Suppl. 2: **Assessment criteria.** The following table offers examples of the application of criteria and parameters in our analysis. ● = fully / directly applies, ○ = partly / indirectly applies; — = does not apply / parameter is not considered in the study.

CRITERION / PARAMETER	APPLICATION
PURPOSE OF ASSESSMENT This criterion was assessed based on the authors' statements. In some cases authors declare their approach to be suitable for several purposes.	
Predictive system	Approaches to support decisions about the introduction or secondary release of alien species. ● = Typical approaches are, e.g. Panetta (1993; 'an assessment system … which evaluates proposed plant introductions') or Reichard and Hamilton (1997; 'a decision tree for evaluating invasive potential of new introductions'). ○ = Kumschick et al. (2012) developed a framework 'primarily meant to prioritize established and invasive species'; additionally, they point out the basic applicability of their approach for border control of species, with some reservations (e.g. 'system does not assess entry or establishment probability'). — = Does not apply.
Prioritisation tool	Approaches to support decisions on the management of alien species. ● = Kil et al. (2004) developed a ranking system 'to manage and monitor invasive alien plants'. The approach provided by Skurka et al. (2011) is another typical approach of this category ('… we developed a novel science-based, transparent, analytical ranking tool to prioritize weed populations…for eradication'). ○ = Approaches originally not designed to support management decisions, but, with consideration of some reservations, suitable for this purpose (e.g. Blackburn et al. (2014); '… but our approach may contribute to a process of prioritising species for management'). — = Does not apply.
Information tool	Approaches that offer information about impacts, invasiveness etc. of alien species without explicitly supporting decisions on introduction or management. ● = Parker et al. (2007) for example developed a system to rank species by their potential invasiveness, regarding this as a 'simpler proposition' with 'less serious consequences than using a model to determine whether or not to allow species to enter'. In some cases this category was assigned if authors did not make clear statements about the purpose of their approach (e.g. Miller et al. 2010). — = Does not apply.
ASSESSMENT METHODOLOGY With a focus on the underlying methodology by which overall assessment results are generated, we differentiate among decision trees, scoring systems and matrix tools.	
Decision tree	Approaches generating assessment results by simple yes/no questions, usually put into a hierarchical order. ● = Typical representatives of this category are, e.g. Tucker and Richardson (1995) or Reichard and Hamilton (1997). ○ = Approaches in which a (small) decision tree is used as a pre-evaluation step (e.g. to figure out which species should be further assessed), while the core assessment is based on a scoring system or a matrix tool (e.g. Weber and Gut 2004, Randall et al. 2008).
Scoring system	Approaches in this category derive assessment results by adding or multiplying points allocated to individual parameter values. ● = Typical scoring systems are e.g. Pheloung et al. (1999) or Ou et al. (2008). — = Does not apply.
Matrix tool	Approaches using a two-dimensional matrix in which main criteria are combined to

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	generate assessment results. ● = Kowarik et al. (2003), for example, combined the magnitude of impact with the conservational value of affected resources. Sandvik et al. (2013) combined invasion potential with ecological effect. — = Does not apply.
CONSIDERATION OF ENVIRONMENTAL IMPACTS In general alien species can induce impacts on human health and environmental, economic or other resources of interest.	
Environmental	● = Impacts on environmental resources such as biodiversity (for detailed examples see below) are directly included through explicit criteria or questions. ○ = Environmental impacts are included indirectly by considering relevant effect-related species characteristics, for instance, the ability of a species to form large and dense monocultures (e.g. Weber and Gut 2004). — = Parameter is not considered.
COVERED BIODIVERSITY LEVELS When considering biodiversity as an environmental resources, we generally differentiate impacts on genetic, species and ecosystem diversity.	
Genetic diversity	● = Impacts on genetic diversity, e.g. by hybridisation, are directly included through explicit criteria or questions (e.g. 'hybridizes with a particular native species', Randall et al. 2008). — = Parameter is not considered.
Species diversity	● = Impacts on species diversity are directly included through explicit criteria or questions, for instance regarding 'competition resulting in replacement or local extinction of one or several native species' (Blackburn et al. 2014), transmission of diseases or organisms to native species' (Nentwig et al. 2013) or 'predation' (Kumschick et al. 2012). ○ = Impacts on species diversity are included indirectly by considering relevant effect-related species characteristics, for instance, a species' ability to form large and dense monocultures (e.g. Weber and Gut 2004). — = Parameter is not considered.
