is clear. The information requested on the benefits of a taxon is also more explicit, asking for, amongst other things, which stakeholders are benefitting. Finally, a section was added to the guidelines on general formatting and rules to improve consistency between assessments.

## Acknowledgements

SK acknowledges the support of the Centre for Invasion Biology (CIB) at Stellenbosch University. We thank Katelyn Faulkner, Ashlyn Padayachee, and Nolwethu Jubase, as well as Pablo González-Moreno and Wolfgang Rabitsch for comments on an earlier version of the manuscript, and ASRARP members, people on the training courses and assessors for feedback on the RAAT.

## Additional information

### Conflict of interest

The authors have declared that no competing interests exist.

### Ethical statement

No ethical statement was reported.

### Funding

This work was supported by the Centre for Invasion Biology (CIB) at Stellenbosch University and the South African Department of Forestry, Fisheries and the Environment (DFFE), noting that this publication does not necessarily represent the views or opinions of DFFE or its employees.

## Author contributions

All authors contributed to the conceptualisation of the manuscript. SK led the development of the framework and writing, with inputs from JR UW and LCF.

## Author ORCIDs

Sabrina Kumschick  <https://orcid.org/0000-0001-8034-5831>

Llewellyn C. Foxcroft  <https://orcid.org/0000-0002-7071-6739>

John R. U. Wilson  <https://orcid.org/0000-0003-0174-3239>

## Data availability

All of the data that support the findings of this study are available in the main text or Supplementary Information.

## References

- Canavan S, Richardson DM, Le Roux JJ, Kelchner SA, Wilson JR U (2021) The status of alien bamboos in South Africa. *South African Journal of Botany* 138: 33–40. <https://doi.org/10.1016/j.sajb.2020.11.027>
- Department of Environmental Affairs (2020) National Environmental Management: Biodiversity Act 2004 (Act No. 10 of 2004) Alien and Invasive Species Regulations, 2020. Government Gazette Vol. 1020, No. 43735. [https://www.gov.za/sites/default/files/gcis\\_document/202009/43735rg-11176gon1020.pdf](https://www.gov.za/sites/default/files/gcis_document/202009/43735rg-11176gon1020.pdf)
- European Union (2014) Regulation (EU) No 1143/2014 of the European Parliament and of the Council of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species. *Official Journal of the European Union*, 57, 35. <http://data.europa.eu/eli/reg/2014/1143/oj>
- Keet JH, Robertson MP, Richardson DM (2020) *Alnus glutinosa* (Betulaceae) in South Africa: Invasive potential and management options. *South African Journal of Botany* 135: 280–293. <https://doi.org/10.1016/j.sajb.2020.09.009>
- Kumschick S, Richardson DM (2013) Species-based risk assessments for biological invasions: Advances and challenges. *Diversity & Distributions* 19(9): 1095–1105. <https://doi.org/10.1111/ddi.12110>
- Kumschick S, Wilson JR U, Foxcroft LC (2020) A framework to support alien species regulation: The Risk Analysis for Alien Taxa (RAAT). *NeoBiota* 62: 213–239. <https://doi.org/10.3897/neobiota.62.51031>
- Kumschick S, Bertolino S, Blackburn TM, Brundu G, Costello KE, de Groot M, Evans T, Gallardo B, Genovesi P, Govender T, Jeschke JM, Lapin K, Measey GJ, Novoa A, Nunes AL, Probert AF, Pyšek P, Preda C, Rabitsch W, Roy HE, Smith KG, Tricarico E, Vilà M, Vimercati G, Bacher S (2024) Using the IUCN Environmental Impact Classification for Alien Taxa (EICAT) to inform decision-making. *Conservation Biology* 38(2): e14214. <https://doi.org/10.1111/cobi.14214>
- Mathys C, Jubase N, Visser V, Geerts S (2022) Distribution of *Melaleuca rugulosa* (Schlechtendal ex Link) Craven (Myrtaceae) in South Africa: Assessment of invasiveness and feasibility of eradication. *South African Journal of Botany* 148: 228–237. <https://doi.org/10.1016/j.sajb.2022.04.025>
- Mbobbo T, Richardson DM, Gwynne-Evans D, Deacon J, Wilson JR U (2022) *Psidium cattleianum* (Myrtaceae) invasions in South Africa: Status and prognosis. *South African Journal of Botany* 150: 412–419. <https://doi.org/10.1016/j.sajb.2022.07.002>
- Panetta FD, Timmins SM (2004) Evaluating the feasibility of eradication for terrestrial weed invasions. *Plant Protection Quarterly* 19: 5–11.
- Roy HE, Rabitsch W, Scalera R, Stewart A, Gallardo B, Genovesi P, Essl F, Adriaens T, Bacher S, Booy O, Branquart E, Brunel S, Copp GH, Dean H, D'hondt B, Josefsson M, Kenis M,

