

1 **Different arguments, same conclusions – how is action against invasive alien**
2 **species justified in the context of European policy?**

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22 **Abstract**

23 The prevention and management of invasive alien species (IAS) has become a high priority in
24 European environmental policy. At the same time, ways of evaluating IAS continue to be a topic of
25 lively debate. In particular, it is far from clear how directly policy makers' value judgements are linked
26 to the EU policy against IAS. We examine the arguments used to support value judgements of both
27 alien species and invasive alien species as well as the relation between these value judgements and the
28 policy against IAS being developed at European level. Our study is based on 17 semi-structured
29 interviews with experts from European policy making and from the EU member states Austria,
30 Belgium, Germany and Hungary. We found that our interviewees conceived of IAS in very different
31 ways, expressed a variety of visions of biodiversity and ecosystem services, and adhered to widely
32 different values expressed in their perceptions of IAS and the impacts of IAS. However, only some of
33 these conceptualizations and value judgements are actually addressed in the rationale given in the
34 preamble to the European IAS Regulation. Although value judgements about IAS differed, there was
35 considerable agreement regarding the kind of action to be taken against them.
36

37 **Key words**

38 perception of nature; biodiversity evaluation; ecosystem services; environmental policy; EU
39 Regulation; analysis of arguments

40 **1 Introduction**

41 Invasive alien species (IAS) are often regarded as one of the major threats to biodiversity (McGeoch et
42 al 2010; Simberloff et al. 2013, Rabitsch et al. 2016). Their impacts on ecosystem services are also
43 attracting greater attention (e.g. Pejchar and Mooney 2009, Funk et al. 2014, McLaughlan et al. 2014).
44 While the capability to calculate the economic costs of IAS has existed for a number of years now
45 (e.g. van Wilgen et al. 1996, Pimentel et al., 2005), it is only more recently that the unwanted impacts
46 of IAS on ecosystem functions (e.g. Maron et al., 2006, Scott et al. 2012, Gutiérrez et al. 2014) and
47 human health (Pyšek and Richardson 2010, Hanson et al. 2013) have come to the fore. In addition,
48 there is growing evidence that biological invasions have social impacts as well (Binimelis et al. 2007,
49 García-Llorente et al. 2008). For all these reasons, the topic of IAS is increasingly being addressed by
50 environmental policy makers. As far back as 1992 Article 8h of the Convention on Biological
51 Diversity expressed the shared intention “to prevent the introduction of, control or eradicate those
52 alien species which threaten ecosystems, habitats or species”. Target V of the European 2020
53 Biodiversity Strategy (EC 2011) states: “By 2020, Invasive Alien Species and their pathways are
54 identified and prioritised, priority species are controlled or eradicated, and pathways are managed to
55 prevent the introduction and establishment of new IAS” (EC 2011: 15). These measures were specified
56 in the recent EU Regulation 1143/2014 on the prevention and management of the introduction and
57 spread of invasive alien species (referred to in this paper as the “IAS Regulation” or simply “the
58 Regulation”). This Regulation came into force on January 1, 2015 and mandates preventive and
59 responsive action against a set of IAS that have yet to be defined.

60 However, the significance of IAS for biodiversity decline and harm to ecosystem services is a
61 contested issue. Some scientists challenge the empirical evidence of a link between IAS and impacts
62 on biodiversity and ecosystem services (Gurevitch and Padilla 2004, Thomas et al. 2015). Others
63 maintain that the normative assumptions underlying concepts of harm are unclear (Sagoff 2005, Bartz
64 et al. 2010). The impacts of IAS cannot be evaluated properly, then, without making explicit what is

65 regarded as beneficial or detrimental. Evaluating IAS is made even more complicated by the fact that
66 perceptions of IAS differ according to the knowledge, stakeholder groups and visions of nature
67 involved (García-Llorente et al. 2008, Verbrugge et al. 2013). An increase in knowledge about the
68 impacts of IAS has led to more support for management measures (Bremner and Park 2007, García-
69 Llorente et al. 2008, Lindemann-Matthies 2016) and a greater engagement with issues of non-native
70 species (Verbrugge et al. 2013). Similarly, it has been shown that perceptions of risk increase if a
71 species is perceived to be non-native (Humair et al. 2014b), indicating that knowledge of the origin of
72 a species indirectly influences risk perception (e.g. Binimelis et al. 2007, Andreu et al. 2009). Evans et
73 al. (2008) therefore suggest that the management of IAS should be subjected to regular participatory
74 evaluation by the stakeholder community. ‘Visions of nature’ refers principally to ideas about the
75 properties and functions of nature (e.g. whether or not there is such a thing as a ‘balance of nature’)
76 and views regarding the value of nature (Verbrugge 2013, Heink and Jax 2014). For example,
77 respondents who considered nature to be unstable were generally more concerned about non-native
78 species than respondents who considered nature to be stable (Fischer and van der Wal 2007, Verbrugge
79 et al. 2013). Or alien species are excluded from the concept of biodiversity, as Patten & Erickson
80 (2001: 817) maintain: “...our collective goal in conservation biology is to protect biodiversity. That
81 term is by necessity restricted to native species richness...”

82 There are two reasons why IAS might be judged negatively: first, because they are alien – some
83 authors suggest that conservationists reject alien species per se as valuable components of biodiversity
84 (e.g. Peretti 1998, Woods and Moriarty 2001, Davis et al. 2011) – and, second, due to their negative
85 impacts on biodiversity and ecosystem services, in other words, those effects which establish the status
86 of an alien species as “invasive” (e.g. Clavero and García-Bertou 2005, Simberloff et al. 2011). While
87 invasive species are selected from the pool of alien species, van der Wal et al. (2015) suggest that a
88 species’ abundance and the damage it does to nature and the economy – rather than its origin – are the
89 factors that inform the judgement of a need for conservation action.

90 There is abundant evidence that the way IAS are perceived and judged has a great impact on public
91 support for their management (Fischer and van der Wal 2007, Bremner and Park 2007, Selge et al.
92 2011, Schüttler et al. 2011, Verbrugge et al. 2013, van der Wal et al. 2015). Most of these studies refer

93 to people’s attitudes towards individual IAS and specific management options at a given site (with the
94 notable exception of Selge et al. 2011). We are not aware of any studies which consider arguments for
95 the prevention and management of IAS on a national or supranational level.

96 Our aim in this study is to explore how arguments put forward to support the value judgements of
97 people involved in developing the IAS Regulation are reflected in policies dealing with IAS at a
98 national and EU level. In this way we examine how the IAS Regulation frames the issue of IAS and
99 identify the arguments used in the IAS Regulation to justify action against IAS. We also explore the
100 value judgements about both alien and invasive alien species expressed by those involved in the
101 development of the Regulation. We then examine how these people conceptualize the adverse impacts
102 of IAS and how these perceptions lead to support for or criticism of the prevention and management of
103 IAS. By comparing the arguments found in the IAS Regulation itself and those expressed by the
104 people involved in developing the Regulation we hope to discover which of the arguments formulated
105 against IAS are actually taken up in policy. In a subsequent step we discuss the possible reasons why
106 these arguments are deemed to be valid.

