



RAAD VOOR DIERENAANGELEGENHEDEN

BALANCING BIODIVERSITY AND ANIMAL WELFARE

*ETHICAL AND SOCIETAL CHALLENGES IN THE
MANAGEMENT OF INVASIVE ALIEN SPECIES*

Contents

1. Introduction	15
1.1. Invasive alien species	15
1.2. Legal framework and administrative structure	17
1.2.1. <i>European level</i>	17
1.3. National level	20
1.3.1. <i>Central government, provincial authorities and water boards</i>	20
1.3.2. <i>National Action Plan on Invasive Alien Species</i>	21
2. Prevention	23
2.1 IAS prevention and tailored approach	23
2.1.1. <i>Reinforcing the national gateway; risk assessment and development of a national list</i>	23
2.1.2. <i>European cooperation and a European positive list</i>	24
2.1.3. <i>Strengthening ecosystem resilience</i>	26
3. Eradication, control and animal welfare	27
3.1. Applicable regulations	27
3.2. Available methods	29
3.3. IUCN manual: Management measures for vertebrates	32
3.4. Development of new and humane methods	34
4. Challenges in administrative integration and implementation	38
5. Societal attitude and resistance	40
5.1. Charismatic bias	40
5.2. Individual value systems: relationship with animals and nature	41
5.3. Preventing and dealing with societal resistance	42
6. Normative dimension	44
6.1. Weighing values and interests	44
6.2. Weighing values and interests in practice	46
6.3. Dilemmas in providing shelter for Union list species requiring care	48
6.4. The label 'invasive alien species'	50
6.4.1. <i>Connotations surrounding 'native' versus 'alien'</i>	50
6.4.2. <i>Naturalisation of species</i>	51
7. Conclusion	53
8. Recommendations	55
<i>Emphasis on prevention, early detection and rapid response</i>	55

<i>Integration of animal welfare in research, assessment and decision-making</i>	56
<i>Knowledge development and adaptive management</i>	56
<i>Social dialogue and language awareness</i>	57
<i>International cooperation and regulation</i>	57

9. References	59
Annex 1. Request for an advisory report	63
Annex 2. External interviews	67
Annex 3. Animal species on the Union list	68
Annex 4. Humaneness assessment of control measures	72
Annex 5. Overall assessment of control measures	77

Procedure

The Council on Animal Affairs (hereinafter: RDA or the Council) has drawn up this advisory report at the request of the former Minister for Agriculture, Nature and Food Quality and the former Minister for Nature and Nitrogen (see request in Annexe 1). The advisory report has been prepared by a forum consisting of the councillors Bastiaan Meerburg (chair), David van Gennep and Léon Ripmeester, as well as external experts Jacques van Alphen and Eelke Jongejans. The forum was supported by committee secretary Anne van den Ende of the RDA secretariat.

In preparing this report, the forum met several times and consulted external individuals and organisations (Annexe 2). The insights gathered informed the forum's deliberations and the final advisory report. Aside from the external experts participating in the forum, no external parties were involved in preparing this publication.

The draft advisory report was reviewed by the Council and Jong RDA (the youth division of the Council), making it a product of the Council as a whole.

Research questions

The ministers' full request to the RDA is included in Annexe 1. In subsequent discussions between the RDA and the Ministry, this request was further specified to focus on: (1) an examination of the *societal* resistance that can arise in response to the culling of animals designated as invasive species; and (2) a reflection on how to *balance* the interests of nature as a whole with the interests of individual animals. The request is included in the cover letter for the National Action Plan on Invasive Alien Species:

Tension exists between the conservation of nature and biodiversity and, in some cases, societal reluctance to cull animals. The Council on Animal Affairs has been asked to reflect on that tension and to weigh the interests of nature as a whole against those of individual animals (including attention to animal welfare).

In agreement with the Ministry of Agriculture, Fisheries, Food Security and Nature, the RDA is publishing this advisory report after the National Action Plan on Invasive Alien Species (2026). This approach allows the Ministry to set its ambitions and objectives, while the RDA contributes additional insights and practical guidance for managing invasive alien species (IAS).

Policy and scientific underpinnings

This advisory report builds on existing policy, including the European Invasive Alien Species Regulation and the Ministry of Agriculture, Fisheries, Food Security and Nature's National Action Plan on Invasive Alien Species (2026). The *Thematic Assessment Report on Invasive Alien Species and their Control* by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) forms an important scientific basis for both the action plan and this advisory report.

Relationship with previous advisory reports

The culling of invasive alien species was previously addressed in the advisory report *Shining a light on the killing of animals* (2022). The RDA has also issued several advisory reports relating to wildlife, some of which overlap with the present advisory report:

- 2012 - *Duty of care, naturally. On the welfare of semi-captive and wild animals.*
- 2017 - *Weighing wildlife welfare. Application of the wildlife assessment framework.*
- 2022 - *The role of local and regional authorities in relation to animal welfare.*
- 2022 - *Dilemmas in Wildlife Rescue and Rehabilitation. Caring for wild animals in need of help.*

Definitions and abbreviations

Definitions

Alien species *

A plant or animal species that, through human action, has been introduced outside its natural range and is able to survive and subsequently reproduce there.

- * The Dutch word *uitheems*, which is used in the original text, does not translate directly to *alien*. A closer translation would be *non-native*. Nonetheless, in the interest of clarity, and aware of the importance of harmonisation with common international terminology, we have chosen to use *alien* and not *non-native* for these three concepts in this document. This choice reflects key considerations we took into account during internal consultations on this matter of terminology. In particular, we sought to avoid introducing a new alternative term in this translation and to be transparent about our deliberations and the reasoning behind our choice.

Invasive alien species

A non-native species whose introduction or spread has been found to threaten or adversely impact local ecosystems and biodiversity. Many invasive species also have additional negative impacts, including on public health, the economy, infrastructure or safety.

Invasive alien species of Union concern (*legal term from Regulation (EU) 1143/2014*)

An invasive alien species whose adverse impact has been deemed such as to require concerted action at Union level pursuant to Article 4(3).

Introduction

The movement, as a consequence of human intervention, of a species outside its natural range.

Biodiversity

The variability among living organisms from all sources, including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.

Ecosystem services

The direct and indirect contributions of ecosystems to human wellbeing.

Ecological resilience

The ability of an ecosystem to respond to changes caused by natural or human-induced disturbances, without losing its original function and structure.

Animal welfare

The quality of life as experienced by the animal itself. An animal is considered to have good welfare if it is able to adapt to its environment and attain a state it experiences as positive. The ability to exhibit species-specific behaviour is essential to this.

Integrity

Animal integrity refers to the species-specific wholeness and completeness of an animal and its ability to function independently, according to its nature, in an environment appropriate for the species.

Intrinsic value

The intrinsic value of an animal refers to its inherent worth, independent of any benefit it may provide to humans. Respect for this intrinsic value means that the interests and objectives of animals are considered in decision-making.

Species-specific behaviour

Species-specific behaviour is behaviour typical of members of a species. This behaviour is intrinsically rewarding for the animal and/or supports its biological functioning.

Abbreviations

- **Bal**: Besluit activiteiten leefomgeving (Environmental Activities Decree)
- **Bhd**: Besluit houders van dieren (Animal Keepers Decree)
- **Invasive Alien Species Regulation**: Regulation (EU) 1143/2014
- **WMU**: Wildlife management units
- **IPBES**: Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
- **IPO**: Association of Provincial Authorities
- **IUCN**: International Union for the Conservation of Nature
- **IAS**: Invasive alien species
- **LVVN**: Agriculture, Fisheries, Food Security and Nature
- **NVWA**: Nederlandse Voedsel- en Warenautoriteit (Netherlands Food and Consumer Product Safety Authority)
- **RDA**: Raad voor Dierenaangelegenheden (Council on Animal Affairs)
- **Wd**: Wet dieren (Animals Act)

Reading guide

In this advisory report, the RDA focuses on the normative and societal dimensions of policy on animal invasive alien species, particularly when culling is involved. Explicit attention is paid to animal welfare in the assessment of various control strategies, including non-lethal alternatives.

Extensive scientific and policy-related knowledge on invasive alien species (IAS) is already available. The Ministry is aware of the current state of scientific knowledge and the associated recommendations for authorities and policymakers, as set out in the IPBES report. The introduction briefly outlines this scientific background, as well as the relevant legal and policy frameworks.

Chapter 2 examines prevention as the cornerstone of IAS policy, thereby minimising the need for far-reaching control measures. Chapter 3 discusses the eradication and control of invasive species, focusing on available methods, regulations and the development of welfare-friendly and innovative approaches. Chapter 4 considers challenges in the current administrative framework and policy implementation.

Chapter 5 centres on the societal dimension: how public perception, values and resistance affect the feasibility and legitimacy of policy. Chapter 6 elaborates on this by making the normative dimension explicit and considering the relevant values and interests as a whole.

The advisory report ends with a conclusion and recommendations that lay out a course for a future-proof approach to IAS, with particular attention to prevention, animal welfare, societal legitimacy and international cooperation.

Summary

In the advisory report *Balancing Biodiversity and Animal Welfare – Ethical and Societal Challenges in the Management of Invasive Alien Species*, the RDA reflects on the tensions inherent in managing animal invasive alien species, as well as potential policy improvements.

Background and mandate

Invasive alien species (IAS), or invasive non-native species, are plants or animals that, through human action, end up outside their natural range, where they disrupt local ecosystems and threaten native species. Invasive species may also pose risks to public health, cause economic damage, or threaten infrastructure.

Policy on managing alien species includes control measures such as culling, which sometimes leads to societal resistance. This advisory report has been prepared at the request of the former Minister of Agriculture, Nature and Food Quality, Piet Adema; and the former Minister for Nature and Nitrogen, Christianne van der Wal. They asked the RDA to evaluate that resistance and the balance between the interests of nature as a whole and those of individual animals.

Key principles

This advisory report builds on existing policy. The European Invasive Alien Species Regulation (EU Regulation 1143/2014) provides the framework, obliging Member States to ensure prevention, early detection, eradication and control. The list of invasive alien species of Union concern is key to this. Since 2025, this *Union list* has included 49 plant species and 65 animal species. The Netherlands has largely incorporated the obligations arising from this European regulation into national environmental legislation (the *Environment and Planning Act*, formerly the *Nature Conservation Act*). Provincial authorities are responsible for managing most of the species on the Union list. The Ministry of Agriculture, Fisheries, Food Security and Nature is responsible for certain species, such as the Chinese mitten crab and alien crayfish. The coypu and muskrat, which compromise water infrastructure, fall under the water boards. The State Secretary of Agriculture, Fisheries, Food Security and Nature has developed proposals to further develop and strengthen invasive-species policy in the *National Action Plan on Invasive Alien Species* (2026). The *Thematic Assessment Report on Invasive Alien Species and their Control* by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES, 2023) forms an important scientific basis for policy.

Prevention

The RDA considers prevention the most effective and cost-efficient strategy for minimising damage and protecting biodiversity. Prevention is also in the best interests of animal welfare; by preventing the introduction of invasive alien species, native animals will not be harmed, and there will be no need to cull non-native animals.

Prevention is better than cure. Prevention requires a tailored approach, as IAS constitute a diverse group ranging from insects to mammals, with a wide range of introduction pathways and spread mechanisms.

Although European legislation forms the basis of the policy, national additions are necessary because it generally takes several years for a species to be added to the European list. During that time, problems may arise at national or regional levels. Member States that wait for a species to be placed on the Union list before acting will be too late. Using national lists can bridge this interim period. Rules governing the trade in animals can also contribute to prevention, as IAS are often introduced via the trade in animals and plants. The RDA advocates international cooperation and harmonisation of regulations.

Another line of action is investing in resilient ecosystems. Resilient ecosystems offer new species fewer opportunities to become invasive and cause damage. Measures that enhance ecosystem resilience can not only help reduce the risk of invasion, but they also contribute to broader biodiversity recovery and reduce the need for far-reaching control measures. As such, the Council considers investing in ecosystem resilience to be a no-regret approach and a relevant cornerstone of a forward-looking prevention strategy.

Eradication, control and animal welfare

After prevention, swift action is key. The European Invasive Alien Species Regulation requires Member States to promptly identify and eradicate IAS. If, nevertheless, a species manages to establish itself, measures must be taken to control the population of the invasive species and prevent its further spread. A variety of lethal and non-lethal methods are available for eradicating and controlling IAS, including mechanical techniques for capturing and killing, chemical and biological methods for controlling their spread, and fertility control agents.

When applying these methods, the end does not justify all means. Animal welfare considerations are legally required. The European Invasive Alien Species Regulation stipulates that animals must be spared all avoidable pain, fear and suffering, without compromising the effectiveness of measures. Other national and international legislation is also applicable. Dutch regulations on animal cruelty are set out in the *Animals Act*, and a list of explicitly prohibited methods is set out in the *Environmental Activities Decree*.

Guideline

The *International Union for Conservation of Nature* (IUCN) has developed a European guideline to support sound decision-making on the choice of control methods for vertebrate species on the Union list. In creating the guideline, measures were assessed in terms of cost and effectiveness, humaneness—i.e., preventing avoidable pain, distress or suffering—and other side-effects, including the impact on other species, the environment or public health. The Council notes that more animal-friendly pest control

methods are desirable. Although there are several good examples, progress in this area has been slow so far. Research has remained limited, partly because there is virtually no financial incentive to invest in animal-friendly methods.

Challenges in the administrative structure

The administrative structure itself forms a key challenge. Because provincial authorities are primarily responsible for implementation, approaches vary by region. Provincial authorities often lack specialised expertise, and structural funding is limited. The situation is further complicated by the fact that responsibility for certain species lies with other levels of government, such as the national government (crayfish) or water boards (muskrat). There are organisational structures, such as the Association of Provincial Authorities, in which cooperation and knowledge-sharing are pursued. Policy implementation could be improved through better coordination between provinces and between other authorities. Consultation with neighbouring countries is also necessary, as IAS do not respect geographical or administrative boundaries.

Societal attitude and resistance

Killing animals can sometimes trigger societal resistance. The situation is not the same for all species, and public perception of particular species is a key factor here. There tends to be more empathy for 'charismatic species' perceived as beautiful, friendly or intelligent, such as the raccoon or Pallas's squirrel. Control measures for these species tend to provoke more opposition than for less appealing species, such as crayfish or insects. Context is also a key factor; the control of animals that cause damage or nuisance is more readily accepted than culling for nature-conservation purposes.

Societal values

People's opinion also depends on their underlying orientation or individual value system. Someone with a mutualistic orientation considers humans and animals to be equal actors within the same system and is more likely to object to lethal control measures. It is easier to justify killing animals from a dominionistic perspective in which nature is viewed as serving human interests.

Communication and transparency

Transparent communication about the risks posed by IAS, the possible management measures and the associated ethical considerations is essential. Societal acceptance of IAS management decreases when measures are perceived as ineffective or disproportionate. Successful IAS management is, therefore, not only an ecological challenge, but also a societal one.

Normative dimension: values and interests

IAS policy is shaped by a complex interplay of values and interests, including nature conservation interests, the interests of native and non-native animals and broader societal interests such as the economy, public health and safety.

Recognising the intrinsic value of animals as laid down in the *Animals Act* means that culling is not inherently justified. Nevertheless, other interests may justify measures that are lethal, or that affect the welfare of individual animals. Biodiversity interests are paramount under the legal framework of the EU Invasive Alien Species Regulation. However, the interests of individual animals must also be taken into account when translating this framework into national policy. The regulation explicitly specifies that management measures must spare animals avoidable pain, fear and suffering. The RDA notes that current policy only gives limited consideration to the interests and welfare of individual animals.

Careful weighing of interests

A careful weighing of interests sets out explicitly which interests are at stake and how they are assessed. This helps responsibly address issues relating to the culling of invasive species, initiate and maintain a dialogue on the topic, and actively seek improvements in animal welfare. A decision-making framework can help clarify this. The IUCN guideline can then provide the necessary information to select the appropriate method for each situation and species.

Broader definition in Dutch policy

The Dutch *National Action Plan on Invasive Alien Species* uses a broader definition than the one used internationally, covering both invasive alien species that threaten biodiversity and ecosystem services, as well as plants and animals that cause damage to agriculture or infrastructure, for example. This broader definition will see more animals classified as invasive alien species, which may affect how the public, policymakers, and implementing authorities perceive and value these animals. According to the RDA, the broader definition may negatively affect the animal's position, as it effectively removes the distinction between killing non-native animals for nature conservation purposes and killing them for other reasons.

Wildlife rehabilitation

Conflicting interests and duties in wildlife rehabilitation centres pose ethical dilemmas. On the one hand, there is a legal obligation to assist animals in need; on the other hand, rehabilitation centres are prohibited from releasing individuals of species on the Union list back into the wild once they have recovered. In most cases, it is practically impossible or undesirable to house such animals permanently in a rehabilitation centre or zoo. The euthanasia of admitted IAS may be a solution, though the attending veterinarian may consider this ethically objectionable if an animal has good prospects of recovery or is otherwise healthy. The periodic collection and subsequent killing of IAS under provincial arrangements is undesirable from an animal-welfare perspective. Killing animals in need may also undercut rehabilitation centres, whose core mission is to take in these animals and restore them to health.

Language

Language can play a guiding role in how we deal with IAS. Terms such as 'invasive', 'non-native' and 'colonisation' are loaded concepts with cultural, historical or normative associations. They convey an underlying judgement about which species 'belong here' and which do not, while ecosystems are by nature open and dynamic. The RDA advocates language awareness, as the choice of words can affect the animal's position within policy and public perception.

Conclusion

The Council concludes that a future-proof approach to IAS requires three interrelated key principles. When these elements align, IAS policy can support both ecosystem protection and our moral responsibility toward individual animals.

1. Prevention and early detection should be prioritised

Prevention and early detection can help minimise environmental damage and animal suffering, which can also reduce societal resistance.

2. Decision-making regarding culling and population management requires careful consideration

Transparent and justifiable considerations that explicitly take biodiversity, effectiveness, proportionality and animal welfare into account are essential for societal understanding and support of far-reaching measures.

3. Increase cooperation and knowledge development

The approach requires more intensive collaboration and knowledge development, both nationally and internationally. Continued efforts to develop effective, more animal-friendly management methods are also necessary to ensure that measures remain ecologically effective, feasible and socially defensible.

Recommendations

The RDA recommends the following:

▪ Prioritise more effective prevention, early detection and rapid response

Prevention, early detection, and rapid response are the most cost-effective strategies for limiting biodiversity loss and preventing animal suffering. Effective prevention requires a combination of stricter regulation, effective supervision, investment in raising awareness and public education, and improved methods for species identification. It also requires a clear division of responsibilities and effective coordination between national and provincial authorities, including sufficient capacity, structural funding and the pooling of specialist expertise. Bolstering ecosystem resilience is an additional prevention strategy that can both reduce the likelihood of invasive species becoming established and minimise their harmful effects.