Ecosystem diversity	● = Impacts on ecosystem diversity are directly included through explicit criteria or questions concerning changes to processes, structures, abiotic factors etc. (e.g. 'taxon documented to alter composition, structure, or normal processes or function of a natural ecosystem', Pheloung et al. 1999). ○ = Impacts on ecosystem diversity are included indirectly by considering relevant effect-related species characteristics, for example, a species' ability to 'fix nitrogen' (Parker et al. 2007). — = Parameter is not considered.
IMPACT MAGNITUDE Quite often decisions on the introduction or management of alien species depend on whether (potential) impacts are significant. Besides the value of affected resources the overall magnitude of impacts is important in assessing the significance of impacts. Relevant parameters may be: a) magnitude of overall impact, b) size / intensity of individual effects, c) spatial extent of species spread, d) abundance of alien species, e) cumulativeness of impacts, f) irreversibility of impacts.	
Magnitude of overall impact	● = Approaches that explicitly present the magnitude of overall impact, mainly by merging individual impact scores into a final impact score (e.g. Randall et al. 2008) or by combining effect size with relevant impact attributes such as abundance and spatial extent (e.g. Olenin et al. 2007). ○ = The magnitude of overall impact is not explicitly presented but to some extent it can be derived by a closer look at individual assessment categories. For instance, some scoring systems consider different types of impacts but do not provide for generating a final impact score (e.g. Ou et al. 2010). — = Parameter is not considered.

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Effect size	● = Approaches provide for at least a three-stage scale of the effect size (e.g. Kumschick et al. 2012, Blackburn et al. 2014). ○ = Approaches only partly (i.e. referring to some but not all effect-related criteria) provide for at least a three-stage scale of the effect size (e.g. Kowarik et al. 2003, Parker et al. 2007). — = Parameter is not considered.
Spatial extent	● = Approaches clearly incorporate the spatial extent of alien species, e.g. by separate criteria such as 'current range size in region' (Ou et al. 2008). ○ = Approaches allow for a rough estimation of this parameter, e.g. by checking for climate/habitat match (e.g. Tucker and Richardson 1995, Pheloung et al. 1999). — = Parameter is not considered.
Abundance	● = Approaches consider this aspect through explicit criteria such as 'abundance and distribution range' (Olenin et al. 2007) or 'local range expansion or change in abundance' (Randall et al. 2008). ○ = Approaches allow for a rough estimate of this parameter, e.g. by considering 'frequency and number of introductions' (Ou et al. 2008). — = Parameter is not considered.
Cumulativeness	● = Approaches consider the concurrence of impacts caused by assessed alien species and impacts of alien species already present in the area of interest or impacts caused by other relevant factors such as land use. For example, Magee et al. (2010) developed an 'Index of Alien Impact to estimate the collective ecological impact of in situ alien species'. — = Parameter is not considered.
Irreversibility	Irreversibility can refer to the impacts of alien species or to alien species themselves (i.e. possibility of control / eradication). In our analysis we focus on the impact-related meaning. ● = Approaches explicitly consider this parameter by a separate criterion or by using it as a characteristic feature to differentiate the effect size within most effect-related criteria (e.g. Blackburn et al. 2014). ○ = Approaches do not explicitly consider this parameter (e.g. by a separate criterion) but use it as a characteristic feature to differentiate the effect size within some effect-related criteria (e.g. Randall et al. 2008, Feng and Zhu et al. 2010). — = Parameter is not considered.
CONTEXT DEPENDENCE OF ENVIRONMENTAL IMPACTS Impacts of alien species vary with environmental conditions over time and space and reflect underlying values (e.g. stakeholder interests). Thus assessment approaches should address the context dependence of impacts and provide information on a) alien species potential to impact environment; b) potential and c) actual distribution of the alien species; d) occurrence of (potentially) affected resources; e) conservation value of (potentially) affected resources; f) positive effects an alien species might induce.	
Species potential to impact environment	● = Approaches directly include impacts on relevant resources such as biodiversity through explicit criteria / questions (e.g. Virtue et al. 2008, Koop et al. 2012). ○ = Approaches include impacts on relevant resources such as biodiversity by considering relevant effect-related species characteristics, for instance, a species' ability to form large and dense monocultures (e.g. Weber and Gut 2004). — = Parameter is not considered.