107 **2 Framing of issues related to biodiversity and ecosystem services in the** 108 **EU Regulation on invasive alien species**

109 The IAS Regulation “sets out rules to prevent, minimize and mitigate the adverse impact on
110 biodiversity of the introduction and spread within the Union ... of invasive alien species” (Article 1).

111 In Article 3 (1) alien species are defined as any live specimen of a species or lower taxonomic level
112 introduced outside its natural range. The preamble to the Regulation states by way of clarification that
113 species migrating “naturally” in response to environmental changes should not be considered as alien
114 species in their new environment. “Invasive alien species” means an alien species whose introduction
115 or spread has been found to threaten or adversely impact upon biodiversity and related ecosystem
116 services (Article 3 (2)). Interestingly, IAS are considered not only to cause damage to ecosystems but
117 also to reduce the resilience of those ecosystems (Preamble, paragraph 26).

118 In the course of developing the Regulation, policy makers wrestled to find the right definition of IAS.
119 It needed to be in line with the CBD definition, which reads as follows: “‘Invasive alien species’

120 means an alien species whose introduction and/or spread threaten biological diversity” (UNEP 2002:
121 257). Further, the definition needed to reflect the European Biodiversity Strategy (European
122 Commission 2011), which highlights the protection of ecosystem services as a conservation target. The
123 2013 proposal for the IAS Regulation (EC 2013) therefore introduced ecosystem services in addition
124 to biodiversity as entities in need of protection from IAS. But it also cited human health and “the
125 economy” as dimensions which might be negatively affected by IAS. However, in order to better align
126 the Regulation with the CBD definition, human health and the economy were not taken up in the
127 version that was finally brought into law.

128 The definition of IAS already implies which entities are considered to be adversely affected, namely,
129 “biodiversity and related ecosystem services”. Article 5 (1f) specifies that impacts on biodiversity and
130 ecosystem services include impacts on “native species, protected sites, endangered habitats, as well as
131 on human health, safety, and the economy”. With regard to impacts on species, it is worth noting that
132 the Regulation seems to consider “native species” as conservation objects both in their own right and
133 in instrumental terms (for their role in providing ecosystem services), whereas alien species are
134 acknowledged only indirectly in their contribution to ecosystem services, if at all.

135 In essence the Regulation addresses the prevention, early detection and rapid eradication of a species
136 at an early stage of invasion as well as the management of IAS which are already widespread on EU
137 territory. However, the articles relating to the prevention and management of IAS refer only to species
138 listed as IAS of Union concern (“the Union list”); these are to be determined by means of a risk
139 assessment. Thus the Regulation prioritizes action against those species that are most likely to have
140 significant adverse impacts or that have already led to such impacts. The focus on a finite number of
141 IAS arises out of the principle of proportionality. At several places in the Regulation it becomes clear
142 that the costs of action taken against IAS should be lower than the costs of inaction, also taking into
143 account the benefits from use of the species. Further, the Regulation clearly states that prevention is
144 more desirable than rapid eradication or containment and control, and that it is more efficient to
145 eradicate a population of IAS as soon as possible when the number of specimens is still limited.

146 **3 Methods**

147 **3.1 Approach: expert interviews**

148 Our aim was to elicit the widest range of views and value judgements of IAS as possible. Since our
149 aim was to examine the way in which interviewees reasoned rather than to obtain a representative
150 overview of the attitudes they held, a qualitative approach was required. Qualitative research methods
151 are by now well-established ways of capturing the diversity and complexity of biodiversity-related
152 issues, the underlying concepts that inform policy options as well as the participants' views on these
153 issues and concepts (Fischer and Young, 2007, Menzel and Bögeholz, 2010, Selge et al. 2011).

154 We conducted semi-structured interviews to explore how IAS and the impacts of IAS are understood
155 and evaluated with regard to biodiversity by policy makers from different sectors and by individuals
156 working at the interface between environmental science and policy. The main professional occupation
157 of the interviewees from the science-policy interface is to provide scientific advice to policy makers.
158 At the European level, these include members of the Joint Research Centre (JRC) Institute for
159 Environment and Sustainability and of the European Environment Agency (EEA), while at the
160 national level they belong, for example, to the German Federal Agency for Nature Conservation.

161 We also conducted interviews with stakeholders who were consulted in the process of developing the
162 IAS Regulation but were not closely involved with IAS as an issue. The stakeholders were recruited
163 from among the participants of a stakeholder consultation organized in Brussels in 2010, including
164 representatives from the areas of sustainable development and plant protection, animal rights, the pet
165 trade, crop seed production, as well as landowners and hunters, among others. The Hungarian
166 stakeholder was selected on the basis of a recommendation by another expert. Our intention in the
167 interviews had been to delve more deeply into the connections between knowledge of IAS, value
168 judgements, and options for acting against IAS; it turned out, however, that our prepared interview
169 guide expected too much from the stakeholders in some respects. For this reason, we only conducted a
170 few interviews with this group.

171 The interviews were held between autumn 2013 and winter 2014 and involved a total of 17
172 interviewees (Table 1). The interviews lasted about 1-1½ hours. They were quite extensive, the aim
173 being to ascertain not only the interviewees' basic perceptions of nature but also their practical ideas

174 about managing IAS. Although our aim was not to account systematically for differences between the
 175 lines of argumentation used by different groups (stakeholders, policy makers, individuals at the
 176 science-policy interface) or countries, we did seek to include a broad range of viewpoints on the
 177 conceptualization, perception and evaluation of invasive alien species. Our purpose, then, was to cover
 178 all the groups of interviewees (mentioned above) and to explore the views held by people from
 179 different countries at least once.

180

181 Table 1: Composition of the interviewee sample (n=17). Interviewees were affiliated to institutions
 182 acting on different political levels (European and national).

	Policy making	Science-policy interface	Stakeholders
European level:			
European Union	3	-	2
National level:			
Austria	-	1	-
Belgium	1	1	-
Germany	2	4	-
Hungary	-	2	1

183

184 By selecting individuals who were involved in developing the European IAS Regulation, we were able
 185 to assume a high level of knowledge about IAS. However, our interviewees' specific expertise and
 186 personal experience with biological invasions differed. Depending on the institutional and educational
 187 background, most interviewees had expertise either in scientific knowledge or in policy-related or
 188 strategic knowledge, or both. While researchers in invasion biology tended to have a detailed insight
 189 into biogeographic patterns and ecological processes, policy makers had a deeper understanding of
 190 legal issues and of politicians' acceptance of action against IAS.