▪ Integrate animal welfare into research, assessment and decision-making

In practice, animal welfare is not yet structurally included in decision-making regarding culling and management. Animal welfare considerations must be embedded in the decision-making process, and more research is needed to develop non-lethal or more animal-friendly methods.

- **Focus on adaptive management**

Ecological impacts, societal responses and technological possibilities evolve over time, which calls for a learning and adaptive approach. Adaptive management plans in which measures and objectives are regularly evaluated and refined are key here, as is research into the ecological role of certain alien species and the extent to which ecosystems adapt.

- **Maintain an open dialogue and be mindful of wording**

Societal perceptions, emotions and values significantly influence the feasibility and legitimacy of IAS policy. It is important to maintain an open dialogue about the values at stake, including biodiversity, animal welfare, public health, the economy and safety. The choice of language matters, as unnecessarily loaded terms can hinder open dialogue.

- **Strive for international cooperation and coordination**

IAS management is, by definition, a cross-border issue. Species spread across international borders. Trade, transport and new technology also have an international dimension. We should intensify cooperation with neighbouring countries and EU partners on population management, data exchange and knowledge development. We should also work towards better harmonisation of national rules, such as through a European positive list specifying which species may be kept and traded, and develop a 'fitness test' for the European regulation.

1. Introduction

IAS are recognised internationally as one of the five main direct causes of biodiversity loss, alongside land and sea use, climate change, direct exploitation of organisms and pollution (IPBES, 2023b). This chapter examines what IAS are, as well as the legal and policy framework that applies to these species.

1.1. Invasive alien species

The term IAS (invasive alien species) refers to plants and animals that, through human action, end up outside their natural range, where they disrupt local ecosystems and pose a threat to native species (IPBES, 2023b).¹ Many invasive species also have additional negative impacts on public health, the economy, infrastructure or safety, among others.

Globalisation, international trade, climate change and changes in land use are major drivers of the introduction and spread of IAS; with international trade forming the most significant pathway (IPBES, 2023b). Climate change, habitat fragmentation and the loss of habitat quality make ecosystems more vulnerable to invasions.

IAS can have a major impact on biodiversity; they were implicated in 60% of documented cases of species extinction globally. IAS were the sole cause of extinction in 16% of cases, but almost all of those cases (90%) involved the extinction of species on islands (IPBES, 2023b). The Dutch situation differs from the global context. The Netherlands' position as a delta at the end of major river systems, its connection to a continental hinterland and its intensive trade and transport flows make it vulnerable to the introduction and spread of invasive species. However, the consequences are unlikely to resemble the island dynamics that drive much of the global extinction data. In the Netherlands, IAS are more likely to add pressure on native species and ecosystems already burdened by cumulative anthropogenic stressors (Lecomte et al., 2026). IAS can also contribute to biotic homogenisation², changes in ecosystem functions³ and damage to agriculture, infrastructure, the economy and public health.

¹ There are various definitions for the term 'invasive ~~alien~~^{non-native (alien)} species'. In this report, the RDA maintains the definition set out in the IPBES report published in 2023: 'Invasive alien species are animals, plants or other organisms introduced directly or indirectly by people into places out of their natural range of distribution, where they have become established and dispersed, and generating an impact on local ecosystems and species. Invasive alien species are a subset of established alien species that have negative impacts.'

² Biotic homogenisation refers to reduced variation in species composition between areas (a decline in beta-diversity), causing species communities to become increasingly similar.

³ For example, the Asian hornet can disrupt the regulating ecosystem service of pollination by preying on honeybees and other pollinating insects.

The 2023 IPBES report⁴ states that IAS pose a growing global threat to ecosystems, the economy and human health (IPBES, 2023b). That threat comes at a considerable societal cost (Figure 1). In 2019, the global costs of IAS were estimated at over 423 billion USD per year. The vast majority of that related to damages, with only a small proportion related to management measures (IPBES, 2023b). Cumulative costs in Europe for 1960–2020 were estimated at 140.2 billion USD, increasing by at least a factor of ten per decade (Haubrock et al., 2021). Recent analyses suggest that the available cost estimates are likely underestimates due to knowledge gaps and under-reporting (Henry et al., 2023). In Europe, reported damage costs far exceed expenditure on prevention and management (Haubrock et al., 2021).

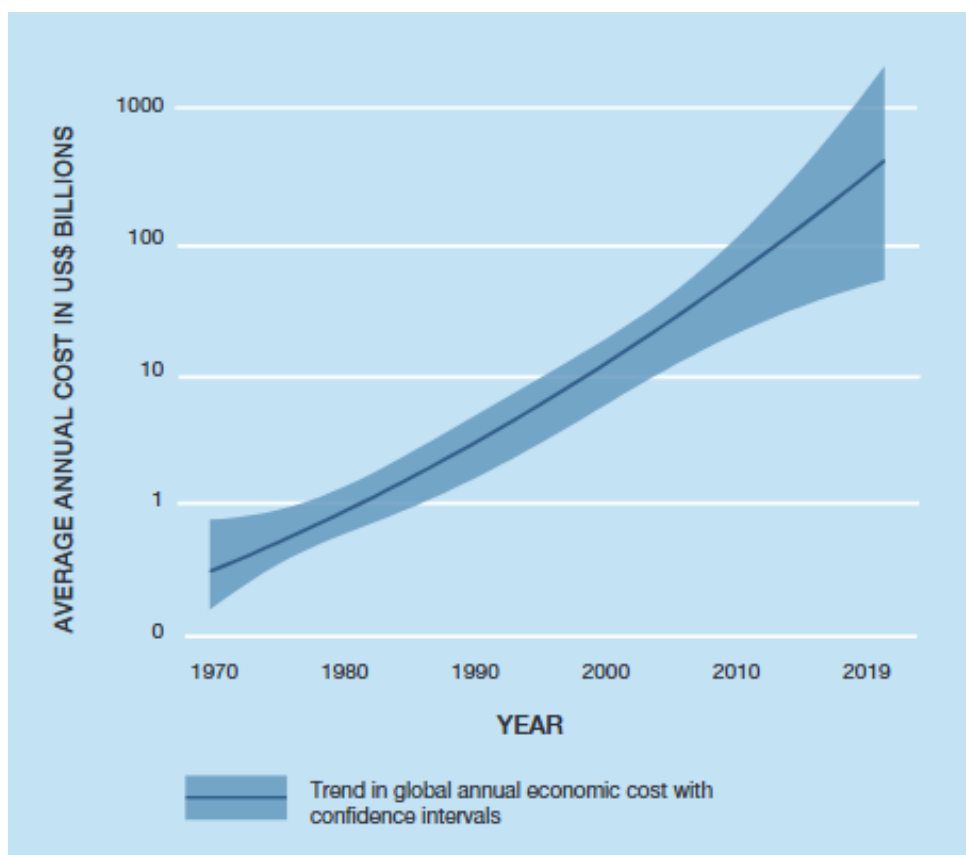


Figure 1. Increase in the documented average annual economic costs of invasive species (IPBES, 2023a).

⁴ The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) is an independent intergovernmental body established by states to strengthen the science-policy interface for biodiversity and ecosystem services.

These findings highlight the importance of prevention and early intervention, both from an ecological perspective and in terms of cost-effectiveness (see also Figure 2). The IPBES report states that an effective approach to IAS requires a combination of prevention, early detection and rapid response, eradication and control measures, in combination with ecosystem restoration. The report cites policy fragmentation and limited implementation capacity as barriers and highlights the importance of integrated governance, international cooperation, education, public awareness and participatory decision-making (IPBES, 2023b).

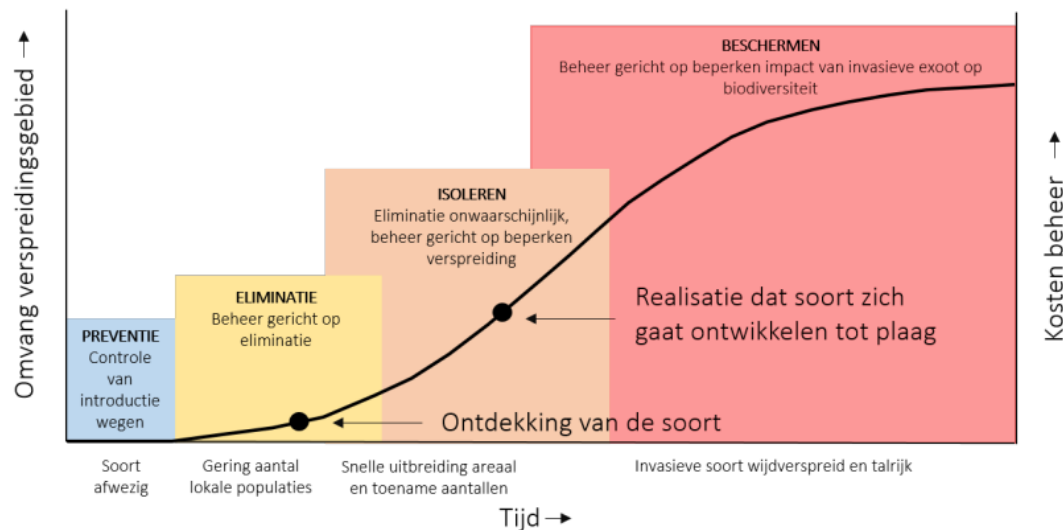


Figure 2. Invasion curve. Source and explanation: Knowledge Network for Nature Restoration and Management (OBN). <https://natuurfkennis.nl/themas/invasieve-exoten/>

1.2. Legal framework and administrative structure

1.2.1. European level

The 1992 Convention on Biological Diversity (CBD) led to European agreements and rules for protecting nature and biodiversity. To protect against the adverse effects of IAS, the Invasive Alien Species Regulation (Regulation (EU) 1143/2014) came into force in the European Union on 1 January 2015. A regulation is binding in its entirety and directly applicable in all EU Member States.

The Invasive Alien Species Regulation aims to limit the introduction, spread and impact of IAS within the European Union as much as possible. Key to the Regulation is a list of invasive alien species of Union concern, whose negative impacts warrant coordinated action at the EU level (see Box 1 for the definitions in the Invasive Alien Species Regulation). This list is known as the Union list.

Definitions under Article 3 of the Invasive Alien Species Regulation

Alien species: any live specimen of a species, subspecies or lower taxon of animals, plants, fungi or micro-organisms introduced outside its natural range; it includes any part, gametes, seeds, eggs or propagules of such species, as well as any hybrids, varieties or breeds that might survive and subsequently reproduce;

Invasive alien species: an alien species whose introduction or spread has been found to threaten or adversely impact upon biodiversity and related ecosystem services;

Invasive alien species of Union concern: an invasive alien species whose adverse impact has been deemed such as to require concerted action at Union level pursuant to Article 4(3);

Invasive alien species of Member State concern: an invasive alien species other than an invasive alien species of Union concern, for which a Member State considers on the basis of scientific evidence that the adverse impact of its release and spread, even where not fully ascertained, is of significance for its territory, or part of it, and requires action at the level of that Member State;

Box 1. Definitions under Article 3 of Regulation (EU) 1143/2014.

The definition of an 'invasive alien species of Union concern' is, in this context, primarily a legal construct. IAS are only included in the Union list if they meet all the criteria set out in Article 4(3) of the Regulation (Box 2), including the condition that available scientific evidence indicates that the alien species is likely to have significant adverse effects on biodiversity or related ecosystem services, and that a risk assessment (pursuant to Article 5(1)) has demonstrated that coordinated Union-level action is necessary to prevent the introduction, establishment or spread of the species. However, in addition to the ecological risk posed by a species, the composition of the Union list is also determined by the political and administrative views of the Member States, as expressed through a formal vote. Member States adopt the list by majority vote and amend it periodically.

The original list—comprising 37 species of concern to the European Union—dates from August 2016 and has since been supplemented and amended four times, in August 2017, 2019, 2022 and 2025, respectively. The current list contains 114 species: 49 plants and 65 animals. This represents a small percentage of the total number of alien species in Europe. It is estimated that there are around 12,000 alien plant and animal species in the European Union and other European countries, of which approximately 10% to 15% are considered invasive (Vilà et al., 2010). An overview of the animal species on the Union list is included in Annexe 3.

The Union list does not include all alien species that are harmful in the Netherlands or elsewhere in the EU, either because a risk assessment meeting EU criteria is lacking or because Member State support for inclusion is insufficient. A species on the Union list does not necessarily have to be harmful specifically in the Netherlands; the list is based on the European perspective and opinion.

Although a species can be removed from the list in the same way—if it is deemed that EU regulation no longer offers any benefits, for example—this has never actually happened in practice. The list is expected to be expanded further.

Regulation (EU) 1143/2014, Article 4(3)

Invasive alien species shall only be included on the Union list if they meet all of the following criteria:

- a) they are found, based on available scientific evidence, to be alien to the territory of the Union excluding the outermost regions;
- b) they are found, based on available scientific evidence, to be capable of establishing a viable population and spreading in the environment under current conditions and in foreseeable climate change conditions in one biogeographical region shared by more than two Member States or one marine subregion excluding their outermost regions;
- c) they are, based on available scientific evidence, likely to have a significant adverse impact on biodiversity or the related ecosystem services, and may also have an adverse impact on human health or the economy;⁵
- d) it is demonstrated by a risk assessment carried out pursuant to Article 5(1) that concerted action at Union level is required to prevent their introduction, establishment or spread;
- e) it is likely that the inclusion on the Union list will effectively prevent, minimise or mitigate their adverse impact.

Box 2. Conditions for the inclusion of invasive alien species on the Union list: the list of invasive alien species of Union concern.

The Regulation prescribes a three-stage approach for Member States to combat the introduction and spread of IAS:

1. Prevention: preventing introduction.
2. Removal: early detection and rapid eradication.
3. Control: population control and containment.

In the event of an invasion by a species of Union concern, measures must be taken at an early stage to rapidly and completely eradicate the species from the environment (Article 17 of the Invasive Alien Species Regulation). If such a species has become established and is widespread, management measures must be taken to keep its population as low as possible and prevent further spread (Article 19 of the Invasive Alien Species Regulation).

5

The approach includes prohibitions applicable to EU citizens and businesses (see Box 3), which aim to curb private possession, trade and the resulting potential to spread IAS as much as possible. Chapter 3 of this advisory report examines the eradication and control of invasive animal populations in greater detail, with a focus on animal welfare.

Restrictions under Article 7 of Regulation (EU) 1143/2014

Invasive alien species of Union concern shall not be intentionally:

- a) brought into the territory of the Union, including transit under customs supervision;
- b) kept, including in contained holding;
- c) bred, including in contained holding;
- d) transported to, from or within the Union, except for the transportation of species to facilities in the context of eradication;
- e) placed on the market;
- f) used or exchanged;
- g) permitted to reproduce, grown or cultivated, including in contained holding; or
- h) released into the environment.

2. Member States shall take all necessary steps to prevent the unintentional introduction or spread, including, where applicable, by gross negligence, of invasive alien species of Union concern.

Box 3. Restrictions under Article 7 of Regulation (EU) 1143/2014.

1.3. National level

1.3.1. Central government, provincial authorities and water boards

The Netherlands implements the obligations arising from the Regulation at various levels of government. Under the Environment and Planning Act (formerly the Nature Conservation Act), nature conservation legislation has been largely decentralised. Provincial authorities are responsible for managing most species on the Union list. The management of animal invasive alien species falls under their broader responsibilities for population management and damage control, executed by provincial wildlife management units.⁶

⁶ Traditionally, provincial authorities have been able to use a mandate issued to individuals or groups to limit the population of certain animal species. Wildlife management units normally have such a provincial mandate, which they can in turn delegate to licensed hunters or local wildlife management associations.

In several exceptional cases, provincial authorities are not assigned management responsibility for certain IAS. Water boards manage muskrats and coypu (this is not new; they were already responsible before those animals were added to the list). The Ministry of Agriculture, Fisheries, Food Security and Nature is responsible for the Chinese mitten crab and alien crayfish designated as IAS. To facilitate fishing, the Ministry of Agriculture, Fisheries, Food Security and Nature has granted exemptions from the prohibitions under b, d, e and f. This enables commercial fishers to help curb the spread of these species and enables recreational anglers to keep any such bycatch for consumption. Lastly, the Minister of Agriculture, Fisheries, Food Security and Nature may issue tailored regulations under Article 11.25 of the Environmental Activities Decree, such as prohibiting deliberate activities involving IAS⁷ and imposing a national trade ban⁸.

1.3.2. National Action Plan on Invasive Alien Species

In 2024, at the request of the then State Secretary Rummenie (Ministry of Agriculture, Fisheries, Food Security and Nature), the broad outlines of a national action plan on invasive alien species were drawn up, in which the Ministry of Agriculture, Fisheries, Food Security and Nature identified six guiding principles for the further development of the action plan:

- A. Focus on prevention and early eradication
- B. Action perspective
- C. Proportionality (cost-benefit analysis)
- D. Ecosystem restoration and strengthening
- E. Collaboration
- F. Ownership

The Ministry of Agriculture, Fisheries, Food Security and Nature stressed that policy choices around IAS management require tailored solutions and careful consideration. No generic solution or approach works in all cases or for all species. This is because (1) species groups differ widely and occur in very different environments, leading to varied risks and impacts; (2) the associated introduction pathways are equally diverse; (3) the nature of available measures varies substantially; (4) the stage, mode and speed of introduction and spread strongly influence the appropriate response; and (5) the moral considerations vary greatly across species, from plants to animals.

⁷ A tailored regulation may be introduced to allow an animal caught in the wild to be kept in a rescue centre until it dies of natural causes.

⁸ As implemented for Asiatic knotweed.

In January 2026, the House of Representatives was presented with the National Action Plan on Invasive Alien Species, which builds on the previously established outline. The action plan includes proposals to further develop and strengthen the IAS policy, with a focus on prevention and early eradication. The action plan sets out the current management strategy for these species, the measures needed to strengthen this approach and the financial implications involved.

During the 2025 spring budget decisions, the Ministry of Agriculture, Fisheries, Food Security and Nature allocated resources to initiate work on the action plan, funding the work of both provincial authorities and the Ministry of Agriculture, Fisheries, Food Security and Nature. The available resources are being used to prioritise prevention and the early detection and eradication of invasive alien species. The plan also focuses on strengthening coordination and cooperation with other authorities and relevant regional partners. The action plan includes national agreements between the Ministry of Agriculture, Fisheries, Food Security and Nature and provincial authorities on the prioritisation and ambitions for each species.

2. Prevention

Prevention is the first and most cost-effective approach to managing IAS (Roy, 2024). Something that isn't there cannot harm the ecosystem and does not need to be controlled. Therefore, it is also the most effective step in terms of animal welfare. If animals do not need to be controlled, their welfare is not at risk either. In other words, prevention is better than cure.