Potential distribution of IAS	● = Operationalisation is based on data about potential distribution of an alien species, for example by including explicit criteria such as 'invasion potential' (Sandvik et al. 2013) or by concretely incorporating the potential for a given species to spread (e.g. Kowarik et al. 2003). ○ = Operationalisation is based on rather rough information concerning this parameter, e.g. by checking for climate/habitat match (e.g. Tucker and Richardson 1995, Pheloung

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	et al. 1999). — = Parameter is not considered.
Actual distribution of IAS	● = Operationalisation is based on data about the actual distribution of the alien species, for instance by including explicit criteria such as 'current range size in region' (Ou et al. 2008) or 'magnitude of occurrence' (Miller et al. 2010). ○ = Operationalisation is based on rather rough information concerning this parameter, for example through criteria such as 'geographic extent' (Molnar et al. 2008) or 'circumstances of current range' (Feng and Zhu 2010). — = Parameter is not considered.
Identification and localization of (potentially) affected resources	● = Operationalisation is based on data about the occurrence of relevant (potentially) affected resources (e.g. native species). The approach provided by Skurka et al. (2011) for instance includes the proximity of alien species populations to relevant resources such as 'concentrations of threatened and endangered species and rare plant communities' and by this supposes the identification and localisation of (potentially) affected resources. ○ = Approaches roughly include this parameter but their application is not based on exact information about the occurrence of potentially (affected) resources. For instance, Ou et al. (2008) consider the 'proportion of current range where the species caused negative impact' and by this give a rather rough idea of where (potentially) affected resources might occur. — = Parameter is not considered.
Conservation value of (potentially) affected resources	● = The conservation value of (potentially) affected resources is explicitly included, e.g. by separate criteria (e.g. Kowarik et al. 2003, Randall et al. 2008) or as a relevant factor for calibrating criteria (e.g. Sandvik et al. 2013). ○ = The conservation value of (potentially) affected resources is used as a characteristic feature to differentiate different levels of effect size within (some) criteria (e.g. Molnar et al. 2008, EPPO 2012). — = Parameter is not considered.
Positive effects	● = The possibility of beneficial effects caused by alien species is comprehensively included, e.g. by separate criteria (Kumschick et al. 2012, Davidson et al. 2017). ○ = Positive effects are considered but marginally. For instance Parker et al. (2007) consider beneficial effects merely in the context of the criterion 'pest/disease interactions': 'host of beneficial (negative) or pest (positive) species / pathogens'. — = Parameter is not considered.
MANAGEMENT OF BIOLOGICAL INVASIONS Considering prospects of a successful management within an assessment procedure may help to allocate limited financial resources more efficiently. Relevant factors include a) availability of methods; b) costs and time commitment for control and/or restoration; c) size of (potentially) infested area; d) number, e) detectability, and f) accessibility of infestations; g) relevant species traits; h) cooperativeness of landowners; i) unwanted management effects; j) restorability of affected resources.	
Availability of methods	● = Approaches directly include the availability of relevant management methods by explicit criteria such as 'measure and effect of control' (Ou et al. 2008) or 'ease of control' (Virtue et al. 2008). ○ = Parameter is indirectly / partly included, e.g. Pheloung et al. (1999) consider only one possible method (chemical control of plants) and do not include further methods. — = Parameter is not considered.
Availability of personnel and financial resources within the required time frame	● = Approaches directly include this parameter through explicit criteria such as 'control cost' (Skurka et al. 2011) or 'minimum time commitment' (Randall et al. 2008). ○ = Parameter not explicitly included through separate criteria but considered as a characteristic feature to differentiate the effect size within some criteria (e.g. Kumschick et al. 2013). — = Parameter is not considered.

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Size of (potentially) infested area		● = Operationalisation is based on data concerning this parameter, e.g. by including explicit criteria such as 'current range size in region' (Ou et al. 2008), 'abundance and distribution range' (Olenin et al. 2007) or 'population size' (Skurka et al. 2011). ○ = Operationalisation is based on rather rough information concerning this parameter, e.g. by checking for climate/habitat match (e.g. Koop et al. 2012) concerning potential infestations. — = Parameter is not considered.
Number of infestations		○ = Approaches consider this parameter but incorporation is rather rough. For instance, Ou et al. (2008) refer to the number of infestations as a characteristic feature to operationalise the criterion 'current range size in region' but do only distinguish two level of infestations (<5 or ≥5). — = Parameter is not considered.
Detectability of infestations		● = Approaches directly include this parameter through explicit criteria such as 'detectability' (Skurka et al. 2011). ○ = Approaches incorporate this issue within other management criteria (Branquart et al. 2016). — = Parameter is not considered.