191 **3.2 Conducting the interviews**

192 All the discussions and interviews started with two general questions about the relation between the
 193 interviewee and the issue of IAS and about his or her understanding of the IAS concept. These rather
 194 broad questions gave them the opportunity to relax and direct their thoughts to the issues to be
 195 discussed, and to express their observations, concerns and views with respect to IAS in their own
 196 words. The focus of the discussions and interviews was subsequently narrowed down by the
 197 interviewer picking up on those arguments used to support value judgements of alien species and IAS

198 and their relation to EU policy. An interview guide (Box 1) was used to make the conversations
199 broadly comparable. We began with a clarification of the key concepts used in the debate about IAS
200 and interpretations of the invasion process. Then the conversation drew on issues of perception and
201 evaluation of IAS. In the last phase of the interview we focused on arguments which have been used to
202 justify or prevent action against IAS and which determined the course of development of the EU
203 Regulation.

204

205 Box 1: Interview guide

- | | |
|-----|---|
| 206 | 1. In what way are you involved in the IAS issue and, specifically, in the development or |
| 207 | implementation of the IAS Regulation? |
| 208 | 2. What does the term “invasive alien species” mean to you? |
| 209 | 3. How would you describe the ecological behaviour of an IAS? How do ecosystems react when |
| 210 | invaded? |
| 211 | 4. How important is the issue of IAS for environmental policy? |
| 212 | 5. How would you judge the value of alien species? |
| 213 | 6. Which parts of nature can be negatively affected by IAS? Why do you think the respective effect is |
| 214 | negative? |
| 215 | 7. What are the reasons for you to protect biodiversity or ecosystem services? |
| 216 | 8. How should negative effects of IAS be addressed at a European level? |
| 217 | 9. Would you like to add anything? |

218

219 **3.3 Data coding and processing**

220 All the interviews were recorded on tape and were transcribed verbatim. The interviewees were
221 anonymized by listing the country (A: Austria, B: Belgium, G: Germany, H: Hungary), the
222 professional background of the interviewee (S: scientist; S/P: science-policy interface; St:
223 Stakeholder) and the chronological order of interviews. For example, Interviewee G-S-1 is the first
224 interview with a German scientist. The data were analysed in several coding processes, namely, open
225 coding, axial coding and selective coding (Corbin and Strauss 1990, Corbin and Strauss 2008). First,

226 we conducted an exploratory analysis of the transcripts and identified recurrent themes, which were
227 coded according to broad categories discussed and validated by all the authors in an iterative process.
228 Using axial coding we systematically explored the full range of variation in the categories under
229 scrutiny, developing a detailed coding framework on this basis. The concepts addressed by the
230 categories and subcategories were then related to other concepts that cropped up; this proved
231 important for the analysis of arguments. Finally, the codes were related (where possible) to theoretical
232 concepts such as ‘value in itself’ or ‘pragmatic conservation approach’. These main categories were
233 used as a guide for structuring the “narrative”, from ways of defining IAS through to suggestions for
234 how to deal with the IAS issue. We conducted the analysis using MAXQDA 10 (VERBI GmbH) and
235 NVivo 11 (QSR) software packages, which are specially designed for qualitative data analysis. The
236 main coding categories (a) refer to perceptions of alien species and IAS and of affected ecosystems or
237 components of ecosystems (b), reflect how the interviewees linked these perceptions to normative
238 values (Fischer and van de Wal 2007) and (c) exhibit how these evaluations are connected to action
239 against IAS, especially at a European level. These coding categories form a structural framework that
240 helps to illustrate the arguments of individual interviewees. They show how arguments in favour of a
241 specific policy against IAS are interlinked and can be traced back to what are, in some cases, very
242 fundamental assumptions (e.g. ideas about biodiversity).

243 **4 Results: Arguments used to frame the concept of invasive alien** 244 **species, to evaluate them and to justify action**

245 **4.1 Perceptions of alien species and invasive alien species**

246 The IAS Regulation focuses on species which are at once alien and invasive. We therefore asked
247 participants in the first part of the interviews about their understanding of the terms “alien” and
248 “invasive”.

249 All the interviewees agreed that the geographical origin of a species is an important factor in
250 determining whether a species is alien. Many of them conceded that there is a grey area between
251 native and alien species (e.g. A-S/P-1, B-P-1, G-S/P-4) and many had a concept of alien species in
252 mind which differed from the definition contained in the IAS Regulation (e.g., E-P-3, E-St-2, G-S/P-

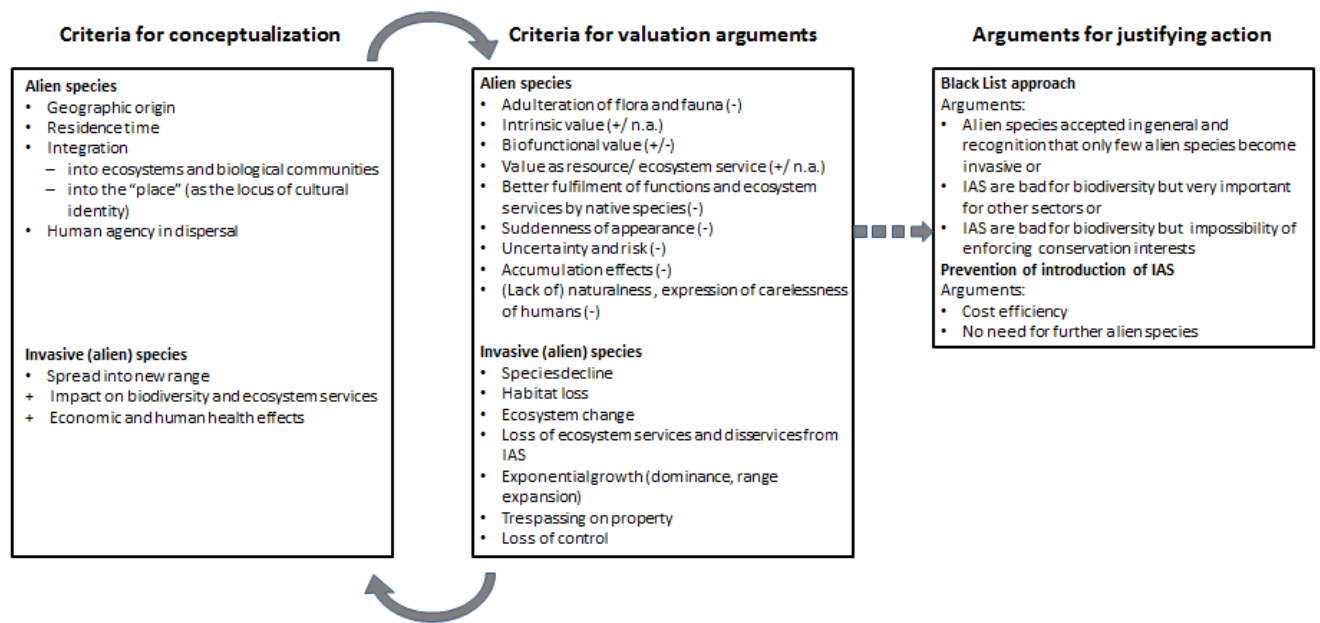
253 4). We additionally identified three criteria where ideas about “alien species” differed from that in the
254 IAS Regulation (Fig. 1).