2.1 IAS prevention and tailored approach

There is no *one-size-fits-all* preventive approach for IAS. This highly diverse group ranges from insects to mammals and lives in very different environments (land, air, freshwater, marine), entering and spreading through a wide variety of pathways. This species diversity requires a tailored approach.

It is also important to recognise that alien animal species (not necessarily invasive) are brought to the Netherlands or Europe both intentionally and unintentionally. Species may be inadvertently transferred through transport and trade chains, such as in ships' ballast water or through the plant trade. They can also migrate via human-made routes such as the Suez Canal. Other alien species are introduced deliberately, such as through the trade and keeping of alien animal species. This presents several points of intervention that can strengthen a preventive approach. For example, invasive species not included on the Union list may often still be legally traded or kept.

The RDA affirms that preventing introduction is the most important step in IAS management for safeguarding the welfare of individual animals, as it avoids the need for eradication and control measures and prevents alien species from negatively affecting the welfare of native species. The National Action Plan on Invasive Alien Species includes various policy instruments to strengthen the preventive approach, covering knowledge, prohibitions, monitoring, communication/education and cooperation. The RDA supports these points of attention and highlights several further considerations below.

2.1.1. Reinforcing the national gateway; risk assessment and development of a national list

The current regulations focus primarily on species explicitly included on the Union list. The effectiveness of this approach is limited by how quickly the EU can assess potentially invasive species and add them to the list, which is affected by risk-assessment requirements and the political decision-making involved. As a result, several years may pass between the first signs of ecological damage and the formal inclusion of a species on the list, during which it may establish and spread. This creates a policy delay between detection, risk assessment and regulation. Potentially harmful species can be legally

imported because they are not yet included on the list or are only recognised or classified as high-risk at a later stage,

which may result in Member States not intervening in time. A proactive, risk-based approach that prioritises preventing introductions is essential to limit future ecological and economic damage caused by IAS. This requires the early identification of species with potentially invasive traits that are not on the Union list. In the Netherlands, this is addressed through horizon scans conducted by the Netherlands Food and Consumer Product Safety Authority.

These risk assessments can also support the establishment of a national list for species that are not yet regulated at EU level but pose a high national risk. A national list would enable a faster response to emerging invasions and allow national measures to take local ecological and societal conditions into account. It can serve as a temporary instrument until a species is added to the Union list. It also enables the inclusion of European species that are considered non-native in the Netherlands. In that context, the National Action Plan on Invasive Alien Species mentions the possibility of introducing national trade bans, such as the Dutch ban on Asiatic knotweed.

2.1.2. European cooperation and a European positive list

Prevention also requires international coordination: The Netherlands is deeply embedded in European trade flows and cannot operate independently of EU policy. Knowledge exchange, joint risk assessments and improved traceability and regulatory enforcement in the trade of alien species can increase the effectiveness of prevention.

The Council draws particular attention to the trade in exotic pets, which constitutes an important risk factor for the introduction of IAS into nature. (Gippert & Bertelsmeier, 2021; Lockwood et al., 2019; Tedeschi et al., 2022). Some exotic pets can cause significant damage to native ecosystems if they escape or are released. The resulting invasive populations can disrupt habitats, compete with native animal species or transmit diseases (viral, bacterial and parasitic) to other animals or humans (Chinchio et al., 2020; Tedeschi et al., 2022).

Restrictions on the trade in alien animal species can help prevent intentional or unintentional introduction of alien species into the environment. One policy tool for this is the 'positive list'. Under this system, only species explicitly authorised may be legally kept, bred, or traded. Positive lists operate according to the 'no, unless' principle: species are only included if they meet predefined criteria relating to risks to public health, ecology and animal welfare, for example. This differs from the reactive nature of 'negative lists', such as the Union list, where prohibitions only take effect once it has been established that the specific criteria for inclusion on the list (e.g., extensive risk assessments) have been met (Toland et al., 2020).

In 2024, the Netherlands implemented a positive list for domestic and hobby animals. This list specifies which mammal species may be kept as domestic or hobby animals, depending on the risk to animal welfare posed by the various species or the danger they present to humans or other animals. Species included on the Union list—and, therefore, already prohibited—are not eligible for inclusion on a positive list. The Ministry of Agriculture, Fisheries, Food Security and Nature is currently (2026) working on a positive list for reptiles.

The Dutch positive list does not include the invasive potential of animal species as an assessment criterion, as preventing the introduction of alien mammal species into the Dutch environment is not one of its primary objectives. However, the National Action Plan on Invasive Alien Species mentions positive lists as an effective preventive measure in managing IAS. Reducing the number of species that private individuals are allowed to keep reduces the risk of alien animal species being introduced into the Dutch environment following the escape or release of alien animal species. A national positive list also provides greater clarity for keepers, traders and regulators. It also helps raise public awareness of the fact that not every animal species is suitable for keeping, which, in turn, reduces the likelihood of people impulsively purchasing alien animal species in general.

These benefits are discussed in the action plan within the national context. However, the European context is also relevant here. There is a lack of harmonised legislation and regulations among Member States on the keeping and trade of alien animal species. This currently results in a patchwork of rules, making it difficult for enforcement agencies to tackle illegal or high-risk trade (Clark, 2023).

An EU-wide positive list would address these inconsistencies and reduce the risk of animal alien species being introduced into the EU. To date, eight of the 27 Member States⁹ have implemented some form of a positive list. Political support for an EU-wide positive list is growing. In 2022, 19 Member States called for an EU-wide framework, after which the European Commission was tasked with conducting a feasibility study. A legal analysis shows that a positive list is compatible with European law and international trade rules (e.g., WTO provisions), provided it is based on clear and objective criteria such as animal welfare and public health (Clark, 2023).

⁹ The eight countries with a positive list are Belgium, Croatia, Cyprus, Italy, the Netherlands, Lithuania, Luxembourg and Malta.

2.1.3. Strengthening ecosystem resilience

The traditional preventive approach to IAS focuses on preventing introduction. However, prevention can also aim to reduce the likelihood that introduced species will establish, spread, and cause harmful effects. In this light, strengthening ecosystem resilience (or ecological resilience¹⁰) deserves consideration as a complementary prevention strategy.

A growing number of studies suggest that invasive species can reach high densities in disturbed or ecologically impoverished systems, whilst more robust ecosystems are better able to withstand invasion (Chaffin et al., 2016; KanTERS et al., 2025). As such, restoration measures focused on ecological processes and habitat conditions can help reduce the risk of invasion. This could include restoring natural predation, promoting species-rich communities, improving habitat and water quality and adopting nature-inclusive landscape design (KanTERS et al., 2025; Lemmers et al., 2022). For alien crayfish, various studies and pilot projects have shown the potential of measures such as introducing predators like eels (van Veenhuisen et al., 2026) or creating nature-friendly riverbanks (KanTERS et al., 2025; Lemmers et al., 2022).

Measures that strengthen ecosystem resilience can help reduce invasion risks while also supporting broader biodiversity recovery and reducing the need for intensive management measures. As such, the Council considers investing in ecosystem resilience to be a *no-regret* approach and a relevant complementary cornerstone of a forward-looking prevention strategy.

¹⁰ Ecological resilience is an ecosystem's ability to respond to changes caused by natural or human-induced disturbances without losing its original function and structure. The term 'resilience' is sometimes replaced by 'robustness'.

3. Eradication, control and animal welfare

The European Invasive Alien Species Regulation obliges Member States to ensure the early detection and eradication of IAS of Union concern. In the event of an invasion, measures must be taken at an early stage to rapidly and completely eradicate the species from the environment (Article 17). If such a species has become established and is widespread, management measures must be taken to keep its population as low as possible and prevent further spread (Article 19). However, the end does not justify all means. This chapter outlines the requirements of the European Invasive Alien Species Regulation, the methods available for managing IAS and the key considerations in selecting an appropriate management measure.

3.1. Applicable regulations

The Invasive Alien Species Regulation includes considerations regarding animal welfare in various places. Article 17 (*eradication*) stipulates that, when taking eradication measures, Member States must ensure that the methods used are sufficient to completely and permanently remove the population of the invasive alien species concerned and that animals must be spared avoidable pain, distress or suffering. Article 19 recognises the importance of animal welfare, stating that “*when animals are targeted, they are spared any avoidable pain, distress or suffering, without compromising the effectiveness of the management measures*”. The article expressly mentions the use of both lethal and non-lethal measures (paragraph 2).

The passages relating to animal welfare are set out in Box 4. It should be noted that under EU regulations, articles are legally binding for Member States, whereas the preamble is not. The preamble contains recitals that help clarify and contextualise the provisions set out in the articles.

Regulation (EU) 1143/2014: Animal welfare considerations involved in the rapid eradication and management of invasive alien species of Union concern.

Recital 25)

Management measures should avoid any adverse impact on the environment as well as on human health. Eradicating and managing some animal invasive alien species, while necessary in some cases, may induce pain, distress, fear or other forms of suffering to the animals, even when using the best available technical means. For that reason, Member States and any operator involved in the eradication, control or containment of invasive alien species should take the necessary measures to spare avoidable pain, distress and suffering of animals during the process, taking into account as far as possible the best practices in the field, for example the Guiding Principles on Animal Welfare developed by the World Organisation for Animal Health. Non-lethal methods should be considered and any action taken should minimise the impact on non-targeted species.

Article 17) Rapid eradication at an early stage of invasion

1. After early detection [...] Member States shall apply eradication measures [...].
2. When applying eradication measures, Member States shall ensure that the methods used are effective in achieving the complete and permanent removal of the population of the invasive alien species concerned, with due regard to human health and the environment, especially non-targeted species and their habitats, and ensuring that animals are spared any avoidable pain, distress or suffering.

Article 19) Management measures

1. [...] Member States shall have in place effective management measures for those invasive alien species of Union concern which the Member States have found to be widely spread on their territory, so that their impact on biodiversity, the related ecosystem services, and, where applicable, on human health or the economy are minimised. Those management measures shall be proportionate to the impact on the environment and appropriate to the specific circumstances of the Member States, be based on an analysis of costs and benefits and also include, as far as is feasible, the restoration measures referred to in Article 20. They shall be prioritised based on the risk evaluation and their cost-effectiveness.
2. The management measures shall consist of lethal or non-lethal physical, chemical or biological actions aimed at the eradication, population control or containment of a population of an invasive alien species. Where appropriate, management measures shall include actions applied to the receiving ecosystem aimed at increasing its resilience to current and future invasions. The commercial use of already established invasive alien species may be temporarily allowed as part of the management measures aimed at their eradication, population control or containment, under strict justification and provided that all appropriate controls are in place to avoid any further spread.

3. When applying management measures and selecting methods to be used, Member States shall have due regard to human health and the environment, especially non-targeted species and their habitats, and shall ensure that, when animals are targeted, they are spared any avoidable pain, distress or suffering, without compromising the effectiveness of the management measures.

Box 4. Regulation (EU) 1143/2014: Animal welfare considerations involved in the rapid eradication and management of invasive alien species of Union concern.

National legislation on animal welfare remains fully applicable to the eradication and control of IAS. For example, the rules on animal cruelty, as set out in the Animals Act (Article 2.1), apply in all cases, including IAS management. The Environment and Planning Act contains rules on methods that may be used to capture and kill animals (this does not include hunting, which is subject to its own rules). There is also a list of explicitly prohibited, animal-unfriendly methods, in accordance with Article 11.72 of the Environmental Activities Decree, which also applies to IAS management.

3.2. Available methods

The methods available for eradicating and controlling IAS can be classified into the categories mechanical control, chemical control, biological control, direct lethal control and fertility control (Box 5). Because of the diversity of invasive alien species, eradication and control methods vary substantially, depending on the species involved, the ecosystem in which they occur, and the available technology and resources. Legal compliance is essential here; only authorised killing methods may be used.

Mechanical control/physical removal

- Live traps or cage traps
- Entry prevention (fencing/barriers)

Chemical control

- Poisoning/rodenticides

Biological control

- Introduction of natural predators
- Use of diseases or parasites

Genetic control

- Genetic techniques such as gene drives

Fertility control

- Sterilisation/castration
- Immunocontraception

Lethal control methods (possibly after capture)

- Shooting
- Gassing
- Euthanasia by injection
- Kill traps

Box 5. Overview of categories of existing control methods.

Individual Member States must select management measures appropriate to their specific circumstances, in accordance with the requirements of the Invasive Alien Species Regulation. Inappropriate measures can fail to achieve the objectives of the IAS Regulation, cause collateral damage, cause unnecessary animal suffering, or lack public support.

This requires careful consideration and a tailored approach. The available methods have different objectives (e.g., killing or limiting reproduction) and, in turn, also differ in their usefulness within the various stages (early elimination or control/containment) of the spread of an invasive alien species. The methods also differ in scalability (labour intensity, seasonality, expertise required), ecological impact (risk of by-catch, disturbance to other species, pollution), and welfare impact on the target species. The effectiveness of a measure also depends on the characteristics of the target species (e.g., its reproductive rate)

and contextual factors. For example, capturing a local population at an early stage of establishment can be an effective elimination method if there is no exchange with other populations. If a species is widespread or if there is exchange between neighbouring populations, capturing animals will be less effective, or not effective at all.

Under the Invasive Alien Species Regulation, releasing captured Union-list animals back into nature is prohibited, even after castration or sterilisation as part of a *Trap-Neuter-Release* programme¹¹. As a result, any animals captured as part of a non-lethal approach must be housed in captivity (e.g., at a rescue centre or zoo), and the necessary housing capacity is generally limited. Zoos are permitted to keep and shelter IAS but not breed them¹². When considering the capture of IAS, it is important to assess whether the animals' welfare can be adequately guaranteed in permanent captivity, especially considering their sometimes complex behavioural requirements.

Case study: raccoon capture in Limburg

The raccoon (*Procyon lotor*) was introduced to Europe in the 1920s and 1930s for fur farming and as a mascot for American soldiers in Germany and France. Due to escapes and deliberate releases in the mid-20th century, raccoons are now widespread across Europe. Among other things, raccoons can transmit canine distemper virus and raccoon roundworm (*Baylisascaris procyonis*) to other animals. The raccoon was added to the EU list in 2016.

Since 2017, raccoon populations have been forming in two core areas in Limburg. An initial announcement by provincial authorities regarding culling led to public resistance. Around 16,000 people signed a petition to stop the plan, prompting provincial authorities to change their strategy. On behalf of the Province of Limburg, a study was conducted between 2019 and 2022 to determine whether and how raccoon capture can be carried out effectively (La Haye et al., 2022). The study consisted of several components: (a) establishing an accessible reporting point to increase the number of raccoon sighting reports, (b) investigating the origin of raccoons where possible and (c) determining whether and to what extent wild raccoons are infected with raccoon roundworm. The aim of the project (*The Raccoon in Limburg*) was to gain experience, evaluate the methods used and, where possible, determine the origin of the raccoons. The project was coordinated by the Dutch Mammal Society in close collaboration with the Limburg Water Board, AAP, the Limburg Wildlife Management Unit and RIVM.

¹¹ Exceptions may be made in the context of research or pest control using 'Judas animals' (Lemmers, 2025).

¹² Unless this is in the interests of a conservation project, which is unlikely to be the case with IAS.

The capture operation included a pause to avoid capturing lactating adults, which would have negatively affected the welfare of their dependent young. During the first period, most animals encountered originated from the same genetic source. In the second period, however, more animals were found whose genetic profiles differed and aligned more closely with the population observed in Wallonia (Ardennes). No animals were found that matched the expanding German population. Public willingness to report raccoon sightings during the operation was relatively high, although several traps were sabotaged during the capture period.

Based on the findings, the Province of Limburg, in agreement with AAP, decided that captured raccoons would no longer be housed at AAP. Rescue centres do not have sufficient capacity to accommodate increasing numbers of animals, and relocation to zoos is rarely possible.

In 2025, the report *Op zoek naar kansrijke beheerstrategieën voor wasberen in Nederland* (Exploring promising management strategies for raccoons in the Netherlands) was published on behalf of the Ministry of Agriculture, Fisheries, Food Security and Nature and the Province of Limburg. This exploratory study examined the possibilities for effective control methods and cross-border cooperation (Lemmers, 2025). The best approach to controlling raccoons appears to be a combination of multiple control strategies. The use of 'smart' traps can optimise the capture efficiency of a professional capture team. This approach can be further supported through culling by hunters and, in the event of by-catch, by the water board's beaver and muskrat control specialists. Mitigation measures can be considered *no-regret* measures and can always be implemented to protect local populations of vulnerable native species. (Lemmers, 2025).

Box 6. The raccoon in the Netherlands.

3.3. IUCN manual: Management measures for vertebrates

The IUCN has drawn up a manual for the management of vertebrate invasive alien species of Union concern¹³ as part of the European Commission's tender project, 'Identification, Assessment, Sharing and Dissemination of Best Practices for Humane Management of Invasive Alien Species'¹⁴ (Smith et al., 2022c). The manual is intended to support implementation of the European Regulation by offering guidance for decisions

¹³ situation in December 2021

¹⁴ The project was a collaboration between the International Union for Conservation of Nature (IUCN) and its SSC Invasive Species Specialist Group (ISSG), the UK Animal and Plant Health Agency, Eurogroup for Animals, the European Alliance of Rescue Centres and Sanctuaries, the European Association of Zoos and Aquaria, and Newcastle University. To develop the manual, the project partners held a series of regional workshops to engage around 200 experts from across the EU, including representatives of national authorities, conservation and animal welfare organisations, hunting associations, academia, zoos, and rescue centres. This participatory process was used to review the guide, collect case studies and identify the relevant legal frameworks for each Member State.

on managing vertebrate invasive alien species using lethal or non-lethal measures, with explicit consideration of the impact on animal welfare.

The manual identifies potential management measures for Union list species and discusses them in the context of the objective of the IAS Regulation (minimising the impact of IAS populations on biodiversity and ecosystems). The measures were assessed in terms of cost and effectiveness, humaneness (e.g., preventing avoidable pain, distress or suffering) and other potential positive or negative side effects (e.g., effects on other IAS, non-target species, the environment or public health).

The humaneness assessment is divided into two categories: (A) the 'overall welfare impact', which assesses the humaneness impact of a measure, excluding the actual killing of the animal (if the measure involves killing); and (B) the 'mode of death', which assesses the humaneness impact of the killing method (if the measure involves killing). If a measure involves the capture and subsequent killing of an animal, it is assessed under both categories.

Under 'overall welfare impact', the measure is assessed according to five separate welfare domains (based on Mellor's five-domain model):

1. Water deprivation, food deprivation, malnutrition
2. Environmental challenge
3. Disease, injury, functional impairment
4. Behavioural or interactive restriction
5. Mental: Anxiety, fear, pain, distress, thirst, hunger, etc.