Accessibility of infestations		● = Approaches directly include this parameter through explicit criteria such as 'accessibility' (Skurka et al. 2011). — = Parameter is not considered.
Species traits or characteristics that might impede management		● = Operationalisation is based on data about relevant species traits (mainly referring to establishment or spread), e.g. by including explicit criteria such as 'long distance dispersal potential within region' or 'reproductive characteristics' (Randall et al. 2008). ○ = Operationalisation of this parameter is based on rather rough information. For example, Panetta (1993) simply requests 'multiple modes of reproduction / dispersal'. — = Parameter is not considered.
Unwanted management effects		● = Approaches directly include this parameter by explicit criteria such as 'impact of control on native species' (Ou et al. 2008, Feng and Zhu 2010) or 'impacts of management on native species' (Randall et al. 2008). ○ = Operationalisation is based on rather rough information concerning this parameter. For example, Nentwig et al. (2016) consider unwanted management effects as a characteristic feature (among others) within the criterion 'impacts on ecosystems': 'The application of pesticides to control impacts might have side effects on non-target organisms which count as ecosystem impacts here'. — = Parameter is not considered.
Restorability of affected resources		● = Approaches directly include this parameter through explicit criteria such as 'cost and time commitment of restoration' (Randall et al. 2008). ○ = Approaches indirectly consider this parameter, mainly when using 'irreversibility of effects' as a characteristic feature to operationalise effect-related criteria (e.g. Kumschick et al. 2012, Blackburn et al. 2014). — = Parameter is not considered.
Cooperativeness of landowners		○ = Operationalisation is based on rather rough information concerning this parameter. For instance, Randall et al. (2008) consider the cooperativeness of landowners as a characteristic feature (among others) within the criterion 'accessibility of invaded areas'. — = Parameter is not considered.
TRANSPARENCY OF ASSESSMENT APPROACHES We reviewed the extent to which approaches meet basic requirements concerning transparency and traceability for a) the approach in its entirety and for individual criteria, b) underlying values, c) use and definition of key terms.		
Trans-parency of	High	The operationalisation of most (≥ 90%) criteria is highly replicable, i.e. the application of criteria leads to identical results, no matter by whom they are applied. This could be guaranteed, e.g. by quantification of thresholds or by providing distinct rules of

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criteria		application. Terms such as 'significant, low, middle, high etc.' without further explanation are avoided.
	Middle	The operationalisation of provided criteria is partly replicable. For example, Ou et al. (2008) provide some quantified criteria (e.g. 'proportion of current range where the species caused negative impact'), but use rather imprecise phrases to differentiate between different levels of impact: 'little or without impact / weak impact / significant impact'. Without further explanation, it remains unclear how impact levels should be assigned.
	Low	Only a few criteria (≤10%) are operationalised in a traceable manner. Kil et al. (2004), for example, mainly use imprecise phrases.
Trans-parency of approach	High	The approach is highly traceable, i.e. the way an overall assessment result (e.g. weighting and conjunction of criteria) is derived is clearly explained.
	Middle	Transparency of the approach is limited because important information on the derivation of an overall assessment result is missing. Some approaches (e.g. Skurka et al. 2013, Davidson et al. 2017) do not (explicitly) describe how individual assessment scores should be linked with each other to generate an overall assessment score.
Disclosure of underlying values		● = Underlying values (e.g. normative substantiation of thresholds) are fully disclosed. For instance, Sandvik et al. (2013) explicitly refer to the conservation value of affected resources to substantiate the calibration of effect-related criteria. ○ = Underlying values are partly disclosed. While an explicit normative substantiation of thresholds is missing, authors at least refer to relevant basic statutory framework (e.g. Randall et al. 2008 operationalise their criterion 'conservation significance of communities and native species threatened' by referring to threatened native species federally listed in the U.S.). — = Underlying values are not disclosed.
Term 'invasive'	Applied, not defined	Term is used but not explicitly defined.
	Applied and defined	Term is used and explicitly defined, either in relation to establishment or spread (e.g. Reichard and Hamilton 1997) or in relation to impacts (e.g. Randall et al. 2008).
Term 'damage / harm / impact / negative effect'	Applied, not defined	Term is used but not explicitly defined.
	Applied and defined	Term is used and explicitly defined (e.g. 'damage': Kowarik et al. 2003; 'biological pollution': Olenin et al. 2007; 'impact / effect': Sandvik et al. 2013).