255 One criterion is the residence time of a species in its new range. Many interviewees tended to regard
256 alien species with a long residence time as native (e.g. B-S/P-1, G-S/P-2, G-S/P-4). One interviewee
257 mentioned the example of the fallow deer (*Dama dama*) (B-S/P-1) which was introduced in the 16th
258 century in the Netherlands, and now could be found on the Red List. In Flanders, by contrast, it is
259 categorized as a released or escaped alien species (Maes et al. 2014). Archaeophytes, i.e. alien plants
260 introduced before 1500 AD (cf. Pyšek 1998), were also frequently mentioned as being native.

261 One reason why archaeophytes in particular were regarded as native is that they were considered to be
262 “fitting in well” (G-P-1) in an unspecified way. Another interviewee expressed this more clearly,
263 regarding a species as native if “it is a member of the local life community” and “has interactions with
264 other species” (H-St-1). Another interviewee (A-S/P-1) also regarded geographically native species
265 which reproduce in habitats where they do not originally occur (such as the common spruce in Central
266 European lowlands) as alien.

267 A further criterion used to determine an alien species is the role of human agency in its dispersal. How
268 natural dispersal is to be distinguished from human-mediated dispersal was regarded by some
269 interviewees as unclear (A-S/P-1, B-P-1). One interviewee (A-S/P-1) was critical of the fact that
270 species which expand their range due to human environmental change (e.g. the Eurasian collared dove
271 *Streptopelia decaocto* inhabiting agricultural and urban landscapes) are not considered alien, whereas
272 species which expand their range due to the connection of river systems by canals are generally
273 considered alien: this struck the interviewee as inconsistent.

274 All the interviewees agreed that not every alien species is invasive. However, there were different
275 views on what attributes render an alien species invasive. Invasiveness is sometimes equated with
276 spread: “*Invasive species are those alien species that spread very aggressively and dramatically*
277 *outwards from the site of introduction*” (H-S/P-2). Most interviewees followed the definition of IAS in
278 the Regulation (i.e. that IAS lead to adverse effects), but opinions differed on whether these effects
279 should refer to biodiversity only or whether they should additionally include economic and human
280 health effects.



281

282 Fig. 1: The link between criteria used to conceptualize alien species and IAS, criteria used to evaluate
 283 them, and arguments put forward to justify action against (potential) IAS, as derived from the
 284 interviews. While conceptualizations and evaluations of IAS seem to go hand in hand (indicated by the
 285 solid arrows), their link to the arguments used to justify action in the IAS strategy is rather
 286 indeterminate (indicated by the arrow with a dashed line). Alien species can be judged positively (+)
 287 or negatively (-) or have no value at all with regard to a certain criterion (not applicable here). In
 288 contrast to this, only the criteria used in negative evaluations of invasive alien species are considered.
 289 The criteria “intrinsic value” and “value as a resource/ecosystem service” were regarded by some
 290 interviewees as not applicable (e.g. A-S/P-1, G-S/P-4, G-P-1) while others considered them to be
 291 suitable criteria for attributing positive values to alien species (e.g. G-S/P-1, E-P-2, E-P-3).

292

293 4.2 Evaluations of alien species and invasive alien species and of their impacts 294 on biodiversity and ecosystem services

295 IAS, by definition, have adverse effects on biodiversity and ecosystem services. However, in order to
 296 understand why IAS are evaluated negatively one has to distinguish between the different perspectives
 297 adopted for the purpose of evaluation (Fig. 1). First, IAS may be evaluated negatively purely because
 298 of their origin. Second, perceptions of IAS are determined by the degree of adversity perceived in their
 299 effects on biodiversity and/or ecosystems.

300 All but one of the interviewees did not consider alien species to be an object of biodiversity
301 conservation, even if an alien species is at risk of becoming extinct in its novel range. The only
302 exception the interviewees could think of was that of an alien species threatened in its native range.
303 Still, some interviewees (B-S/P-1, H-S/P-2) spoke of alien species which are legally protected (e.g.
304 calamus (*Acorus calamus*), a protected plant in Hungary) even though they are not threatened in their
305 native range.

306 Several reasons were given why alien species were considered not to have an equal value to native
307 species. Most notably, some stated apodictically that non-native species “just do not belong here” (G-
308 S/P-2, G-P-1). Another interviewee called the planting of a cedar of Lebanon (*Cedrus libani*) an
309 “adulteration of the flora” (G-P-1). This person also classified the protection of species outside their
310 original range as “ex-situ conservation” (G-P-1) comparable to seedbanks or breeding in zoos; this
311 was regarded only as an emergency strategy in conservation. A further argument that was provided is
312 related to the historical absence or short duration of a species’ presence in a new range. If it has not
313 been there for long, why should anyone care if it disappears again?

314 Only one of the interviewees considered alien species to possess intrinsic value (G-S/P-1). The same
315 interviewee also acknowledged that non-native species can acquire cultural value the longer they are
316 resident in a given range. A whole complex of arguments relates to the biofunctional value of alien
317 species, i.e., the value a species has by virtue of its contribution to the functioning of an ecosystem
318 (e.g. as a resource or habitat structure for other species). Although alien species were largely not
319 regarded as being well integrated into ecosystems, some interviewees did point to the positive role of
320 specific alien species in ecosystem functions. Examples of this were plants that provide food for nectar
321 foraging insects (G-P-1, A-S/P-1), non-native lobsters that became a new food resource and thus
322 fostered the revival of otters in southwest France (B-S/P-1), and black pine (*Pinus nigra*) afforestation
323 used in soil restoration in the Great Plain in Hungary (H-S/P-1). One interviewee (B-S/P-1) even
324 cautioned against eradicating the Himalayan Balsam, because it had developed relationships with
325 native species.

326 Many alien species are generally acknowledged as being a resource for humans (e.g. for food, timber,
327 fuel), and some interviewees explicitly mentioned cases in which the benefits of IAS outweigh their

328 adverse effects on biodiversity. The Douglas fir (*Pseudotsuga menziesii*) and the black locust (*Robinia*
329 *pseudoacacia*) were often cited as species of great importance for forestry (G-S/P-1, H-S/P-2), the
330 mink (*Neovison vison*) as being vital to the fur industry (E-P-2, E-P-3).