The fifth domain is usually a cumulative effect of the other four domains and is generally, but not always, equivalent to the most extreme potential impact. An overview of management measures and their impact on animal welfare is included in Annexe 4 to this advisory report.

The technical details and full assessments of the various control measures are included in Annexes 1 to 32 of the manual (Smith et al., 2022a). The assessment covered the impact on animal welfare, including possible side effects, and the measure's effectiveness and costs. The qualitative conclusions regarding the various measures are presented in a table in Annexe 5.

Information on Member State-specific circumstances is included in Annexes 33 to 41, with Annexe 35 (Atlantic region) relating to the situation in the Netherlands (Smith et al., 2022b). The tables show which Union list species are found in the Netherlands and which have the greatest impact on biodiversity. It also indicates which measures and methods are restricted or prohibited under Dutch legislation and regulations.

The manual offers extensive, practical guidance for the IAS approach, helping decision makers evaluate different methods while considering effectiveness, costs, animal welfare, potential side effects and the national context. It is unclear to what extent provincial authorities are familiar with or have adopted this manual in practice. The discussions held by the RDA revealed no evidence that this guide is widely used.

The manual therefore needs greater attention from provincial authorities and implementing organisations. Given its size, it would be desirable to make the report available in a more accessible format. This could be a manual tailored to the situation in the Netherlands and updated periodically.

It should also be noted that the IUCN manual only includes vertebrate species on the Union list; it does not cover all alien species that can pose a threat to ecosystems and biodiversity in the Netherlands. It is advisable to expand the manual to include species and invertebrates relevant to the Netherlands.

3.4. Development of new and humane methods

The development of new, humane methods to eradicate and control IAS is needed to refine existing policy and optimise the approach. The National Action Plan on Invasive Alien Species cites insufficient innovation, inadequate research into effective and safe control methods and limited evaluation of methods currently in use (in terms of effectiveness, side effects, etc.).

The Council observes developments in certain areas but notes that rapid progress in humane control methods has largely failed to materialise. In addition, not all existing methods that could serve as valuable supplementary measures for certain species are legally permitted or registered for those target species, such as the *Trap-Neuter-Release* method, oral contraceptive methods and immunocontraceptive methods (Lemmers, 2025; Massei, 2023). There are also developments towards potential future applications within the IAS approach, such as *gene drives*, which are controversial due to significant ethical, technical and governance issues (Box 7).

Gene drives

The recent emergence of CRISPR gene-editing technology has sparked significant scientific interest in using gene drives to manage animal populations. Gene drives are genetic systems that cause particular traits to be inherited at rates higher than the standard 50% expected under Mendelian inheritance (Teem et al., 2020). This enables the rapid spread of a targeted genetic modification through a population.

Broadly speaking, there are two main strategies for gene drives in population management (Figure 3). In the first strategy, population suppression, the spread of the genetic element reduces population size by decreasing fertility or disrupting sex ratios, for example. In the second strategy, population replacement, the spread of the genetic element alters the organisms' genotypes, such as making them resistant to a particular disease they would normally transmit to humans (Graeff, 2022). Different types of gene drives are being developed, each with its own spread characteristics. For example, self-limiting gene drives are designed to remain active for only a few generations (Graeff, 2022; Legros et al., 2021).

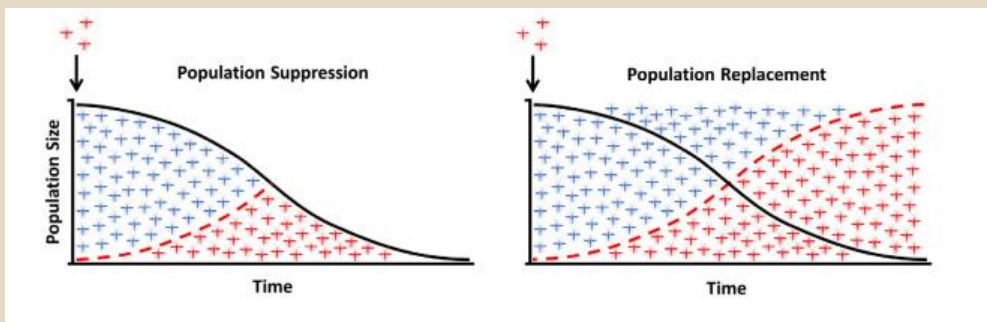


Figure 3. Population suppression (left) and population replacement (right) via gene drives. In both figures, modified insects (red) are released at a low frequency and spread among the wild, unmodified population (blue) (Hammond & Galizi, 2017).

A potential application in IAS control involves suppressive gene drives for species with high reproductive rates in closed populations such as island populations. One presumed benefit of gene drives is that they could enable more humane IAS control than traditional methods (Emerson et al., 2017). However, significant scientific, environmental, and ethical challenges and concerns remain, including unforeseen or unintended environmental effects. For example, the gene drive could spread to the species' native range, introducing the genetic modifications into the wild population there. The gene drive could also spread through sexual reproduction to a closely related species within the ecosystem into which it was released (Teem et al., 2020).

Beyond these ecological concerns, there are fundamental ethical objections relating to both the genetic modification of animals¹⁵ and intentional interventions in ecosystems that may have irreversible effects. (Boersma et al., 2023; Graeff, 2022). Gene-drive organisms do not respect national borders, which prompts questions about appropriate governance structures and who should be involved in decision-making (Graeff, 2022). Even if the technology were technically effective and safe, the use thereof would still be socially and ethically contentious.

Gene drives are also subject to significant legal restrictions. The EU Invasive Alien Species Regulation prohibits the release of Union list species, and the release of genetically modified organisms falls under stringent European GMO regulations. As a result, the practical application of gene drives is currently either prohibited or only feasible under highly restrictive conditions.

Box 7. Developments in gene-drive technologies in the context of IAS management.

Several success stories have emerged in developing new methods, such as smart traps for muskrats and coypu, which also have potential value in managing other invasive species, such as raccoons (Box 8). These successes highlight the importance of national and international research projects aimed at innovation in control methods. Such research inevitably requires funding. The absence of a significant financial incentive is a major hurdle to developing more animal-friendly methods, even though research and validation of effective, innovative, and animal-friendly methods are crucial for environmental protection, animal welfare and long-term societal support. It is therefore positive that the National Action Plan on Invasive Alien Species includes commissioning and supporting research into effective control methods as an additional measure¹⁶ to strengthen early detection and rapid eradication. The action plan considers this a collective task for both provincial authorities and the Ministry of Agriculture, Fisheries, Food Security and Nature, depending on the circumstances. It also sets out the ambition to establish a joint research agenda. The Council stresses that international cooperation could be pursued to that end. The various interests involved in invasive species management (see Chapter 6), including those of the animals themselves, should be represented in the proposed research agenda.

¹⁵ In 2019, the RDA sent an advisory letter to the Minister of Agriculture, Nature and Food Quality regarding gene editing in animals. [Advisory letter on gene editing in animals | Council on Animal Affairs](#)

¹⁶ In addition to the early detection and rapid eradication of IAS using existing methods.

Innovations in the management of muskrats and coypu

Under the Life-MICA project¹⁷, smart traps equipped with image recognition have been developed for coypu. The traps prevent bycatch by closing only when the target species is identified. When activated, the trap sends an instant alert to the manager. It is a more animal-friendly alternative to conventional traps, provided the animal is collected quickly and spends only a short time in confinement. This makes it a labour-intensive method that is not yet in use on a large scale.

In addition to the innovative traps, work is underway on a monitoring method that uses environmental DNA (eDNA) to detect muskrats and confirm their presence in watercourses. This sensitive technique enables routine surveillance of large areas. Using eDNA to detect muskrats and coypu is efficient, objective and requires little labour. It also prevents bycatch, as traps are only placed after positive DNA identification. This makes the method animal-friendly and limits collateral damage to the ecosystem.

Box 8. Smart traps and targeted monitoring of muskrats and coypu.

¹⁷ This project is an international collaboration between partners in Germany, Belgium and the Netherlands, aimed at reducing muskrat and coypu populations to a manageable level. <https://lifemica.nl/>

4. Challenges in administrative integration and implementation

Effective prevention and management of IAS depend not only on the availability of measures and tools, but also on how their implementation is organised administratively. IAS do not adhere to administrative borders, which makes alignment, coordination and clear governance across levels essential. This chapter outlines several challenges related to administrative integration and implementation.

Provincial authorities are primarily responsible for implementing management policy for most IAS. They take measures to eradicate IAS from the environment and to manage populations. However, differences between provinces are substantial. North Brabant and Utrecht are frontrunners, with established policy cycles, evaluations and subsidy schemes, whereas other provinces lag in policy development and implementation. Groningen, for instance, has only had a provincial action plan since 2025. These differences are problematic because invasive species do not adhere to administrative boundaries. This makes a solely provincial approach inefficient, particularly for mobile invasive species. When one province falls behind, it weakens the efforts of the others. This highlights opportunities for a harmonised approach within the Netherlands and internationally. One interview revealed that coordination between the provinces and Germany remains limited, while some southern provinces maintain good contact with Belgium (Flanders). The water boards, which have long been responsible for managing muskrats and coypu, have been actively seeking cross-border collaboration for a while. This remains necessary, as the influx of muskrats and coypu from Germany into the Netherlands is still high.

Adopting different provincial strategies can be an advantage when a species occurs only in certain parts of the country. In that sense, it enables a tailored approach. On the other hand, it may also hamper coordination and knowledge exchange. Given the complexity and specialised nature of the ecological, legal and socio-economic expertise required for IAS management, it is not always efficient to organise this task separately in each province. Provincial authorities may lack the capacity and specialised expertise to conduct detailed technical and interest-based assessments for each species and context and to produce a workable plan. Invasive species are discussed structurally within the Association of Provincial Authorities (IPO), supported by a task group that prepares the content. The national action plan now also provides some central guidance, including on prioritisation.

Although provincial capacity has increased in recent years, it remains vulnerable. Structural funding is lacking, so IAS management efforts are usually funded from the general provincial budget. Implementation often relies on incidental funding and committed individuals, so continuity and prioritisation are not always guaranteed. This

makes it difficult to institutionalise the approach sustainably. The IPO has therefore called for earmarked resources and structural national support in its ambition document.

Funding is also addressed in the national action plan. The Ministry of Agriculture, Fisheries, Food Security and Nature has allocated a total of € 9.2 million to this in its 2025 and 2026 budget. This budget currently prioritises prevention and the complete removal of invasive alien species targeted for eradication from the environment. Of the total budget available for 2025 and 2026, €1.6 million will be allocated to the measures undertaken by the Ministry of Agriculture, Fisheries, Food Security and Nature, and approximately €7.3 million will be made available to provincial authorities for the complete removal of invasive alien species targeted for eradication. This also means that provincial authorities have not yet met the funding requirements to manage widely spread IAS.

Finally, it should be noted that the distribution of Union list species across three levels of government may hinder an efficient approach. This is illustrated in Box 9 using the signal crayfish as an example.

Following the addition of alien crayfish to the Union list in 2016, the Ministry of Agriculture, Fisheries, Food Security and Nature remained responsible for management measures against these species. The Ministry of Agriculture, Fisheries, Food Security and Nature created a legal exemption allowing commercial fishers and recreational anglers to catch and market alien crayfish¹⁸. However, many commercial fishers are not interested in targeting these species because they require specialised equipment. A financial incentive for operators also risks encouraging harvesting without actual eradication. In addition, capturing and moving crayfish under uncontrolled conditions may lead to introduction of the species to previously unaffected areas.

Under current regulations, water boards require a permit to catch crayfish, as the Fisheries Act restricts the use of fishing gear to commercial fishers and permit holders for designated research activities. Under the OBUR programme (programme for developing a management approach to alien crayfish) launched in 2021, the Ministry of Agriculture, Fisheries, Food Security and Nature aims to make it easier for authorities to catch alien crayfish, which will require legislative changes. This raises the question as to whether the quickest route to an efficient approach would be to make the water boards (supported by an adequate governance framework) responsible for managing invasive alien crayfish.

Box 9. Capture of signal crayfish.

¹⁸ This applies to licensed recreational anglers, provided that they fish using a rod and for personal consumption.

5. Societal attitude and resistance

IAS management measures for nature conservation may meet with societal resistance, particularly when far-reaching measures such as culling are employed. In this chapter, the RDA examines the underlying factors behind this resistance and offers guidance on how to increase public support.

5.1. Charismatic bias

Societal resistance to the killing of IAS varies depending on the context and type. A key factor is how people perceive or value certain species. Species that lack emotional or aesthetic attractiveness are more often seen as a nuisance (Selge et al., 2011). There is often less public resistance to control measures for alien crayfish, plants or insects, for example.

The control of other species, e.g., those perceived as beautiful, intelligent or cuddly, leads to far greater public empathy and opposition. Well-known examples include the grey squirrel in the UK and Italy and the raccoon in the Netherlands and Germany. Animal welfare organisations and members of the public mobilise on social media and launch petitions or legal proceedings to stop IAS management campaigns. In Italy, public outrage over the grey squirrel led to the cancellation of a planned eradication programme, despite the negative impact of this species on the native red squirrel (Bertolino & Genovesi, 2003). In the Netherlands, societal resistance also emerged around the capture of the Pallas's squirrel in 2011 (Box 10). Nevertheless, with support from the local community, the population was completely removed at a relatively early stage (La Haye et al., 2023).

Case study: public resistance to Pallas's squirrel capture

Following the escape of nine Pallas's squirrels from a pet shop in Weert, the population grew and spread between 1998 and 2011. Shooting the animals was impossible, as a large proportion of the population lived in built-up areas. Lethal traps would have been difficult to use selectively and likely to provoke public opposition.

Nevertheless, in 2011, the Ministry of Economic Affairs, Agriculture and Innovation and the Province of Limburg commissioned a capture operation. The population was estimated at 50–100 animals. The Dutch Mammal Society carried out the operation in cooperation with Natuurhulpcentrum Opglabbeek, where the squirrels were sterilised and subsequently housed.

Cooperation was encouraged through intensive public education, combined with the fact that the squirrels caused demonstrable damage to trees, garden furniture, pipes and more. According to the Dutch Mammal Society, the decisive factor was the fact that the animals would be housed rather than killed. Only a small number of residents refused to cooperate, despite experiencing actual damage.

Box 10. The Pallas's squirrel in the Netherlands.

This asymmetry in public perception points to a 'charismatic bias', where moral judgements about species management are based less on ecological damage and more on how people relate to an animal. An animal's charisma is determined by a combination of intrinsic species traits and the subjective perceptions and values that people attribute to that species. Because charisma is highly subjective, it can change over time due to factors such as media attention (Jarić et al., 2020).

Charismatic species have traits that influence people's perceptions, attitudes and behaviour. Traits that contribute to species charisma may be visual (e.g., large eyes or a plume tail), auditory (specific sounds, such as birdsong), olfactory (the release of pleasant scents, as in flowering plants), behavioural (e.g., complex, advanced cognitive behaviour) or symbolic (abstract traits embedded in general culture) (Jarić et al., 2020). At the same time, species charisma is highly context-dependent, varying across space and time and influenced by regional, social and cultural factors, as well as by individual value systems (Shackleton et al., 2019). As a result, people have widely differing views on certain species, such as squirrels; some regard them as charismatic because of their physical traits, while others are put off by their rodent-like characteristics.

Species charisma affects more than societal acceptance of eradication and management; it also affects the risks associated with the introduction and establishment of IAS. These species are generally well represented in the aquatic species and exotic pet trade (Jarić et al., 2020).

5.2. Individual value systems: relationship with animals and nature

Public attitudes towards the killing of animals appear to depend not only on the species but also on the context. Actions regarded as acceptable in one context—such as killing animals for food or pest control—may face resistance in the context of nature conservation. Research shows that the moral acceptability of killing animals depends on their social categorisation and the purpose of the killing. (Bradley et al., 2020; Bratanova et al., 2011; Herzog, 2010)

Individual values regarding animals and nature also influence the acceptance of IAS management measures. Two key value orientations are dominance (the view that nature and animals primarily serve human needs) and mutualism (the view that humans and animals are equal actors within the same system); (Vaske et al., 2011). These orientations shape how people view alien species and help explain why opinions on management measures differ so widely (Jacobs et al., 2014). While a dominance-oriented approach tends to emphasise controlling harmful species to protect ecosystems, a mutualistic approach may place greater emphasis on the welfare and survival of individual animals, even when they are non-native.

Society's attitude towards animals and its relationship with them is also changing (RDA, Staat van het Dier 2019, 2024). This affects public acceptance and opposition to the killing of animals, including those covered by IAS policy. Public resistance to killing both charismatic and non-charismatic species may increase. In the Netherlands, killing methods for muskrats have already come under greater scrutiny, and controversy over methods used for other nuisance animals has led to regulatory changes.

5.3. Preventing and dealing with societal resistance

Preventing the introduction of IAS is an effective way of avoiding social resistance. Literature consistently describes prevention as the most cost-effective and socially acceptable approach to invasive species management (Roy, 2024; Simberloff et al., 2013). By removing species at a very early stage, before they are visible to the general public, the societal impact of their eradication can be kept to a minimum. The likelihood of resistance to a species' elimination increases once they have become established and developed a public profile. The risk of societal resistance increases when eradication efforts are prolonged or when public involvement becomes necessary for an effective response. These factors underscore the importance of prioritising early detection, which requires effective monitoring and the capacity to identify emerging IAS quickly.

When active control measures become necessary, transparent communication about the ecological motivation and ethical considerations is crucial to building trust (Sharp et al., 2011). Societal acceptance of the killing or control of IAS depends not only on individual value systems but also on the extent to which the public understands the severity of the problem and the effectiveness of the measures chosen. Does the chosen measure actually solve a serious problem?

Another factor is that the negative effects of invasive species on native biodiversity are often less immediately apparent than the measures themselves. Damage to ecosystems or native species usually manifests itself gradually and out of public view, while far-reaching management measures such as culling are visible and tangible. Highlighting this 'invisible' damage can help foster a better understanding of the need for action. In the case of the Pallas's squirrel in the Netherlands, informing the public helped secure their cooperation (La Haye et al., 2023).

Societal acceptance of IAS management decreases when measures are perceived as ineffective or disproportionate. In practice, conventional capture and killing methods are often the default option. At the same time, alternative, more animal-friendly or non-lethal strategies are still only considered, developed or explained to a limited extent in policy. This reinforces the perception that animal welfare is not being given due consideration, which may lead to resistance. Policymakers and administrators should therefore use IAS management tools with care and transparency. Explicitly considering and communicating different methods, including non-lethal options, can contribute to a more nuanced public debate and, ultimately, to greater public support for necessary measures, even when they entail the killing of animals.

Successful IAS management is clearly both an ecological challenge and a social one. This calls for collaboration between ecologists, ethicists, policymakers and behavioural scientists, and for citizens to be carefully informed and involved in the decision-making process. Only then can biodiversity protection be balanced with societal values. The next chapter discusses these value considerations in greater depth.