- Kettunen M, Linnamagi M, Lucy F, Martinou A, Moore N, Nentwig W, Nieto A, Pergl J, Peyton J, Roques A, Schindler S, Schönrogge K, Solarz W, Stebbing PD, Trichkova T, Vanderhoeven S, van Valkenburg J, Zenetos A (2018) Developing a framework of minimum standards for the risk assessment of alien species. *Journal of Applied Ecology* 55(2): 526–538. <https://doi.org/10.1111/1365-2664.13025>
- Sankaran KV, Schwindt E, Sheppard AW, Foxcroft LC, Vanderhoeven S, Egawa C, Peacock L, Castillo ML, Zenni RD, Müllerová J, González-Martínez AI, Bukombe JK, Wanzala W, Mangwa DC (2023) Chapter 5: Management; challenges, opportunities and lessons learned. In: Thematic Assessment Report on Invasive Alien Species and their Control of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. In: Roy HE, Pauchard A, Stoett P, Renard Truong T (Eds) IPBES secretariat, Bonn, Germany. <https://doi.org/10.5281/zenodo.7430733>
- Verbrugge LNH, Leuven RSEW, van der Velde G (2010) Evaluation of international risk assessment protocols for exotic species. *Repository for Environmental Science* 352: 1–54.
- Wilson JR, Kumschick S (2024) The regulation of alien species in South Africa. *South African Journal of Science* 120(5/6): 17002. <https://doi.org/10.17159/sajs.2024/17002>
- Wilson JR, Panetta FD, Lindgren C (2017) Detecting and responding to alien plant incursions. Cambridge University Press, 286 pp. <https://doi.org/10.1017/CBO9781316155318>
- Zengeya TA, Wilson JR [Eds] (2023) The status of biological invasions and their management in South Africa in 2022. South African National Biodiversity Institute, Kirstenbosch and DSI-NRF Centre of Excellence for Invasion Biology, Stellenbosch, 122 pp. <https://doi.org/10.5281/zenodo.8217182>
- Zengeya TA, Ivey P, Woodford DJ, Weyl OLF, Novoa A, Shackleton RT, Richardson DM, van Wilgen BW (2017) Managing conflict-generating invasive species in South Africa: Challenges and trade-offs. *Bothalia* 47(2): a2160. <https://doi.org/10.4102/abc.v47i2.2160>

## Supplementary material 1

### Supplementary information

Authors: Sabrina Kumschick, Llewellyn C. Foxcroft, John R. U. Wilson

Data type: docx

Explanation note: **figure S1**. An overview of the Risk Analysis for Alien Taxa (RAAT) framework v2.0. **figure S2**. Decision tree for making recommendations for listing categories (1a, 1b, 2) of alien taxa as per South Africa's NEMBA A&IS Regulations. **table S1**. Changes made between v1.2 and v2.0 of the Risk Analysis for Alien Taxa (RAAT) framework. **table S2**. Versions of the Risk Analysis for Alien Taxa (RAAT) framework available on Zenodo.

Copyright notice: This dataset is made available under the Open Database License (<http://opendatacommons.org/licenses/odbl/1.0/>). The Open Database License (ODbL) is a license agreement intended to allow users to freely share, modify, and use this Dataset while maintaining this same freedom for others, provided that the original source and author(s) are credited.

Link: <https://doi.org/10.3897/neobiota.97.135975.suppl1>