331 However, many interviewees stated clearly that it is preferable when both ecosystem functions and
332 services for humans are provided by native species (e.g., A-S/P-1, B-P-1, H-S/P1, H-St-1). They
333 argued that the functions and services provided by alien species could easily be replaced by those of
334 native species and that the ES benefits from alien species did not outweigh the losses they caused.

335 It was striking that the speed of expansion of an alien species' range or the suddenness of its
336 appearance seemed to play a major role. Nature seems to be taken by surprise: "*When they [alien*
337 *species] are introduced from different contexts – pow! – they suddenly appear. Natural immigration*
338 *based on a gradual process is certainly more likely to be acceptable to nature and the environment; in*
339 *other words, the native species might accommodate them more easily*" (G-S/P-3). Another interviewee
340 describes the migration of Southern European insects to Central Europe as "something smooth" and
341 "as part of natural change and of biodiversity adapting itself to climatic changes" (E-P-1).

342 Finally, most interviewees regarded alien species as a risk to biodiversity. Being alien is thus
343 considered to be a proxy for potential damage to biodiversity and ecosystem services (see the
344 following section). One aspect of this risk is uncertainty: as we cannot fully rule out the possibility that
345 a non-native species will become invasive, non-native species in general are frequently regarded as a
346 potential threat. There have been many examples of a species not being expected to become invasive
347 that did eventually become so (e.g. the red-eared slider *Trachemys scripta elegans* in Hungary). With
348 regard to uncertainty, the interviewees also referred to gaps in knowledge. Many of the effects of non-
349 native species (e.g. on soil organisms) and their interactions with native species and ecosystems are
350 currently not well researched. The interviewees also referred to the cumulative effects of non-native
351 species. Native species are considered to recede to the extent that alien species expand: "*...and when*
352 *we introduce non-native species time and again, even if we do not have evidence of any effects, a large*
353 *proportion of alien species will take up the space previously occupied by native species*" (G-S/P-3).

354 On the basis of the interviews, then, we were able to identify two distinct dimensions in which IAS are
355 regarded as deleterious, namely, their ecological behaviour and their effect on biodiversity and
356 ecosystem services.

357 In terms of behaviour, some interviewees (E-P-1, G-S/P-3, G-S/P-4) described the process of range
358 expansion and dominance in dramatic terms: “*I have seen rivers with Himalayan Balsam, there are*
359 *rows of pink all along their banks. There is nothing else, there is nothing else*” (G-S/P-4). One
360 interviewee highlighted the exponential increase of IAS, linking it to an increase in damage: “*So for*
361 *all species that are already established, there is an increase in damage, plus there are always new*
362 *species coming in, so if you add all this on top of existing damage we have got an exponential growth*
363 *in damage (...). It is all very frightening*” (E-P-1). Another interviewee (E-St-1) regarded IAS as a
364 problem because they could also enter private property when they spread. Here, IAS impact on
365 cultural and legal issues and are seen to act as trespassers.

366 Interestingly, the behavior of IAS is often linked to human actions and the way they are evaluated. One
367 interviewee stated that the increase of pathways leads to an “uncontrolled threat”. Here, both human
368 agency and loss of control play a major role in the evaluation of IAS.

369 In addition to the adverse effects of IAS on biodiversity and ecosystem services, most interviewees
370 were aware of other “disservices” arising from IAS, e.g. adverse effects on human health and the
371 economy. Nearly all the interviewees thought immediately of adverse effects on native species by
372 competition and/or predation. The next issue these interviewees mentioned was that of the impacts of
373 IAS on ecosystems. Here we asked what changes were regarded as constituting negative effects on
374 ecosystems and why.

375 Most of these interviewees regarded ecosystem changes (e.g. changes in structures or processes) as
376 damage, including cases in which there is no evidence of any far-reaching impairment of species.
377 Thus, ecosystems themselves were regarded as targets of conservation, irrespective of the functions
378 they provide for species (e.g. provision of food, migration corridor) or their services to humans. Any
379 change in an ecosystem is regarded as a negative change. One example mentioned in terms of its
380 detrimental effects was that of the Himalayan Balsam (*Impatiens glandulifera*): “*It leads to a massive*
381 *increase in biomass, which would not be there otherwise, it causes changes in matter fluxes etc., which*

382 *are also ecosystem functions... . It has an enormous impact, but in my opinion no serious effects on*
383 *individual animal and plant species”* (G-S/P-2). Interestingly, the negative impact of Himalayan
384 Balsam on species richness was also considered to be considerably overstated because it has not
385 noticeably outcompeted other species, in spite of its abundance (G-S/P-2) or has not affected
386 threatened species (B-S/P-1). Another interviewee deplored the fact that the characteristics of an
387 ecosystem are changed by the black cherry (*Prunus serotina*): “*They are just changing the conditions.*
388 *They are forming such a dense cover, cause so much shade, that they change the ecosystem, they*
389 *change the characteristics of the ecosystem”* (E-P-1).

390 It is worth mentioning that the effects of IAS on ecosystem services were mentioned in greater detail
391 almost only by those interviewees who worked in non-conservation related sectors. One example
392 highlighted by two interviewees was the Asian long-horned beetle (G-S/P-1, E-P-3). Being native to
393 Asia, this beetle is sometimes introduced in infested wood packaging used in international trade and
394 has been found in at least 11 countries in Europe (Meng et al. 2015). Larval feeding causes high tree
395 mortality and hence inflicts considerable damage upon forestry. This beetle has so far been recognized
396 mainly in the field of plant protection and as an organism which causes economic damage to forests.
397 Hence the fact that ecosystem services are mainly addressed by representatives of non-conservation
398 sectors could be due to the particular interests and knowledge in circulation there, which differ from
399 the interests and knowledge base of conservation actors.

400 **4.3 Justification for action against invasive alien species, focusing on the** 401 **European level**

402 There was general unanimity among the interviewees that prevention is preferable to other
403 management options once the species has been introduced (eradication, containment, control). Overall
404 they considered a “Black List approach” to be feasible, i.e. a ban on those alien species deemed to be
405 harmful on the basis of a risk assessment. None of the interviewees referred to the potential severity of
406 damage caused by alien species as a means of justifying their ban in general. It therefore seems that
407 the magnitude of potential damage caused by alien species was not considered significant enough to
408 take such radical action, especially in the light of uncertainty.

409 The interviewees essentially offered two arguments for preferring prevention to management of
410 introduced species (Fig. 1). The overriding argument was that prevention is much more cost efficient
411 than management. This claim was supported by the view that an efficient system of border control is
412 partially established or could be accomplished with moderate effort and also that there are already
413 successful methods available for reducing pathway risks for plant quarantine pests. Therefore, the
414 costs of developing and introducing such a system would not be very high. By contrast, the
415 precondition for rapid eradication, namely, an early warning system, has so far not been established,
416 and there was considerable doubt concerning the whether such an early warning system would actually
417 work. For more widespread species, most interviewees regarded complete eradication as nearly
418 impossible. Another reason given by the interviewees for supporting the prevention of the introduction
419 of non-native species was that they simply did not see any need for the introduction of further species
420 beyond those already traded.