6. Normative dimension

IAS policy is shaped by a complex interplay of values and interests (Box 10). When making policy decisions, these values and interests must be explicitly weighed against one another.

6.1. Weighing values and interests

Acknowledging the intrinsic value of animals means that killing them is never, and will never be, the obvious choice. Even when done in the most dignified way possible, it remains problematic and more than just an operational issue. (RDA, 2022). Killing animals always constitutes a morally significant drawback that requires justification. It calls for a careful deliberation that clearly sets out which interests are included and how animal welfare is considered (RDA, 2022).

Weighing those interests is no easy task. In the debate surrounding IAS, the interests of individual animals are pitted against biodiversity concerns and, in some cases, public health, animal health, safety, or economic interests (Box 11). Furthermore, the nature of competing interests differs across species, and their impacts on these interests vary. As a result, the weighing of interests is not the same for all species.

Ecological interest

Invasive alien species can displace or prey on native species, disrupt ecosystems and contribute to the homogenisation of landscapes.

Public and animal health

Some IAS can transmit pathogens to humans and animals, making the protection of public and animal health a relevant consideration in this assessment. At the same time, control methods can also pose health risks, such as through the use of chemical pesticides.

Economic interest

IAS generate economic losses in the Netherlands and worldwide by causing damage to agriculture, infrastructure and other sectors.

Safety interest

Some invasive species pose a safety risk, for example if they damage dykes.

Interests of animals

Animals have an interest in staying alive and avoiding pain, distress and suffering. IAS control methods are often lethal and can severely affect animal welfare. Drowning traps for muskrats, for example, cause a long, painful death and often catch non-target species.

Biodiversity interests are paramount in the European Invasive Alien Species Regulation. An alien species is considered invasive if its introduction or spread has been found to threaten or adversely affect biodiversity and related ecosystem services. For Union list species, the balance of interests between the animal and biodiversity has therefore already been determined at EU level. The Regulation requires Member States to prioritise biodiversity protection and ecosystem functioning when dealing with these species. These species must be eradicated (Article 17) or managed (Article 19). The regulation therefore prioritises biodiversity considerations over the interests of individual animals and makes this legally binding on Member States. *However*, the interests of animals must still be taken fully into account in the further development of policy. The European Invasive Alien Species Regulation stipulates that animals must be spared all avoidable pain, fear and suffering, without compromising the effectiveness of measures.

It is noteworthy that the National Action Plan on Invasive Alien Species broadens the definition of an invasive alien species to include 'species that, through human action, have ended up outside their natural range and that are harmful to biodiversity and related ecosystem services *or other societal objectives (values and interests), such as public health, safety and the economy.*' This makes the IAS management approach (including eradication and control) applicable to alien species that do not directly disrupt the ecosystem but cause nuisance or damage in other domains. While these concerns are legitimate, there is also a risk in an implicit weighing of interests that fails to distinguish between killing animals for economic reasons and killing animals for the sake of protecting biodiversity. By categorising all these animals as IAS, the likelihood increases that the interests of the individual animal are not adequately considered.

One alternative is to break down the proposed definition in the national action plan as follows:

An invasive alien species is a species that, through human action, has been introduced outside its natural range and threatens or adversely impacts biodiversity and associated ecosystem services. Many invasive species also pose risks to other societal objectives (values and interests), such as public health, safety and the economy.

This description aligns with how the term is defined in the internationally authoritative IPBES report¹⁹ and also reflects the broader risk assessments carried out by the Netherlands Food and Consumer Product Safety Authority, as well as those undertaken as part of the procedure for adding a species to the Union List.

¹⁹ On page 7 of the report, the term is defined as follows: *Invasive alien species are a subset of established alien species that spread and have a negative impact on biodiversity, local ecosystems and species. Many invasive alien species also have impacts on nature's contributions to people (embodying different concepts, such as ecosystem goods and services and nature's gifts) and good quality of life.*

6.2. Weighing values and interests in practice

Current policy focuses primarily on species and ecosystems, with very limited attention to the interests or welfare of individual animals. This is also evident from provincial policy documents. For example, the Groningen Provincial Action Plan on Invasive Alien Species (2025–2029) states: *'Given its legal mandate regarding invasive alien species, the province sees no room to broadly incorporate animal welfare into its considerations in the management of invasive alien species on the Union list.'* It is apparent from the discussions held by the RDA in the run-up to the preparation of this advisory report that provincial authorities do not structurally incorporate animal-welfare considerations into their decision-making, despite this being a requirement under the IAS Regulation. Thorough species-specific and context-specific assessments require both capacity and expertise.

The intrinsic value of animals does not imply that killing animals or harming their welfare is never justified. However, this intrinsic value, together with the management approach to invasive alien species, demands a careful weighing of interests, specifying explicitly which interests are involved and how they are weighed. This helps responsibly address issues relating to the killing of invasive species, initiate and maintain dialogue on the topic, and actively seek improvements in animal welfare. A decision-making framework can help clarify this. The flowchart below may be helpful in this regard (Figure 4).

The *International consensus principles for ethical wildlife control* (Dubois et al., 2017) could provide a useful starting point for a more holistic approach, one that also encompasses decentralised authorities, such as provincial authorities in this case. In addition to animal welfare, this involves prevention, a systematic approach, social acceptance and the establishment of clear and achievable outcomes. This approach also emphasises the need to consider the specific circumstances in each case, warning against taking firm action solely due to the presence of a negatively labelled species—in this case, the designated invasive alien species.

Flowchart for managing IAS

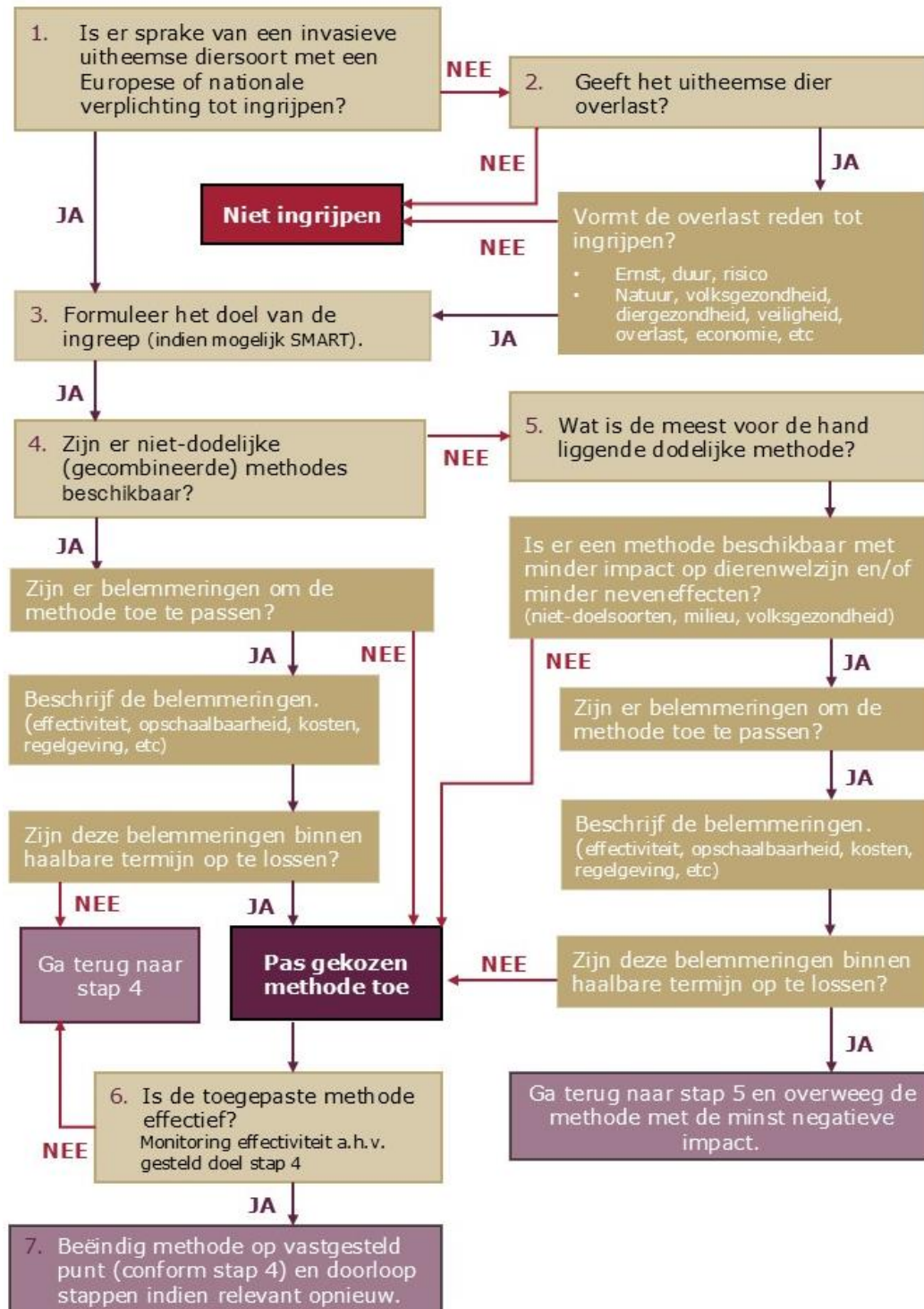


Figure 4. Flowchart to assist in decision-making regarding the management of invasive alien animal species. Adapted from the flowchart developed for dealing with nuisance animals, as set out in the RDA advisory report *Shining a light on the killing of animals* (RDA, 2022).

6.3. Dilemmas in providing shelter for Union list species requiring care

The normative dimension relating to animals extends beyond whether species should be controlled and which methods should be used to that end. Ethical dilemmas arise for animal-care professionals when, in the course of their work, they come into contact with species on the EU list that require care, such as the Egyptian goose. The Egyptian goose is a well-established and widespread species in the Netherlands and is covered by Article 19 of the Regulation. The National Action Plan on Invasive Alien Species includes an agreement with provincial authorities (p. 88) establishing an obligation of effort²⁰ aimed at reducing the Egyptian goose population by 10% per year.

Members of the public regularly bring injured and sick Egyptian geese to wildlife rescue centres. Every year, around 1,300 Egyptian geese in need of care are taken to these centres, of which around 50% recover (*Position Paper: Dierenhulpverlening en invasieve exoten zitten knel tussen wet en wens - een praktische en ethische benadering* (Animal Rescue and Invasive Species Caught Between Legal Requirements and Societal Expectations: A Practical and Ethical Approach, 2025)). However, the rules set out in the European Invasive Alien Species Regulation remain fully applicable. This means that a rehabilitated animal may not be released back into the wild. Instead, the animal will have to be euthanised²¹ or, once it has recovered, be placed in a licensed rescue centre or zoo for the rest of its life. The national action plan states that provincial authorities are committed to reaching agreements with wildlife rescue centres willing to take in rescued Egyptian geese. The goal is that Egyptian geese taken into care will be collected periodically from rescue centres on behalf of provincial authorities and euthanised in a dignified manner. It is also stated that wildlife rescue centres may refuse to take in rescued Egyptian geese.

However, the latter point conflicts with Article 2.1(6) of the Animals Act: ‘Every person shall provide an animal in need with the necessary care’ (see also RDA, Dilemmas in wildlife rescue and rehabilitation, 2022). It can be assumed that this provision also allows for the transport of alien species in need of assistance. Furthermore, the refusal of assistance by any veterinary professionals that may be present at a wildlife rescue centre is also at odds with Article 4.2 of the Animals Act, which stipulates that persons authorised to practise veterinary medicine professionally must not fail to provide the care they, in their professional capacity, are required to provide to an animal for which their assistance has been sought. This provision explicitly also applies to non-captive animals. In other words, veterinary professionals working at a wildlife rehabilitation centre may *not* withhold assistance from wild animals in need. Euthanasia may be

²⁰ Around 40,000 Egyptian geese winter in the Netherlands each year. The number of breeding pairs is estimated between 7,000 and 13,000. <https://stats.sovon.nl/stats/soort/1700>

²¹ From the animal’s perspective, this should happen as soon as possible, instead of after a recovery period.

considered a form of assistance provided to the animal. On a different note, animals that are not in need of assistance (members of the public are not always able to make this judgement reliably) may be refused by rehabilitation centres. Such animals also do not need to be admitted merely because they belong to an invasive species, only for the centre to then 'have to' euthanise them or keep them in captivity for life.

For those involved, the intake of invasive animals in need can raise ethical dilemmas. The main role of volunteers and staff at wildlife rescue centres is to help animals, and members of the public who bring animals in often expect them to be released back into the wild after their recovery. However, the release of IAS is not permitted under the European Invasive Alien Species Regulation. At the same time, permanently housing large numbers of these animals is not feasible, nor is it always desirable from an animal welfare perspective. For example, few permanent shelters are available for Egyptian geese, which are difficult to keep in captivity.

Veterinarians may also experience moral conflict when euthanising healthy animals or those with a good chance of recovery, particularly when it does little to reduce an already widespread population. In such cases, killing individual animals may be seen as neither proportionate nor effective from a management perspective. Euthanising animals that have been brought in and could still be treated effectively also conflicts with the objectives of animal rescue centres and can undermine volunteers' commitment. Societal and financial support for their work may also suffer. The animal itself does not benefit from being housed at the shelter for a while, only to be transported and killed afterwards.

It can therefore be concluded that, in this situation, there may be conflicting obligations at both a legal and moral level. This also illustrates the broader tension in IAS management between protecting ecosystems and biodiversity on the one hand and safeguarding the welfare and lives of individual animals on the other. Although wildlife rehabilitation centres must remain aware of their role within ecosystems alongside their care for individual animals—with euthanasia sometimes being a necessary option—this case shows that implementing the regulation in practice creates friction on several fronts. From a practical implementation and enforcement perspective, it may also prompt consideration of whether further clarification of the rules is desirable. The RDA also recommends including this issue in a future European Invasive Alien Species Regulation *fitness check*²².

²² A fitness check assesses existing EU legislation to determine whether it remains effective, efficient, relevant, and coherent, and whether it should be simplified, amended, or repealed. The assessment focuses primarily on the suitability and feasibility of the rules.

6.4. The label 'invasive alien species'

6.4.1. Connotations surrounding 'native' versus 'alien'

The label 'invasive alien species' clearly has significant consequences for these animals and our treatment of them. These terms have an interesting history, in which the perception and appreciation of 'non-native' or 'alien' species have changed over time.

In the 18th century, Linnaeus catalogued the different species. This enabled a distinction between 'the familiar' and 'the unfamiliar' or 'the new'. He noted that species could spread—including through human activity—and 'colonise' new areas. Initially, non-native species were not considered negative or threatening. He described new additions to Sweden's flora as 'foreign recruits' who had not come to conquer the Swedish countryside, but to reinforce the army of veterans. That largely positive view changed with the emergence of Darwinism in the 19th century. The perception of alien species shifted towards a competitive framework: species were seen as competitors that could displace native species (Peeters, 2026). The threatening connotations conveyed by the Darwinian metaphor of competition are reinforced by the military and political language used in connection with IAS and their management. Terms such as *invasion*, *attack*, *eradication* and *colonisation* fit within a military frame of reference that suggests conflict and defence.

This framing shapes how we talk about nature. Although the terms *native*, *non-native*, or *alien* may appear to be neutral classifications at first glance, they are laden with cultural, historical and normative associations (Warren, 2023). The terminology implicitly suggests a judgement as to which species belong here and which do not, and often assumes a preference for a particular historical habitat type with a specific set of species. This makes nature seem to take on the characteristics of a state, with borders and foreigners (Peeters, 2026). As such, the debate on IAS also touches on a broader and more fundamental question, namely what 'nature' entails. In public discourse, nature is sometimes implicitly treated as a system with a specific, desired harmonious endpoint, while in reality, ecological systems are dynamic and constantly changing. The framing may also narrow the debate, as species are already assessed based on their origin rather than their ecological impacts.²³ This may obscure the distinction between species that are actually harmful and those that establish themselves without significant negative effects (Box 12). Future-proof policy requires a critical awareness of this language and the underlying framing. Using an ecologically grounded yet socially sensitive conceptual framework can support a more nuanced assessment of species and help avoid polarising narratives.

²³ However, it is impossible to determine in advance with any high degree of certainty which species will become invasive.

Criticism of the binary distinction between native and alien

A state-centric perspective on nature can lead to a romanticised image of a harmonious, static ecosystem in which native species are assumed to be naturally in balance. However, ecological succession has no identifiable beginning or end. It involves open, dynamic systems with constant change and species migration (Botkin, 2001; de Snoo & Musters, 2025), especially today, under the pressures of rapid climate change and urbanisation (Davis et al., 2011).

In line with this, the strict distinction between *native* and alien species has come under criticism. Opponents argue that it oversimplifies the underlying spectrum and may even prove counterproductive for species conservation and management (Lemoine & Svenning, 2022). Some alien species have no observable negative effects on their new environment, or may even provide ecological value (Blackburn et al., 2014; Davis et al., 2011). For this reason, some scientists argue that species should be assessed by their ecological effects instead of their geographic origin (Davis et al., 2011). After all, the terms alien or *native* say much less about a species' ecological impact than its classification as invasive. As an alternative, Lemoine & Svenning (2022) propose ten gradations between native and alien species, each with a distinct management strategy. Their framework is intended to show that introduced species can be less problematic than their alien (non-native) status might imply.

Box 12. Criticism of the binary distinction between native and alien.

6.4.2. *Naturalisation of species*

In some cases, alien species are viewed positively, or become more positively viewed over time. These species are embraced for their cultural value or exploited for economic gain. Examples of naturalised plant species in the Netherlands include cranberries on Terschelling or horse chestnuts. Non-native animals such as the rabbit (once introduced by the Romans, now considered native) and the ring-necked parakeet are now both popular with the public. The negative impact of alien species on biodiversity and local ecosystems may also diminish over time.²⁴ The concept of *naturalisation*, where species become assimilated both ecologically and culturally, has scarcely been developed in current policy. In practice, origin is often considered decisive, even when a species has adapted and become integrated. A motion adopted by the House of Representatives in 2025 regarding the potential naturalisation of the mouflon as a native species illustrates how the conceptual boundaries between native and alien are being questioned in a political context.²⁵ This means that even invasive alien species can become naturalised

²⁴ In an article in De Volkskrant (2025), Professor De Snoo noted that there are no known cases in Europe where alien species have proven to be a problem for native biodiversity a hundred years after their introduction. He calls for a broader shift in nature policy, from targeted active management to strengthening robust ecosystems in which organisms can move freely and respond to one another (De Snoo & Musters, 2025).

²⁵ House of Representatives, Parliamentary Year 2025–2026, Parliamentary Paper 2025D23540, No. 347, *Motion by Member Flach et al. concerning advice on the possible status of the mouflon as a native species*, 22 May 2025.

over time. Although it is procedurally possible, there have been no cases to date in which species on the Union list have been removed following re-evaluation.

7. Conclusion

IAS pose a real and growing challenge to native biodiversity, ecosystem services and other societal interests. Intervention is often necessary and justifiable, even when it has consequences for individual animals. This urgency underlines the importance of an approach that relies less on retrospective intervention and more on prevention and early detection. Delaying intervention increases environmental, social and moral costs and makes it more likely that far-reaching measures with substantial animal welfare impacts will be considered the only remaining option. The number of animals that must be captured or killed also increases the longer intervention is delayed.

The approach to IAS management highlights a fundamental conflict in nature conservation policy: the protection of ecosystems and biodiversity on the one hand, and the welfare and lives of individual animals on the other. Within this conflict space, there are situations in which it is not possible to do justice to all the relevant interests and values at the same time. This makes it all the more important that interventions are explicitly and carefully justified and that animal welfare is given a prominent and integral role in the considerations surrounding eradication and population management. Transparency on this issue is essential for societal understanding and support, not least because public perceptions of species can vary greatly and some species elicit more empathy than others.

This advisory report shows that the current policy and administrative system are not yet sufficiently equipped to deal with this conflict. Although the European framework explicitly requires preventing avoidable suffering, animal welfare is not yet given a structural, explicitly weighted role in decision-making on eradication and population management in practice. This creates a risk that welfare considerations will not be given sufficient weight when deciding *whether* and *how* to intervene.

IAS management is not merely a financial, technical, or environmental issue; it is also fundamentally normative and societal in character. The Council recognises that both the distinction between 'native' and 'alien' and the predominant use of terms such as 'invasion' and 'control' shape the moral positioning of species and animals. Although such categories have a scientific basis and can be useful in policymaking and communication, they can also oversimplify matters conceptually and increase polarisation. This underscores that decision-making on IAS is not value-neutral and that language, framing and underlying values must be an explicit part of the discussion.

The Council also notes that the institutional organisation does not align with ecological reality in all respects. Responsibilities, expertise and capacity are fragmented, while species pay no heed to administrative boundaries and developments are often rapid and cross-border in nature. This can lead to differences in implementation and to suboptimal or delayed measures, creating risks for biodiversity, animal welfare and societal interests—and thereby also for public support for management.

The Council therefore concludes that a future-proof approach to IAS requires three interrelated key principles. Firstly, prevention and early detection should be prioritised to minimise both environmental damage and animal suffering. Prompt action also prevents populations from becoming established and coming to the attention of the general public, allowing the intervention to remain more limited in scope and duration, which may further help to prevent societal resistance.

Secondly, decision-making on eradication and population management requires transparent, well-substantiated considerations in which biodiversity, effectiveness, proportionality and animal welfare are explicitly taken into account. It is important that non-lethal measures are seriously explored and weighed alongside lethal methods where possible. Such transparency is essential for public understanding and support for far-reaching interventions, not least because public perceptions of species can differ strongly, and species regarded as beautiful, intelligent or 'cuddly' often elicit greater societal resistance to intervention.

Thirdly, this approach requires closer national and international cooperation, as invasive species are not constrained by administrative boundaries. This cooperation is also important for joint knowledge development and for further developing effective, animal-friendly control methods. This enables measures to remain ecologically effective and feasible while also being socially acceptable and respecting animal rights as much as possible.

When these elements align, IAS policy can support both ecosystem protection and our moral responsibility toward individual animals. The following chapter sets out the Council's recommendations in the light of these principles.

8. Recommendations

In the coming years, the pressure exerted by IAS on local ecosystems and native species will continue to increase, driven by factors such as globalisation, climate change and more intensive trade and travel. These developments increase both the likelihood of new introductions and the spread of established species. This, in turn, increases the number of situations in which public authorities face consequential decisions about eradicating or controlling animal populations. Timely prevention and a rapid response remain not only the most cost-effective strategies, but also the most capable of minimising environmental damage, animal suffering and societal resistance.

The RDA makes the following recommendations for future-proof policymaking, in addition to (and sometimes overlapping with) the National Action Plan on Invasive Alien Species:

Emphasis on prevention, early detection and rapid response

Once a species has become established and spreads, the ecological impact, management complexity, and number of animals that need to be captured or killed often increase rapidly. Prevention, early detection, and rapid response are therefore not only the most cost-effective strategies but also the most effective ways to prevent biodiversity loss and animal suffering.

An effective preventive approach requires a combination of regulation, supervision, knowledge and societal involvement.

- Strengthen regulations aimed at preventing introductions. This includes import restrictions and sanitary and phytosanitary measures that limit the introduction of organisms via trade flows.
- Ensure effective inspection and supervision. Effective checks at external borders, as well as at garden centres and other retail chains, are essential to prevent the introduction of IAS or detect them on time.
- Invest in raising awareness and public education. Members of the public (e.g., animal owners, gardeners and recreational visitors) can be involved in species introductions, intentionally or unintentionally. Effective public communication can help prevent introductions and support early detection through observation networks.
- Strengthen rapid species identification capabilities. Effective identification tools, digital identification keys and accessible knowledge resources can help professionals and amateurs recognise potentially invasive species on time, even if a species has not previously been recorded in the Netherlands.

- Ensure a clear division of responsibilities and effective coordination between national and provincial authorities, including sufficient capacity, structural funding and the pooling of specialist expertise.
- Invest in strengthening robust and resilient ecosystems that can better withstand disruptions caused by new species, reducing reliance on far-reaching management measures in the long term.

Integration of animal welfare in research, assessment and decision-making

Although European legislation requires preventing avoidable suffering, animal welfare is not yet given a structural, explicitly weighted role in decision-making on eradication and management in practice. A well-substantiated normative justification is especially crucial in situations where large numbers of animals are killed, including for communication with the public.

- Explicitly incorporate welfare considerations in decision-making. Highlight the values and policy objectives protected through intervention (e.g., biodiversity, ecosystem services, the welfare of native animals, public health or economic interests) and why interventions that affect the welfare or lives of invasive animals are considered proportionate in that light. Ensure that these considerations are transparent and well-substantiated for decision-makers, practitioners and the public.
- Invest in the development, testing and implementation of non-lethal or more dignified methods where effective and proportionate.
- Recognise the value of timely action. In many situations, early intervention can be the most welfare-friendly option, as it prevents populations from expanding and avoids the need for more far-reaching measures later on, when larger numbers of animals would need to be captured or killed.
- Develop a practical guide for local authorities outlining, in line with the IUCN manual, a careful approach to IAS, in which effectiveness, scalability, ecological side-effects and the impact on the welfare of target and non-target species are assessed systematically. This can contribute to more consistent, transparent and well-substantiated decision-making.

Knowledge development and adaptive management

Uncertainty is inherent in IAS management, as ecological effects, societal responses, and technological possibilities change over time, which calls for a learning and adaptive approach.

- Use adaptive management plans in which the choice of measures and objectives are periodically reviewed and adjusted in the light of new knowledge.
- Where relevant, examine the ecological role of certain alien species and the extent to which ecosystems are adapting, without downplaying the risks.

Social dialogue and language awareness

Societal perceptions, emotions and values strongly influence the feasibility and legitimacy of IAS policy. Differences in how species are valued, and in the visibility of suffering, play an important role in this.

- Maintain an open dialogue about the values at stake, including biodiversity, animal welfare, public health, the economy and safety. Highlight uncertainties and the considerations taken into account, and communicate them to the general public.
- Adopt a definition of IAS in line with the European Regulation and the IPBES report, with a clear distinction from alien species that primarily cause other forms of societal harm. This will prevent the implicit conflation of interests and strengthen transparency, careful decision-making and public legitimacy.
- Be aware of the impact of language; where possible, avoid unnecessarily polarising or militaristic metaphors.

International cooperation and regulation

IAS management is, by definition, a cross-border issue. National borders do not confine species; trade, transport and new technologies also have an international dimension.

- Intensify cooperation with neighbouring countries and EU partners to manage cross-border populations in a coordinated manner, exchange data, pool knowledge on methods and jointly develop these methods further.
- Explicitly take international governance into account when developing new approaches such as genetic techniques, as their effects are not confined to national borders.
- Take international differences in animal welfare into account and aim to give the Netherlands a leading role in this area within the EU.
- Advocate for an EU-wide positive list to prevent the introduction of high-risk animal species and harmonise the current patchwork of national rules. This will strengthen the preventive aspect of the policy and reduce the likelihood that far-reaching control measures will be needed at a later stage.

- Advocate for a fitness check of the European Invasive Alien Species Regulation. The Regulation is a key tool for a harmonised approach to IAS. However, experience shows that dilemmas and practical issues remain, including wildlife care for Union list species and the use of certain non-lethal control methods such as *Trap-Neuter-Release*. A fitness check can provide insight into the effectiveness, feasibility and coherence of current regulations and identify areas that need clarification or amendment to better balance biodiversity targets, animal welfare and practical feasibility.

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Annex 1. Request for an advisory report



Ministerie van Landbouw,
Natuur en Voedselkwaliteit

> Retouradres Postbus 20401 2500 EK Den Haag

Raad voor de Dierenangelegenheden
T.a.v. de heer mr. drs. J. Staman, voorzitter
Bezuidenhoutseweg 73
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Datum 22 november 2022
Betreft Aanvraag zienswijzen spanning tussen gehouden en niet-gehouden
dieren, doden van exoten en samenleven met de wolf.

Geachte heer Staman,

Het ministerie van LNV heeft te maken met een grote verscheidenheid van dossiers. In het werkplan voor de RDA heeft u op ons verzoek al twee onderwerpen opgenomen die op het raakvlak natuur en diergezondheid en dierenwelzijn liggen. Aanvullend wil ik de RDA vragen om een brede maatschappelijke dialoog over de wolf te organiseren en te adviseren over samenleven met de wolf. In deze brief ga ik nader in op deze vraagstukken en de vraag aan de RDA.

1. Spanning tussen gehouden en niet gehouden dieren

Het ministerie van LNV heeft bij zijn verantwoordelijkheden ten aanzien van het beleid op het gebied van diergezondheid en dierenwelzijn te maken met verschillende belangen die soms conflicterend zijn. Dit speelt bij gehouden dieren (bijvoorbeeld hobbymatig gehouden dieren en commercieel gehouden dieren) en bij niet-gehouden dieren. Sommige partijen uit de veehouderijsector(en) zien wilde dieren in de natuur als bedreiging voor de gezondheid van hun dieren en daarmee een bedreiging voor hun bedrijf. Voorbeelden daarvan zijn vogelgriep bij wilde vogels, en Afrikaanse varkenspest bij wilde zwijnen. De impact van uitbraken van dierziekten op de dierenhouders is groot en hun vraag om maatregelen om een mogelijke besmetting uit het wild te voorkomen is daarom begrijpelijk. Hoewel LNV een rol speelt bij de bestrijding van bepaalde dierziekten bij gehouden dieren, is die rol bij preventie en bestrijding van deze ziekten bij wilde dieren minder eenduidig. De vraag is bovendien hoe ver een overheid kan en moet ingrijpen in dierpopulaties in de natuur om dreiging van dierziekten bij gehouden dieren te verkleinen.

Ondertussen staat de biodiversiteit er wereldwijd slecht voor, zo ook in Nederland. Verdere achteruitgang van de natuur is ongewenst. Natuur is de basis van ons bestaan en heeft een eigen bestaansrecht dat beschermd dient te worden. De wet natuurbescherming biedt handvatten voor populatiebeheer en schadebestrijding van in het wild levende beschermde diersoorten mits deze soorten niet in hun voortbestaan worden bedreigd of dit gevaar lopen en er geen andere bevredigende oplossing is. Preventieve maatregelen zoals populatiebeheer, maar

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Ons kenmerk
DGNVLG-S / 22218586

ook het plaatsen van hekken en lasers in de uitloop van pluimveebedrijven, kunnen interfereren met de natuur en het natuurlijk evenwicht.

Directoraat-generaal Natuur,
Visserij en Landelijk Gebied
Cluster Soorten

Aan de RDA wordt gevraagd om te reflecteren op deze spanning tussen het welzijn en de gezondheid van gehouden dieren enerzijds en het welzijn, de gezondheid en belang van dieren in de natuur én de natuur als geheel anderzijds. Op basis van een bureau-onderzoek naar risico's en gevolgen (denk aan Afrikaanse Varkenspest, vogelgriep) én interviews met experts vanuit beide kanten kan de RDA hierover een beschouwing geven en (algemene) handvatten en leidende principes voorstellen ten behoeve van beleidsvorming op het raakvlak van gehouden dieren en natuur.

Ons kenmerk
DGNVLG-S / 22218586

2. Doden van invasieve uitheemse soorten

Invasieve uitheemse soorten (IUS) zijn planten of dieren die (door menselijk handelen) buiten hun natuurlijke verspreidingsgebied geïntroduceerd zijn en waarvan de introductie of verspreiding een bedreiging is of nadelige gevolgen heeft voor de biodiversiteit en aanverwante ecosysteemdiensten. Ze vormen een grote bedreiging voor de biodiversiteit doordat ze inheemse soorten kunnen verdringen of zelfs doen uitsterven. Een aantal IUS is ook schadelijk voor de gezondheid en/of veiligheid van mensen.

De biodiversiteit staat er wereldwijd slecht voor en verdere achteruitgang van de natuur is ongewenst, ook in Nederland. De Europese Exotenverordening (nr. 1143/2014) verbiedt het opzettelijk op het grondgebied van de Europese Unie brengen, houden, verhandelen, kweken en in de natuur uitzetten van dieren of planten van een op de Unielijst geplaatste soort. Voor Unielijstsoorten die nog niet wijd verspreid zijn moeten lidstaten uitroeingsmaatregelen treffen. Voor Unielijstsoorten die zich reeds wijd in de natuur hebben verspreid, moeten lidstaten beheersmaatregelen treffen. Beheersmaatregelen bestaan uit dodelijke of niet-dodelijke maatregelen om een populatie van invasieve uitheemse soorten uit te roeien, te beheersen of in te dammen. De juridische kaders bieden de ruimte voor het treffen van beheersmaatregelen, doden kan één van die maatregelen zijn. Hierbij dient onder andere te worden gezorgd dat dieren vermijdbare pijn, stress of lijden wordt bespaard.

Het betreft vaak (zeer) grote aantallen dieren, aangezien IUS zich kenmerken door hun ongebreidelde toename bij gebrek aan natuurlijke vijanden of door gunstige leefomstandigheden in Nederland. Doden kan noodzakelijk zijn, omdat niet-dodelijke methoden meestal slechts voor een beperkt aantal exemplaren haalbaar zijn en hoge kosten met zich meebrengen. Toch klinkt vanuit maatschappelijke kringen steeds vaker de roep om met name de 'aaibare' IUS niet te doden (te denken valt aan wasberen, schildpadden e.d.), zie ook uw zienswijze "doden van dieren aan het licht". Hierbij verliest men uit het oog welke schade deze IUS aan de natuur toebrengen en de maatschappelijke kosten en (natuur-)schade die een niet-dodelijke aanpak (zoals bijvoorbeeld permanente opvang, of niet-bestrijden) met zich meebrengen. In bovengenoemde zienswijze signaleert u deze schurende kwestie en benoemt u vooral preventie van vestiging als aanbeveling. Preventie is de basis van het exotenbeleid, maar kan helaas niet voorkomen dat zich toch exoten vestigen in de Nederlandse natuur of zich al gevestigd hebben.

Aan de RDA wordt gevraagd om te reflecteren op de spanning tussen behoud van natuur en biodiversiteit en de maatschappelijke wens om geen dieren te doden (met het oog op dierenwelzijn). Het verzoek daarin te betrekken:

- de paradox tussen het direct zichtbare dierenleed dat ontstaat door het vangen en doden van IUS versus het minder zichtbare leed van schade aan de natuur en (het welzijn van) dieren in de natuur veroorzaakt door IUS;
- de paradox / het schisma tussen denkbeelden over aalbare en niet-aalbare dieren;
- de paradox / het schisma tussen denkbeelden over het doden voor het behoud van natuur en van grote aantallen dieren om andere overwegingen (zoals in veehouderij en visserij voor consumptie, bestrijding van plaagdieren);
- de paradox tussen de maatschappelijk wens (geen dieren doden) en gebrek aan (financieel) draagvlak voor de maatschappelijke kosten van niet-dodelijke maatregelen;
- de proportionaliteit, uitvoerbaarheid en redelijkheid van niet-dodelijke maatregelen voor IUS.

Deze adviesvraag vraagt om een zorgvuldige afweging van de belangen voor de natuur in zijn geheel en van dierenwelzijn (waar de expertise van de RDA-leden zich voornamelijk op richt). Dat vraagt ook om een evenwichtige samenstelling van het team dat aan deze vraag werkt. Het is daarom van belang dat de RDA samenwerking zoekt met externen (zoals ecologen en deskundigen op het gebied van wetgeving op dit vlak), om te waarborgen dat vanuit al deze perspectieven naar de vraag gekeken wordt.

3. Samenleven met de wolf

De wolf is sinds een aantal jaren terug in Nederland. Door sommige partijen wordt de komst van de wolf toegejuicht, bij andere partijen leven veel zorgen. Zoals aangekondigd in het Commissiedebat Natuur, wil ik de RDA vragen om een brede maatschappelijke dialoog te organiseren over de positie van de wolf in Nederland. Doel van deze dialoog is om over en weer begrip te krijgen voor de verschillende standpunten en verdere verharding van het debat te voorkomen. Daarnaast wil ik de RDA vragen om tijdens de gesprekken te verkennen wat er nodig is om in Nederland samen te leven met de wolf en op basis hiervan met een advies te komen. Onderdelen die in dit advies in ieder geval aan de orde zouden moeten komen zijn de positie van de wolf in de Nederlandse natuur, de beleefde angstgevoelens voor de wolf en bescherming van vee tegen de wolf.

Bij deze verzoek ik uw raad zienswijzen op te stellen voor deze drie onderwerpen op het raakvlak natuur en diergezondheid en dierenwelzijn. Alle drie de vraagstukken vragen om een zorgvuldige afweging tussen de belangen van natuur en gezondheid en welzijn van (gehouden) dieren.

**Directoraat-generaal Natuur,
Visserij en Landelijk Gebied**
Cluster Soorten

Ons kenmerk
DGNVLG-S / 22218586

Hoogachtend,



Piet Adema
Minister van Landbouw, Natuur en Voedselkwaliteit



Christianne van der Wal-Zeggelink
Minister voor Natuur en Stikstof

Annex 2. External interviews

In preparing this advisory report, we consulted several external individuals and organisations. The insights gathered informed the forum's deliberations and the final advisory report.