421 Although the interviewees supported prevention, all of them adhered to an “innocent until proven
422 guilty” approach for intentional introduction and the rapid eradication of IAS. This seems at first sight
423 to be a contradiction. This attitude was substantiated by a variety of patterns of argumentation. If alien
424 species are accepted in general, it makes sense to filter out only those alien species that probably cause
425 harm. Surprisingly, although many interviewees were aware of the fact that only a small percentage of
426 alien species turn out to be harmful (e.g., G-S/P-1, G-S/P-2, H-S/P-1), only one interviewee explicitly
427 mentioned this fact as a reason for supporting the Black List approach (G-S/P-1). Many, however,
428 accepted the reasons given for various land users to benefit from alien species that have already been
429 introduced long ago (e.g., A-S/P-1, G-S/P-1, G-S/P-4). Further, there were interviewees who supported
430 a “guilty until proven innocent” approach in principle but who gave up on this view in advance
431 because they anticipated that it would be practically impossible to gain political support for it. They
432 believed that other sectors (e.g. forestry) would object to the “guilty until proven innocent” principle
433 and that these sectors were too powerful to be overruled. It was also acknowledged that free trade is
434 highly valued politically and is also established in WTO agreements and European law. Thus, these
435 interviewees were aware of the fact that their viewpoint conflicts with existing legislation.

436 **5 Discussion**

437 The aim of our study was to examine which arguments are put forward when conceptualizing,
438 perceiving and evaluating IAS by individuals involved in developing the IAS Regulation, and how this
439 has informed this Regulation (Fig. 1).

440 Many interviewees (e.g., E-P-3, E-St-2, G-S/P-4) had ideas about alien species which deviated
441 significantly from those implied by the definition contained in the IAS Regulation, which focuses on
442 the role of human agency in a species' range expansion. The interviewees often had a
443 multidimensional concept of nativeness in mind, with a smooth transition between native and alien.
444 The criteria by which they judge whether a species is alien are residence time, distance to place of
445 natural origin, ecological adaptation to communities, and type and degree of human agency. Although
446 there is great unanimity in the ecological literature about defining alien species as depending on the
447 existence of human agency, outside ecology the concept of alien species is discussed subject of lively
448 debate (for a detailed account, see Eser 1999, as well as Woods and Moriarty 2001, O'Brien 2006,
449 Warren 2007, Knights 2008, Keulartz and van der Weele 2009; for an overview of concepts of
450 invasive alien species see Humair et al. 2014a).

451 In the literature on invasion biology and biodiversity conservation there are two definitions for
452 "invasive" (e.g. Simberloff and Rejmánek 2011, Ricciardi 2013). An "ecological definition" uses
453 spread and rate of range expansion as defining criteria. In contrast to this, a "policy definition" (like
454 the one found in the IAS regulation) focuses on impacts on natural resources or on human well-being.
455 This makes it clear that the concept of alien species can vary according to context and purpose. The
456 reasons for including impacts on the economy or on human health in the definition of IAS are clearly
457 strategic and political. Those interviewees who thought that economic and human health impacts
458 should be taken into account argued that the IAS issue acquires greater political significance for this
459 reason, that synergies with other land use sectors come into play when taking action against IAS (e.g.
460 phytosanitary measures), and that harm to human health and economic costs would strategically help
461 conservationists to make their case: *"If we add it [economic and human health impacts], it helps our*
462 *discourse because there are DGs [Directorates-General] and member states which were listening*
463 *because it caused so much damage"* (E-P-1).

464 However, some interviewees (mainly from nature conservation, G-S/P-3, G-S/P 4, G-P-1) were
465 sceptical about integrating harm to the economy and human health into the concept of IAS. They
466 expressed some fear that those IAS responsible for causing harm to the economy and to human health
467 may mainly be covered by the Regulation in the end and that biodiversity conservation may recede
468 into the background - or, even worse, that resources may be diverted away from biodiversity
469 conservation. Another argument is that the EU Regulation, as clearly stated in the Preamble, is based
470 on nature conservation legislation, as is the Convention on Biological Diversity.

471 The practice of adapting definitions to the purposes for which they are intended is a common one in
472 the policy context (e.g. Schiappa 2003). It is interesting, however, that the IAS regulation adopts a
473 pragmatic policy-related definition of “invasive” but not of “alien”. Some interviewees are concerned
474 that the possibility of alien species becoming naturalized is ruled out by the definition of ‘alien’ (B-
475 S/P-1, G-S/P-1). Today’s alien species will thus also be alien in the future. Nativeness has also been
476 associated with nativism and xenophobia (Gould 1998, Peretti 1999). Historical aspects (e.g. residence
477 time), community membership and also cultural criteria are sometimes mentioned as possible ways to
478 expand the nativeness concept (e.g. Hettinger 2001, Woods and Moriarty 2001, Knights 2008). It was
479 not geographical origin that troubled the interviewees but rather human carelessness in species
480 dispersal. *“We are behaving with biodiversity as if we could just play around with it, and we are
481 neglecting all the linkages within an ecosystem. (...) ... and people do not think about all the
482 consequences even though they are so obvious. (...) ... the cause is human behaviour; then invasive
483 species are a consequence of this human behaviour”* (E-P-1). Such an argument is described by
484 Skogen (2001) as reflecting a notion that “we should not meddle with nature”. One term which would
485 focus attention on human agency rather than on species’ attributes is “introduced species”. In this way,
486 the concept of “being alien” (which is ambiguous and has xenophobic connotations) could be avoided.
487 Most of our interviewees did not think that alien species have a value in themselves, and there was
488 great scepticism concerning the biofunctional value of alien species. Here, species are clearly judged
489 on their origin (cf. Davis et al. 2011, Humair 2014b). This seems to contrast with the findings of van
490 der Wal et al. (2015) that species are not judged primarily on their origins. However, their analysis was
491 focused on the prioritization of management measures used to tackle both native and alien species at

492 conservation sites. Setting priorities in taking action against specific species is a different task than
493 making a general evaluation of the entirety of native species compared with the entirety of alien
494 species. The impacts of IAS on biodiversity and ecosystem services are certainly crucial when setting
495 priorities in prevention and management according to the IAS Regulation. Still, native species and
496 non-native species are often not considered to have the same conservation value. We thus concur with
497 Binimelis et al. (2007) who found that alien species themselves are conceptualized as an
498 environmental problem – and not just their impact on the environment (cf. Humair 2014b).

499 Many interviewees viewed alien species as lacking value because they are “out of place” in several
500 ways (e.g., E-P-1, G-S/P-2, G-P-1). First, alien species are regarded as unnatural elements in their new
501 range. This view reflects the definition of “alien” in the IAS Regulation, i.e. relating to species
502 introduced outside their natural range. Naturalness, generally defined as the absence of human
503 influence (Hunter 1996, McIsaac and Brün 1999), is understood here as a historical approach which
504 uses an “original” state as a yardstick for judging naturalness. Framing the conservation of alien
505 species in their novel range as “ex-situ conservation” is understandable against this background.
506 Naturalness can also relate to the process of range expansion. In this respect human-mediated dispersal
507 is considered unnatural. This may also apply to returning native species (van Herzele et al. 2015).
508 However, alien species can also be involved in natural processes. Range expansion after introduction
509 or secondary release can occur by natural dispersal. Some alien species can appear in habitats in late
510 stages of succession which have not been influenced by human management for a long time (Kowarik
511 1999). In contrast to this, the management of alien species is based on human activity and is therefore
512 not natural. Hence, to what extent alien species are considered natural is a matter of perspective.

513 Second, many interviewees consider non-native species as harmful because they are not adapted to
514 local species and environments (e.g. E-P-1, E-P-2, G-S/P-2). The notions of “adaptation” expressed by
515 the interviewees were quite fuzzy, and the scientific literature does not give much indication either of
516 when an organism fits into a community or ecosystem. Hettinger (2001: 198) states that a species has
517 adapted, for example, “when it has changed its behaviour, capacities, or gene frequencies in response
518 to other species or local abiota” or when it moves into a type of ecological assemblage that is already
519 present in its home range. When the interviewees refer to the biofunctional value of alien species, they

520 also address the issue of ecological interconnectedness in their novel habitats. From a normative point
521 of view, it is questionable whether or not biofunctional value is actually a value in an ethically relevant
522 sense. Eutrophication might be biofunctionally good for nitrophilous communities, but that does not
523 mean eutrophication has great value for nature conservation. Similarly, an alien species is not valuable
524 merely because it provides a food resource for another species, and neither is a native species valueless
525 if it is poorly interconnected with other species in functional terms. It is remarkable that the
526 classification criteria for alien species largely overlap with evaluative criteria. For example, a species
527 is alien when it does not belong to a place or an ecosystem - and yet not belonging to a place or an
528 ecosystem definitely implies a value judgement.

529 Third, as alien species are not well integrated they are considered a potential risk to native
530 biodiversity. If they cannot be used by other species, e.g. as a food resource, but occupy the space of
531 native species, this could lead to unforeseen adverse effects on biodiversity and ecosystem services.
532 Hence, being alien is regarded as an indicator of having negative effects. However, the validity of
533 alienness as an indicator of invasiveness is sometimes contested. Thompson et al. (2011) claim that
534 whether or not plants are 'winners' or 'losers' in terms of their ability to thrive in human-dominated
535 landscapes is largely unrelated to their native or alien status. Schlaepfer et al. (2011) emphasize that a
536 subset of non-native species will undoubtedly continue to cause harm, but that other non-native
537 species could increasingly come to be regarded as beneficial.

538 It is surprising that many interviewees considered not only certain impacts on biodiversity and
539 ecosystem services as harmful but also the very behaviour of invasive alien species. The processes of
540 spread and the formation of dominant populations was regarded as "frightening". As Hulme (2012)
541 points out, though, the perception of harm is often biased and is frequently associated with the most
542 widespread alien species which, however, do not necessarily cause the greatest impact. The crossing of
543 property boundaries was also viewed with concern. An evaluation of the ecological behaviour of alien
544 species as undesirable is sometimes criticized. For example, Sagoff (1999) lists uncontrolled fecundity,
545 tolerance for "degraded" conditions and aggressiveness as negative attributes of IAS. Remarkably, the
546 same attributes and behaviours are also referred to in debates about returning native species (van
547 Herzele et al. 2015).

548 With regard to the impacts of IAS, the interviewees frequently perceived significant changes in
549 ecosystem structure and function as harm. This makes sense given the assumption that species in
550 communities are strongly interconnected and that alien species cannot take on the roles of native
551 species. An impairment of the “health of ecosystems”, which could be interpreted as proper
552 functioning and freedom from distress (cf. Jax 2010), was explicitly mentioned in this context: “*I*
553 *think (...), they [IAS] are symptoms of the health of ecosystems. In other words, if ecosystems are (...)*
554 *more and more concerned by the invasive alien species it is because, in some way, their capacity to*
555 *defend themselves against them has probably decreased. We call this resilience - the capacity of the*
556 *ecosystem to defend itself. It is like a living organism when you are attacked by different microbes. The*
557 *more ill you are, the less you are able to defend yourself against them” (E-P-2).*

558 As Bartz et al. (2010) point out, not all unnatural changes to the environment are prima facie
559 detrimental. They define an adverse impact as a reduction in the positively valued attributes of one or
560 more conservation resources (e.g. a decrease in the population size of a native species due to the
561 spread of a non-native species). In the case of changes in ecosystem structure and functions, it was
562 often not clear from the interviews in what way certain positively valued attributes were reduced by
563 IAS. This points to the more general problem that the concept of “harm to the natural environment” is
564 nebulous and undefined (Sagoff 2005; see also Humair et al. 2014a). Even if ecosystem change due to
565 alien species is perceived as negative, as one interviewee (G-P-2) made clear, it is quite implausible
566 that major changes to ecosystem structures or functions would suffice as an argument for justifying
567 action against the alien species that cause these changes.

568 Views of IAS as unnatural and as compromising the proper functioning of ecosystems thus clearly
569 reflect specific visions of nature and of human-nature relationships held by the interviewees. For
570 example, “proper functioning” and especially “ecosystem health” suggest the notion of a balance of
571 nature. This is in line with the findings of Verbrugge et al. (2013) who found that the overwhelming
572 majority of respondents in their study on perceptions of alien species agreed with the paradigm of a
573 balance in nature. Given that equilibrium theories are highly disputed in ecology and conservation, it
574 is surprising that interviewees with a background in these fields have not yet incorporated the
575 possibility of dynamic paradigms into their conceptions of nature. There seems to be a considerable

576 gap between the way IAS are perceived and evaluated by different interviewees on the one hand and
577 the arguments that are actually used to justify action against IAS on the other. Our findings indicate
578 that only a small number of the many arguments for and against (invasive) alien species were
579 discussed openly in the course of developing the EU Regulation. One reason is almost certainly that
580 some fundamental issues simply do not arise when discussing European legislation (e.g. the debate
581 about the value of alien species). Another reason may be that only those arguments were selected
582 which are strategically helpful for gaining credibility and support for the Regulation (van Herzele et al.
583 2015), such as arguments relating to ecosystem services. It may also be that our interviewees
584 anticipate that some visions of nature (e.g. a balance of nature) or value judgements based on the
585 ecological behaviour of IAS are not shared by those who are to implement the Regulation.