Dolf Moerkens	Dutch Water Authorities
Nick Clark and Léa Badoz	Eurogroup for Animals
Ingrid Visseren-Hamakers	Radboud University
Lennart Zwart	Provincial Task Force on Invasive Alien Species
Lowieke Vermeulen	Wageningen University & Research
Maarten Jacobs	Wageningen University & Research
Norbert Peeters	Leiden University
Rob Leuven	Radboud University
Wilfred Reinhold	Platform Stop Invasieve Exoten (platform to stop invasive alien species)
Daniëlla van Gennep	Spreekbuis Wildopvang en Dierenambulances (advocacy platform for wildlife care centres and animal ambulances)

Annex 3. Animal species on the Union list

Mammals

On the Union list since	03-08-2016	02-08-2017	15-08-2019	02-08-2022	07-08-2025
<u>American mink</u> (<i>Neogale vison</i>)					X
<u>Fox squirrel</u> (<i>Sciurus niger</i>)	X				
<u>Spotted deer</u> (<i>Axis axis</i>)				X	
<u>Coypu</u> (<i>Myocastor coypus</i>)	X				
<u>North American beaver</u> (<i>Castor canadensis</i>)					X
<u>Grey squirrel</u> (<i>Sciurus carolinensis</i>)	X				
<u>Small Asian mongoose</u> (<i>Herpestes javanicus</i>)	X				
<u>Muntjac deer</u> (<i>Muntiacus reevesi</i>)	X				
<u>Muskrat</u> (<i>Ondatra zibethicus</i>)		X			
<u>Pallas's squirrel</u> (<i>Callosciurus erythraeus</i>)	X				
<u>Coati</u> (<i>Nasua nasua</i>)	X				
<u>Siberian chipmunk</u> (<i>Tamias sibiricus</i>)	X				
<u>Sika deer</u> (<i>Cervus nippon</i>)					X
<u>Finlayson's squirrel</u> (<i>Callosciurus finlaysonii</i>)				X	
<u>Raccoon</u> (<i>Procyon lotor</i>)	X				
<u>Raccoon dog</u> (<i>Nyctereutes procyonoides</i>)		X			

Birds

On the Union list since	03-08-2016	02-08-2017	15-08-2019	02-08-2022
<u>Sacred ibis</u> (<i>Threskiornis aethiopicus</i>)	X			

<u>Indian house crow</u> (<i>Corvus splendens</i>)	X			
<u>Crested myna</u> (<i>Acridotheres cristatellus</i>)				X
<u>Egyptian goose</u> (<i>Alopochen aegyptiacus</i>)		X		
<u>Red-vented bulbul</u> (<i>Pycnonotus cafer</i>)				X
<u>Red-whiskered bulbul</u> (<i>Pycnonotus jocosus</i>)				X
<u>Ruddy duck</u> (<i>Oxyura jamaicensis</i>)	X			
<u>Common myna</u> (<i>Acridotheres tristis</i>)			X	

Reptiles and amphibians

On the Union list since	03-08-2016	02-08-2017	15-08-2019	02-08-2022
<u>African clawed frog</u> (<i>Xenopus laevis</i>)				X
<u>American bullfrog</u> (<i>Lithobates catesbeianus</i> , synonym <i>Rana catesbeiana</i>)	X			
<u>Common kingsnake</u> (<i>Lampropeltis getula</i> , <i>L. holbrooki</i> , <i>L. nigra</i> , <i>L. californiae</i> , <i>L. splendida</i>)				X
<u>Pond slider</u> (<i>Trachemys scripta</i>)	X			

Invertebrates

On the Union list since	03-08-2016	02-08-2017	15-08-2019	02-08-2022	07-08-2025
<u>Asian hornet</u> (<i>Vespa velutina</i>)	X				
<u>Asian needle ant</u> (<i>Brachyponera chinensis</i>)					X
<u>Electric ant</u> (<i>Wasmannia auropunctata</i>)				X	
<u>Obama flatworm</u> (<i>Obama nungara</i>)					X
<u>Shovel-headed gardenworm</u> (<i>Bipalium kewense</i>)					X
<u>New Guinea flatworm</u> (<i>Platydemus manokwari</i>)					X
<u>New Zealand flatworm</u> (<i>Arthurdendyus triangulatus</i>)			X		

<u>Northern giant hornet</u> (<i>Vespa mandarinia</i>)					X
<u>Red imported fire ant</u> (<i>Solenopsis invicta</i>)				X	
<u>Tropical fire ant</u> (<i>Solenopsis geminata</i>)				X	
<u>Black fire ant</u> (<i>Solenopsis richteri</i>)				X	

Freshwater invertebrates

On the Union list since	03-08-2016	02-08-2017	15-08-2019	02-08-2022	07-08-2025
<u>Calico crayfish</u> (<i>Faxonius immunitis</i>)					X
<u>Signal crayfish</u> (<i>Pacifastacus leniusculus</i>)	X				
<u>Chinese mystery snail</u> (<i>Cipangopaludina chinensis</i>)					X
<u>Chinese mitten crab</u> (<i>Eriocheir sinensis</i>)	X				
<u>Virile crayfish</u> (<i>Faxonius virilis</i>)	X				
<u>Spiny-cheek crayfish</u> (<i>Faxonius limosus</i>)	X				
<u>Golden mussel</u> (<i>Limnoperna fortunei</i>)				X	
<u>Giant ramshorn snail</u> (<i>Marisa cornuarietis</i>)					X
<u>Common yabby</u> (<i>Cherax destructor</i>)					X
<u>Marbled crayfish</u> (<i>Procambarus virginalis</i>)	X				
<u>Red swamp crayfish</u> (<i>Procambarus clarkii</i>)	X				
<u>Rusty crayfish</u> (<i>Faxonius rusticus</i>)				X	

Fish (fresh, brackish and marine waters)

On the Union list since	03-08-2016	02-08-2017	15-08-2019	02-08-2022	07-08-2025
<u>White Perch</u> (<i>Morone americana</i>)				X	
<u>Amur sleeper</u> (<i>Percottus glenii</i>)	X				

<u><i>Oriental weatherloach</i></u> (<i>Misgurnus anguillicaudatus</i>)					X
<u><i>Stone moroko</i></u> (<i>Pseudorasbora parva</i>)	X				
<u><i>Northern Snakehead</i></u> (<i>Channa argus</i>)				X	
<u><i>Mummichog</i></u> (<i>Fundulus heteroclitus</i>)				X	
<u><i>Mosquitofish</i></u> (<i>Gambusia affinis</i>)				X	
<u><i>Eastern Mosquitofish</i></u> (<i>Gambusia holbrooki</i>)				X	
<u><i>Striped eel catfish</i></u> (<i>Plotosus lineatus</i>)			X		
<u><i>Northern weatherfish</i></u> (<i>Misgurnus bipartitus</i>)					X
<u><i>Pumpkinseed</i></u> (<i>Lepomis gibbosus</i>)			X		
<u><i>Black bullhead</i></u> <u><i>catfish</i></u> (<i>Ameiurus melas</i>)				X	

Other marine species

On the Union list since	03-08-2016	02-08-2017	15-08-2019	02-08-2022
<u><i>Dwarf surf clam</i></u> (<i>Mulinia lateralis</i>)				X
<u><i>Japanese eelgrass</i></u> (<i>Nanozostera japonica</i>)				X
<u><i>Northern Pacific sea star</i></u> (<i>Asterias amurensis</i>)				X
<u><i>Rugulopteryx okamurae</i></u>				X

Annex 4. Humaneness assessment of control measures

An overview of IAS management measures and the animal welfare implications of these methods, as set out in Chapter 5 of the *Manual for the management of vertebrate invasive alien species of Union concern, incorporating animal welfare* (Smith et al., 2022c).

Biological control

Measure	Overall welfare impact (5 domains)					Mode of death
	Water deprivation, food deprivation, malnutrition	Environmental challenge	Injury, disease, functional impairment	Behavioural, interactive restriction	Anxiety, fear, pain, distress, thirst, hunger etc.	Suffering before irreversible unconsciousness
Native predators	No impact	No impact	Mild – Moderate to Severe – Extreme impact	No impact	Mild – Moderate to Severe – Extreme impact	No suffering to Mild – Moderate suffering
	Native predators select prey (including those with dependent young) and hunt according to their own requirements and capabilities, without any reference to human expectation. Kills may not be swift, and hunts may injure prey without always killing them but predation in most contexts will produce a very short period of extreme fear (pursuit) and a short period of suffering (seconds).					

Habitat manipulation

Measure	Overall welfare impact (5 domains)					Mode of death
	Water deprivation, food deprivation, malnutrition	Environmental challenge	Injury, disease, functional impairment	Behavioural, interactive restriction	Anxiety, fear, pain, distress, thirst, hunger etc.	Suffering before irreversible unconsciousness
Aquatic barriers – physical	No impact	No impact to Mild – Moderate impact	No impact	No impact	No impact	Not applicable
	Physical barriers have little or no welfare impact upon the aquatic IAS of Union concern.					
Aquatic barriers – non-physical	No impact	No impact to Mild – Moderate impact	No impact to Severe – Extreme impact	No impact to Mild – Moderate impact	No impact to Severe – Extreme impact	Severe – Extreme suffering
	Non-physical barriers that work as deterrents, have little or no welfare impact upon the aquatic IAS of Union concern. Electric and CO ₂ barriers have the potential for more serious welfare impacts. Ozone is the only barrier that is intentionally lethal, and exposure to non-lethal doses can lead to serious injury.					

Measure	Overall welfare impact (5 domains)					Mode of death
	Water deprivation, food deprivation, malnutrition	Environmental challenge	Injury, disease, functional impairment	Behavioural, interactive restriction	Anxiety, fear, pain, distress, thirst, hunger etc.	Suffering before irreversible unconsciousness
Aquatic habitat management – Pond drying/draining	Mild – Moderate impact	Mild – Moderate to Severe – Extreme impact	Mild – Moderate to Severe – Extreme impact	Mild – Moderate impact	Mild – Moderate impact to Severe – Extreme impact	Severe – Extreme suffering
	Depending on how long after draining, and under which circumstances, the target species is removed from the water body, this measure can expose aquatic animals to extreme conditions, i.e. acute exposure to air and lack of water. Therefore when applying this measure, it is important to ensure that all target aquatic animals are removed from the water body before it is completely devoid of water and later euthanised appropriately, in order to guarantee that the measure is applied avoiding unnecessary welfare impacts. When this measure is used to kill animals, i.e. through acute exposure to air and lack of water, it will lead to a slow death with severe/extreme levels of suffering.					
Physical terrestrial barriers	No impact to Mild – Moderate impact	No impact	Mild – Moderate impact	Mild – Moderate impact	No impact to Mild – Moderate impact	Not applicable
	The impact on the animals' welfare may be limited to occasional injuries and behavioural/interactive restrictions. The additional impact of neutering the contained animals should be considered if relevant.					

Hand removal

Measure	Overall welfare impact (5 domains)					Mode of death
	Water deprivation, food deprivation, malnutrition	Environmental challenge	Injury, disease, functional impairment	Behavioural, interactive restriction	Anxiety, fear, pain, distress, thirst, hunger etc.	Suffering before irreversible unconsciousness
Hand removal	No impact	No impact	No impact to Mild – Moderate impact	No impact	Mild – Moderate impact	Not applicable
	Hand removal is generally fast and does not involve particular severe impacts on animals. However, handling and restraint of animals almost certainly will produce fear in wild species, and could potentially lead to some injuries. The duration of fear will depend to the time it takes to euthanize.					
Physical fishing methods	Mild – Moderate impact	Mild – Moderate impact	Mild – Moderate to Severe – Extreme impact	Mild – Moderate impact	Severe – Extreme impact	Not applicable
	Most types of aquatic nets used to capture animals usually involve some degree of environmental challenge (lack of oxygen), behavioural restrictions (inability to swim or hide from predators), distress and injury. The severity of injuries depends on the specific method used, the species in question and how the technique is undertaken.					

Other

Measures	Overall welfare impact (5 domains)					Mode of death
	Water deprivation, food deprivation, malnutrition	Environmental challenge	Injury, disease, functional impairment	Behavioural, interactive restriction	Anxiety, fear, pain, distress, thirst, hunger etc.	Suffering before irreversible unconsciousness
Egg oiling	No impact	No impact	No impact	Mild – Moderate impact	No impact to Mild – Moderate impact	No suffering to Mild – Moderate suffering
	Egg oiling causes the death of the developing embryo in the egg through asphyxiation. Young embryos are not considered able to feel pain so in these cases the method is considered to lead to little welfare impact. However, embryos in the last 20% of incubation can experience pain and in these cases they may experience suffering before death.					
Electrofishing	No impact	Mild – Moderate to Severe – Extreme impact	Mild – Moderate to Severe – Extreme impact	Mild – Moderate to Severe – Extreme impact	Mild – Moderate to Severe – Extreme impact	Not applicable
	If properly used, electrofishing should not lead to the death of the animal. However, depending on many different factors, including the environmental conditions of the site being treated and the target species, the application of this method can have varying degrees of harmful effects on the animals targeted (as well as to bycatch).					
Fertility Control - chemical (in bait) & injection	No impact	No impact	No impact to Mild – Moderate impact	No impact	No impact to Mild – Moderate impact	Not applicable
	The measure in general is considered to have a mild welfare impact, although repeated treatments may have a cumulative effect. Further details on the impact of this measure for many of the vertebrate IAS of Union concern are needed. In relation to the use of triploidy in American bullfrogs it can be considered to have no impact on welfare. Although little information is available on the sensory capacity of amphibian eggs at the stage of development, given that the procedure takes place 10 minutes after fertilisation, negligible impacts are to be expected.					
Hunting dogs (tracking/ baying)	No impact	No impact	No impact to Mild – Moderate impact	No impact	No impact to Mild – Moderate impact	Not applicable
	Mild – Moderate impact is expected for the hunted animals (and the tracking/baying hunting dogs), given the use of appropriately trained dogs, or dogs that are wearing a muzzle. Time between finding the animal and death/handling/capture of the animal is short with dogs (minutes), for example compared with non-lethal trapping, where animals can be restrained for hours or more.					
Judas animals	No impact	Mild – Moderate impact	Mild – Moderate impact	Mild – Moderate impact	Mild – Moderate impact	Not applicable
	Capture/recapture of Judas animals and culling of disclosed animals causes stress of varying severity to the Judas animals themselves. Their welfare may also be affected by surgical sterilisation, being introduced in new areas, being isolated and having to find other conspecifics. The severity of the stress is exacerbated by the repetition of these actions.					

Poisoning or intoxicants

Measures	Overall welfare impact (5 domains)					Mode of death
	Water deprivation, food deprivation, malnutrition	Environmental challenge	Injury, disease, functional impairment	Behavioural, interactive restriction	Anxiety, fear, pain, distress, thirst, hunger etc.	Suffering before irreversible unconsciousness
Chemical treatment of habitats	No impact	No impact	Mild – Moderate to Severe – Extreme impact	Mild – Moderate impact	Mild – Moderate impact to Severe – Extreme impact	Mild – Moderate suffering to Severe – Extreme suffering
	For the fish species and <i>Lithobates (Rana) catesbeianus</i> , different chemical treatments result in different degrees of humaneness impact, for example Rotenone leads to observable behavioural stress and death occurs between 24-36 hours (though time to death is heavily affected by water temperature). For the mammals, aluminium phosphide has a moderate impact (based on studies on rabbits), which cannot automatically be assumed to be the same for <i>Myocastor coypus</i> or <i>Ondatra zibethicus</i> .					
Poisons and toxins in bait	No impact	No impact	No impact	No impact	No impact	Mild – Moderate suffering to Severe – Extreme suffering
	For methods involving toxic baits it is likely that there will be no welfare impact prior to the animal ingesting the bait. However, anticoagulant rodenticides take days to cause irreversible insensibility before death and suffering is likely to range between moderate/severe/extreme. No approved poison product is available for <i>S. carolinensis</i> since approval for warfarin for use against this species lapsed in 2014. There are also no approved poison products in the EU for the other potential target species discussed here - <i>H. javanicus</i> and <i>O. zibethicus</i> . Until such time that regulatory approval of a substance with relatively low target and non-target welfare impacts emerges, the overall recommendation of this assessment is that the use of poisons and toxins in bait to manage IAS of Union concern is unsuitable. The use of baits also has the potential for non-specific killing of other animals through ingestion of toxin/bait directly or ingestion of poisoned animals.					
Stupefying bait	Mild – Moderate impact	No impact	No impact to Severe – Extreme impact	Severe – Extreme impact	Mild – Moderate to Severe – Extreme impact	Mild – Moderate suffering to Severe – Extreme suffering
	The welfare impacts of treatment with Alphachloralose depends critically on the operator's ability to quickly retrieve the animals that have taken the bait and humanely dispatch them, and also ensure the welfare of non-target species pending recovery. This, in turn, is dependent on dosage of the stupeficient received by each animal, which may be hard to control, and the extent to which the treated animals disperse.					

Shooting

Measures	Overall welfare impact (5 domains)					Mode of death
	Water deprivation, food deprivation, malnutrition	Environmental challenge	Injury, disease, functional impairment	Behavioural, interactive restriction	Anxiety, fear, pain, distress, thirst, hunger etc.	Suffering before irreversible unconsciousness
Shooting	No impact	No impact	No impact to Severe – Extreme impact	No impact	No impact to Severe – Extreme impact	No suffering to Severe – Extreme suffering
	If used appropriately, shooting should result in a rapid instantaneous death for the majority of animals, with no consequences for their welfare. However, shooting carries the risk of wounding with potentially severe consequences for the welfare of the animal concerned. This risk can be reduced by the selection of appropriate firearms and ammunition, detection devices and scopes, the training of the shooters, and measures to ensure wounded animals are followed and quickly dispatched with a second shot.					

Trapping

Measures	Overall welfare impact (5 domains)					Mode of death
	Water deprivation, food deprivation, malnutrition	Environmental challenge	Injury, disease, functional impairment	Behavioural, interactive restriction	Anxiety, fear, pain, distress, thirst, hunger etc.	Suffering before irreversible unconsciousness
Cage traps	Mild – Moderate impact	Mild – Moderate impact	Mild – Moderate impact	Mild – Moderate to Severe – Extreme impact	Mild – Moderate impact	Not applicable
	If used appropriately by trained personnel, cage traps offer a flexible and relatively humane method of animal capture and restraint. If traps are checked at intervals appropriate for the species and are used correctly (e.g. avoiding extreme conditions and unsuitable locations), mortality rates associated with cage traps approach zero. Use of trap alarms is recommended to minimize time in the trap.					
Drowning traps	No impact	No impact	Mild – Moderate impact	Severe – Extreme impact	Severe – Extreme impact	Severe – Extreme suffering
	The use of drowning traps causes severe suffering in target and non-target animals. Death by drowning induced hypoxia is not considered an acceptable method of euthanasia by veterinary and laboratory researchers.					