586 There was broad agreement on two issues concerning action against IAS. First, in the context of risk
587 assessment, alien species that are expected to become invasive need to be identified, and only against
588 these species should action be taken (Black List approach). Second, the most feasible action regarding
589 these species is to prevent their introduction into the territory of the EU. The question that arises here
590 is why there should be such a robust consensus on these principles when conceptual and value-related
591 perspectives on IAS differ so widely.

592 One reason is that these conceptual and evaluative issues do not have any consequences in practice.
593 For example, although there are differing views about which species should be considered as alien and
594 invasive, several respondents emphasized that this does not have any effect on the selection of IAS.
595 For those species being considered for the list of Union concern, there is broad agreement that they are
596 both alien and invasive.

597 Another reason is that there is a consensus that some alien species do indeed cause serious harm,
598 although there might be different views about which entities (biodiversity, human health, agricultural
599 crops) are harmed. It is therefore not such a great challenge to establish a general consensus on the
600 need to act against species which are proven harmful. However, it might be quite difficult to agree on
601 specific species which should appear on the list of IAS of Union concern. Many interviewees (e.g., A-
602 S/P-1, G-S/P-1, G-S/P-3) expected there might be conflicts over this issue: for example, species which
603 cause a net economic loss but are important for the economy of one sector only (e.g. mink for the fur

604 trade or the black locust for forestry) might still not be listed. In this respect, potential conflicts are
605 shifted from the IAS Regulation itself to the list which is to be added to the Regulation. As one
606 interviewee stated, *“you can ask five people to produce a list of the worst invasive species, then you*
607 *can ask five different people, and you will get a completely different list”* (A-S/P-1). A formal risk
608 assessment should therefore help to establish agreement on the species which should be listed as IAS
609 of Union concern. Roy et al. (2013) tried to harmonize risk assessments from different sectors (e.g.
610 nature conservation and plant protection) and different EU member states (for an overview of risk
611 assessments, see also Verbrugge et al. 2014) and presented a “Draft list of proposed IAS of EU
612 concern”. Decisions on which species should be listed as IAS of Union concern will be based on final
613 risk assessments carried out either by the Commission or by Member States. In December 2015 the
614 Commission submitted a first draft list containing 37 species.

615 A final reason why consensus has been achieved on a policy against IAS is that the arguments
616 regarding the destructive nature of species are ultimately not so important. When it comes to taking
617 action, the question of a species’ potential usefulness outweighs that of its potential harmful impacts.
618 The IAS Regulation itself emphasizes that risk assessments must weigh the benefits of IAS against
619 their adverse effects. The interviewees broadly agreed that precaution is most easily achieved by
620 preventing species introduction in the first place. But here, too, they did not refer to the projected costs
621 of damage caused by IAS but rather argued that prevention is cheaper than eradication or control.

622 Some of the interviewees would have liked to achieve more rigorous regulations on IAS (G-S/P-3, G-
623 P-1). Here, divergent opinions about the correct course of action remain which cannot be resolved by
624 debate. A politically feasible solution will be one with which the different parties to the debate can
625 live. The way the conflict is settled will probably have more to do with political power than with good
626 arguments.

627 **6 Conclusions**

628 In this paper we have examined the arguments put forward by experts and stakeholders involved in
629 developing the IAS Regulation with regard to evaluations of and appropriate measures to be taken
630 against IAS. The interviewees were shown to perceive IAS in a much more richly textured way than

631 that expressed in the Regulation; they also often framed the adverse impacts of IAS differently than in
632 the Regulation. Hence, the motives of those who support (or oppose) the IAS Regulation extend far
633 beyond the rationale for the Regulation outlined in its preamble. We also found that the arguments put
634 forward by our interviewees are often used in a strategic way. Economic arguments are expected to be
635 convincing to policy makers but do not necessarily reflect the strong support for biodiversity
636 conservation found in those who put forward these arguments. It would be interesting to conduct
637 further research on the reasons why some arguments are considered more convincing than others.

638 Our findings suggest that differences in argumentation regarding the value of alien species and the
639 impact of IAS in general have little effect on the development of the IAS Regulation. However, this
640 might be different when it comes to the process of drawing up a list of specific IAS of Union concern.

641 What constitutes harm to ecosystems is still a topic that requires further debate. While it is widely
642 recognized that species loss conflicts with the goal of species conservation, greater clarity is needed
643 regarding the point at which ecosystem change, independent of species loss, is considered harmful and
644 regarding the values with which ecosystem change is believed to conflict. Unless evaluative
645 assumptions (e.g. notions of a valuable state of “ecosystem health”) are shared by the stakeholders
646 involved, no amount of argument will convince them, and conflicts will be resolved on the basis of
647 power relations rather than through argumentation. Stakeholder consultations such as the one
648 conducted by DG Environment for the “EU Strategy on Invasive Alien Species” could be further
649 developed to discuss the topic of harm. In terms of practical management of IAS, integrating
650 stakeholders in participatory processes of adaptive management, as suggested by Evans et al. (2008),
651 would certainly be a good way forward.

652 Our study has confirmed that it is important to reveal the implicit value judgments because this can
653 improve communication about environmental policies and help to create a shared understanding. It can
654 also facilitate critical reflection on and a debate about values. In our view, analysing arguments and
655 reflecting critically on the validity of even widely accepted arguments can advance the debate about
656 evaluations of IAS.

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820

Criteria for conceptualization

Alien species

- Geographic origin
- Residence time
- Integration
 - into ecosystems and biological communities
 - into the “place” (as the locus of cultural identity)
- Human agency in dispersal

Invasive (alien) species

- Spread into new range
- + Impact on biodiversity and ecosystem services
- + Economic and human health effects

Criteria for valuation arguments

Alien species

- Adulteration of flora and fauna (-)
- Intrinsic value (+/ n.a.)
- Biofunctional value (+/-)
- Value as resource/ ecosystem service (+/ n.a.)
- Better fulfilment of functions and ecosystem services by native species (-)
- Suddenness of appearance (-)
- Uncertainty and risk (-)
- Accumulation effects (-)
- (Lack of) naturalness , expression of carelessness of humans (-)

Invasive (alien) species

- Species decline
- Habitat loss
- Ecosystem change
- Loss of ecosystem services and disservices from IAS
- Exponential growth (dominance, range expansion)
- Trespassing on property
- Loss of control

Arguments for justifying action

Black List approach

Arguments:

- Alien species accepted in general and recognition that only few alien species become invasive or
- IAS are bad for biodiversity but very important for other sectors or
- IAS are bad for biodiversity but impossibility of enforcing conservation interests

Prevention of introduction of IAS

Arguments:

- Cost efficiency
- No need for further alien species