Measures	Overall welfare impact (5 domains)					Mode of death
	Water deprivation, food deprivation, malnutrition	Environmental challenge	Injury, disease, functional impairment	Behavioural, interactive restriction	Anxiety, fear, pain, distress, thirst, hunger etc.	Suffering before irreversible unconsciousness
Goodnature self-resetting traps	No impact	No impact	No impact	No impact	No impact	No suffering to Severe – Extreme suffering
	No impact occurs before the killing method (trap triggering) is applied, and the manufacturer reports claim that these traps can cause irreversible unconsciousness instantly. However, the only data available on time to irreversible unconsciousness are unable to support such claims for Goodnature traps with ship rats, brushtail possums and stoats because of the practicalities of testing unconsciousness instantly after trap triggering. Goodnature traps for <i>S. carolinensis</i> have been approved in the UK indicating that in tests most squirrels were irreversibly unconscious in ≤300 seconds (exact times were not recorded). As individuals of <i>S. niger</i> can be much heavier than <i>S. carolinensis</i> , traps would need to undergo welfare testing for this particular species. The A18 Mongoose Goodnature trap is currently undergoing welfare testing but manufacturer reports claim that it can kill mongoose instantly. While these traps have the potential to cause only relatively limited suffering, severe to extreme suffering cannot yet be ruled out in some cases.					
Live decoy traps	Mild – Moderate impact	Mild – Moderate to Severe – Extreme impact	Mild – Moderate to Severe – Extreme impact	Mild – Moderate to Severe – Extreme impact	Mild – Moderate to Severe – Extreme impact	Not applicable
	Individuals used as the decoy will have their welfare impacted, and they must be provided with food, water, perches, space to stretch and shelter and protected from severe weather. Captured animals should be removed quickly based on regular inspection of the traps. Care is needed, for example in the placement of traps, to reduce the risks of predation.					
Neck-hold traps, and snares	Mild – Moderate impact	Mild – Moderate impact	Mild – Moderate to Severe – Extreme impact	Severe – Extreme impact	Severe – Extreme impact	Not applicable
	Animals caught in snares and snare traps (neck-hold traps/snares, and non-lethal stop-snares) commonly suffer moderate injuries, including damage to tendons or ligaments and amputation of a digit. Severe to extreme injuries also sometimes occur, with luxation or fractures of the limbs or amputation and snared animals may be severely injured or strangled. Sometimes animals chew or bite their own feet and limbs, or exhaust themselves trying to escape. Captured animals are potentially exposed for hours to environmental conditions outside their normal range and to attack by predators. Use of trap alarms is recommended to minimize time in the trap.					
Spring traps	No impact	No impact	No impact	No impact	No impact	No suffering to Severe – Extreme suffering
	No impact occurs under any domain before the killing method (trap triggering) is applied. The welfare impact of spring traps is likely to vary widely among species, trap model and the way the trap is used. When deployed according to best practise, they have the potential to produce instantaneous and irreversible insensibility and death, however potentially severe-extreme suffering cannot be ruled out. Traps must be checked regularly so that injured animals can be killed quickly. While traps that have passed AIHTS or NAWAC standards are expected to cause irreversible unconsciousness within 5 or 3 minutes respectively, other traps have not been tested in this way.					

Measures to dispatch/remove once captured

Measures	Overall welfare impact (5 domains)					Mode of death
	Water deprivation, food deprivation, malnutrition	Environmental challenge	Injury, disease, functional impairment	Behavioural, interactive restriction	Anxiety, fear, pain, distress, thirst, hunger etc.	Suffering before irreversible unconsciousness
Cooling then freezing	No impact to Mild – Moderate impact	Mild – Moderate to Severe – Extreme impact	Mild – Moderate impact	Mild – Moderate impact	Mild – Moderate impact	No suffering to Severe – Extreme suffering
	Rapid freezing of small amphibians and reptiles (<4g) will result in almost immediate death. Some amphibians, reptiles, and fishes can be euthanised through hypothermia (cooling followed by freezing) where the cooling acts as an anesthetic before freezing to ensure there is no suffering as the formation of ice crystals in the body could lead to pain (note that drugs, e.g. MS 222 can also be used to anaesthetise). The appropriateness of the measures depends upon temperature tolerance, with species inhabiting areas where ambient (or water) temperatures fall to very low levels may maintain neural activity at lower temperatures compared to those found in warmer climates.					
Injection euthanasia	No impact	No impact to Mild – Moderate impact	No impact	No impact to Mild – Moderate impact	No impact to Mild – Moderate impact	No suffering to Mild – Moderate suffering
	This technique does not lead to suffering and is considered one of the most rapid and reliable methods of performing euthanasia. Sedation or anaesthesia is required, unless in case of direct intravenous administration, either to facilitate the handling of animals or to avoid fear and pain. Injection euthanasia is applied to restrained animals; therefore pain and stress are related to the technique employed to capture the animals (e.g. trapping) and to handle them before sedation. This measure also includes the (non-injection) application of use of drugs applied via water in order to euthanize fish species. For this, welfare impacts can arise due to animals being kept in containers while the drug is administered. There is also evidence that some fish species exhibit stress before the animals lose consciousness.					
Keeping in captivity	No impact	Mild – Moderate impact	Mild – Moderate impact	Mild – Moderate impact	Mild – Moderate impact	Not applicable
	The impact of captivity on a non-domestic animal is considered mild-moderate, depending on species-specific characteristics and scientific knowledge supporting best practices. In addition to the captivity itself, captured animals destined for a life in captivity will be confined in transport cages, transported and potentially quarantined, the cumulative welfare impacts of which should also be taken into account. Further research is needed to quantify the welfare outcomes associated with captivity on wild-caught individuals of the 22 vertebrate IAS of Union concern.					

Measures	Overall welfare impact (5 domains)					Mode of death
	Water deprivation, food deprivation, malnutrition	Environmental challenge	Injury, disease, functional impairment	Behavioural, interactive restriction	Anxiety, fear, pain, distress, thirst, hunger etc.	Suffering before irreversible unconsciousness
Cervical dislocation	No impact	No impact	No impact	Mild – Moderate impact	Mild – Moderate impact	No suffering
	When performed correctly by well-trained individuals, cervical dislocation appears to be a method of euthanasia with a low welfare impact, which may induce rapid loss of consciousness and ensures a rapid death. It is feasible and effective in small fish but should be confirmed by exsanguination or destruction of the brain.					
Cranial depression	No impact	No impact	No impact	Mild – Moderate impact	Mild – Moderate impact	No suffering
	Cranial depression can represent one of the most humane methods of dispatch for restrained animals when applied by a trained operative. The animal is likely to experience fear for a very short period while being removed from the trap and presented for dispatch. Insensibility (and usually death) are instantaneous when cranial depression is applied by a competent operator. Generally, penetrating captive bolts are more appropriate for euthanasia of medium and large mammals. However, adequate restraint is important to ensure proper placement of captive bolts, and this becomes progressively more challenging with larger wild animals. Cranial depression is then not recommended for animals above 3 kg.					
Decapitation	No impact	No impact	No impact	Mild – Moderate impact	Mild – Moderate impact	No suffering
	While decapitation is considered a humane method of dispatching animals particularly in laboratories and farms, the method is not widely used in wildlife management.					
Electrocution	No impact	No impact	No impact	Mild – Moderate impact	Severe – Extreme impact	Mild – Moderate suffering
	The method is used for farmed animals and sometimes also with wild animals. Since animals do not lose consciousness for 10 to 30 seconds the method should not be applied without ensuring a rapid unconsciousness by passing a current through the brain before the animal is electrocuted. However, 'electrical and electronic devices capable of killing or stunning' are prohibited under Annex VI of the Habitats Directive (Council Directive 92/43/EEC).					

Measures	Overall welfare impact (5 domains)					Mode of death
	Water deprivation, food deprivation, malnutrition	Environmental challenge	Injury, disease, functional impairment	Behavioural, interactive restriction	Anxiety, fear, pain, distress, thirst, hunger etc.	Suffering before irreversible unconsciousness
Modified atmospheres	No impact	Severe – Extreme impact	No impact	Mild – Moderate impact	Mild – Moderate impact	Mild – Moderate suffering to Severe – Extreme suffering
	Euthanasia using modified atmospheres is not as quick as most other methods of dispatch, with animals subjected to the method experiencing periods of distress lasting for some time (a number of 10s of seconds). In addition, it has the potential to be applied incorrectly and produce much greater suffering, especially where it is applied in field settings.					
Shooting - dispatch restrained animals	No impact	No impact	No impact	Mild – Moderate impact	Mild – Moderate impact	No suffering
	Shooting in a cage with a properly placed gunshot can cause immediate insensibility and humane death, making this one of the quickest methods of dispatch for restrained animals when applied by trained operatives. Personnel should be trained in correct and safe use of firearms and the anatomy of the species involved, in order to correctly target vital areas.					
Slaughter (knife)	No impact	No impact	No impact	Mild – Moderate impact	Mild – Moderate impact	No suffering
	Animals are slaughtered using a transverse cut across the throat, close to the head, causing exsanguination. The length of time between making the cut and loss of consciousness remains controversial. There are different opinions on whether the animal feels pain during the neck cut and if the resulting drop in blood pressure causes discomfort or distress. Therefore, slaughter with a knife should be considered a terminal procedure to be used only in stunned or anaesthetised animals and this assessment assumes that either stunning or anaesthesia has been applied prior to slaughter.					
Surgical sterilisation	Mild – Moderate impact	Mild – Moderate impact	Mild – Moderate impact	Mild – Moderate impact	Mild – Moderate impact	Not applicable
	Assuming best practice application of this technique, this measure would rank as having mild-moderate humaneness impact. Despite surgical sterilisation being a one-off procedure to render permanent infertility, the long-term welfare impacts of sterilising on non-domestic species is still lacking research (i.e. behavioural changes, sociability, survival).					

Annex 5. Overall assessment of control measures

This annexe presents the qualitative conclusions regarding the various management methods for IAS, as set out in Appendices 1–32 of the *Manual for the management of vertebrate invasive alien species of Union concern, incorporating animal welfare* (Smith *et al.*, 2022a). The assessment covered the impact on animal welfare, including possible side effects, and the measure's effectiveness and costs.

Measure	Qualitative conclusion
1. Native predators	The use of native predators as a measure to intentionally manage IAS appears superficially attractive. For potentially little outlay (catching and translocating some animals) native predators might give the appearance of a benign bio-control agent, whilst also contributing to the restoration of degraded ecosystems and rewilding landscapes often considered to be in need of conservation action. By bringing these iconic and often charismatic species geographically and metaphorically closer to people there is a chance of using them to engage citizens in wider ecological/conservation discourse, as well as benefit from the free ecological service they would provide in consuming listed IAS to the benefit of society. However, the use of bio-control agents imported into ecosystems has a very long history of disaster, with at least four of the listed IAS having established their threat to Europe by repeatedly having been imported and released to control weeds/pests in other parts of the world, and subsequently damaging ecosystems at national or even continental scales (e.g. common myna). It should be remembered that the modern productive anthropogenic landscapes of Europe, often occupied by home-owners as frequently as they are farmers or foresters (e.g. spread of urban and urbanized land-uses), are so different to the unaltered natural ecosystems previously occupied by the former native predators, as to make the reintroduced marten, lynx, wolf or bear a novel presence in these anthropogenic ecosystems. The repeated failures of bio-control should teach us to be extremely cautious about introducing novel species even if they are native
2. Aquatic barriers	Physical barriers, especially temporary ones, that are specifically constructed for the containment of aquatic IAS have a role to play in certain situations, for example to block migratory passage. However, while they may be effective in preventing spread of aquatic IAS, they have significant side effects upon hydrological regimes and water chemistry, native biodiversity especially migratory species, and can block navigation. Non-physical barriers have fewer negative side effects particularly on the environment, and can be used without blocking flow and navigation, but are not yet 100% effective, especially when used in isolation. They are still mostly used as a deterrent to stop fish entering intakes for power plants etc., but may also be used to support eradication campaigns to prevent reinvasion. However new research, and the development of new methods (e.g. CO ₂ and Ozone) show promise. The most successful of the established non-physical barriers is the electric barriers (PDC), such as EDB on the Chicago ship canal which has so far been successful at preventing the movement of silver carp, however its effectiveness at blocking juvenile individuals which have been recorded closer to the barriers, has yet to be tested. In addition, an electrical barrier has been shown to be effective at preventing reinvasion of introgressed brown trout in a stream in Sardinia. For most non-physical barriers, especially those that work as a deterrent stimuli (light, acoustic, and bubbles), there are little to no negative humane impacts, however electric and CO ₂ can potentially lead to injury and distress if the fish cannot move away from the barrier. Ozone is the only measure that is intentionally lethal and it is assumed that the fish die through asphyxiation. There are no case studies that could be found for non-physical barrier use for the aquatic IAS of Union concern, but there is no reason why they could not be applied to them. In addition, non-physical barriers have ongoing running and maintenance costs, and malfunction, damage or human error can reduce their effectiveness.

3. Aquatic habitat management - Pond drying/draining	Draining invaded water bodies is an effective tool for the management of aquatic vertebrate IAS. Although more costly than only using chemical application, it is the only other method that can warrant the complete eradication of aquatic species from specific localised areas. Provided that good practices are implemented in order to avoid unnecessary suffering of the target animals and that negative impacts on non-target native species are carefully managed, this measure can prove very useful and effective for the management of aquatic vertebrate IAS. The measure is, however, only appropriate and effective in small enclosed waterbodies and in areas where it is acceptable to use highly disruptive methods (e.g. sites with low nature conservation value). As such, before the measure is undertaken, it is of utmost importance to take into consideration both the suitability and susceptibility of the area and of the aquatic ecosystem in general, to maximise effectiveness and minimise non-desired potential impacts in the community.
4. Physical terrestrial barriers	Physical barriers have been used only for research purposes to contain the red-eared sliders in urban ponds. Therefore, its effectiveness on larger scale is unknown. However, it represents an interesting, humane non-lethal option to contain the species in small or specific areas, particularly for non-breeding populations. The relatively high cost of fencing—both building and maintenance— during the species' long lifespan (40 years) and the potential impact on non-target species should be considered. Surgical sterilisation can be undertaken to prevent captive individuals reproducing, while this would obviously increase costs.
5. Hand removal	Removal by hand or facilitated by the use of dip-netting, spearing, or other instruments is time-consuming. The method includes also the removal of eggs, nests, and hatchlings. Hand removal itself can have mild to moderate humaneness impacts, however the measure is often used with methods of euthanasia which also need to be considered (see other assessments). Its effectiveness on alien vertebrate eradications and control has been demonstrated in projects that also involved the application of other techniques, e.g. trapping, passive netting, or electrofishing. Therefore, it should be considered a complementary technique more than a single method to manage a species. Hand removal of eggs (or their treatment in the nest to reduce hatching) and larvae may drastically reduce the replacement of adults.
6. Physical fishing methods including aquatic nets and traps	Both aquatic nets and traps can be very useful in management actions of aquatic IAS, due to their practicality and low costs. However, their use is only cost-effective and worth considering when used either in small and confined water bodies and/or in integration with a variety of other measures, such as electrofishing, hand capturing, shooting, draining or biocontrol. Because of the lack of humaneness and strong negative effects on non-target fauna, the use of any type of gill net, trawl net and hook and line should be avoided, with a preference for the use of seine nets. Aquatic traps are usually less invasive to animals caught and, if designed correctly and checked regularly, only have mild effects on non-target animals.
7. Egg oiling	the measure of egg oiling is deemed to be humane on the target animals (particularly if applied in an early stage of the incubation period, see above) and cause little adverse effects on non-target animals. Once applied, the method is extremely effective on preventing the hatching of treated eggs. However, this method shows to require significant time commitment when dealing with larger populations which creates a significant cost due to personnel requirements as location of nests in order to achieve the appropriate number to effectively reduce population requires more effort. The method has been shown to reduce population size, but other evidence indicates that it is the lesser of effective measures behind shooting and nest-trapping. This measure would be useful to employ as a combination with other measures, or where more effective measures are inapplicable due to the location of the population e.g. national protected areas, or if shooting or other culling methods are not socially accepted. Egg oiling can be effective on small populations where nests are easily accessible and detectable.
8. Electrofishing	In general, electrofishing is considered very efficient. The method seems to have some harmful effects, particularly on salmonids, but seems not to have side effects on other fish and amphibians, particularly if used properly. Moreover it seems to be more effective and less harmful than other chemical and mechanical methods, although it requires to be used in conjunction with other tools (various kinds of nets etc.). As the method does not foresee the direct dispatch of the target animals, the removal needs to be accompanied by measures to dispatch the animals (e.g. through an overdose of anaesthetics).

9. Chemical fertility control	The use of different fertility control methods will depend on the availability of the product in Member States. [...] It is recognised that for a rapid reduction in population numbers, culling is the most efficient method at the moment. However, a combination of culling and fertility control can be employed to first reduce and then maintain a population. Fertility control can also be effective as a standalone measure where the population is small and contained as this will reduce the likelihood of immigration of fertile individuals. The measure of fertility control and management appear to be quite costly, but this could be mitigated by reduced reliance on capture and handling (through the use of remote administration methods) and increasing volunteers who can accompany trained staff]. The use of remote administration can also reduce the welfare impacts on the animal, however this may be coupled with reduced ability to identify individuals as increase the potential of an incomplete administration. Humanness should also be considered in a manner that reflects if the product requires re-administration and therefore the animals are subject to re-capture and/or re-treatment. Fertility control methods could be useful in areas where hunting or culling methods are not feasible. It is also important to note that public attitudes are generally more accepting of this method in comparison to other lethal methods. Preliminary results on the development of oral contraceptive/vaccination are encouraging, but more research needs to be conducted in field trials on the use of fertility control in baits before they can be considered as an effective method for population control
10. Hunting dogs (tracking/ baying)	The measure is, if correctly used, very effective and also relatively humane, Mild-Moderate. Someone, however, has to train and care for the dogs. Costs depend on the setup of the management. If fully professional it will be quite expensive and labour intense. If like in the Nordic countries there are many hunters that already have hunting dogs the cost of hiring them with their dogs are much lower, such a system is for example practiced in the Island of Åland. However, this may imply higher risks of impact on animal welfare and non-target species, if the best practice recommendations are not followed, i.e. the hired dogs are not well trained or are not wearing a muzzle. [...] Land access and hunting laws in other parts of Europe, outside the Nordic countries, may be a major obstacle to adapt hunting dogs as an IAS management tool.
11. Judas animals	Judas animals is a technique intense (quite expensive) and quite labor intensive measure. At high population densities its value is limited seen only as a mean to reduce the population. As a combined research and management measure it may, however, be well worth the cost and time also at high or medium sized population densities, to learn more about how to manage the population and become more efficient as a whole. At very low population densities the measure has proven to be very valuable, sometimes necessary, to find and cull the last remaining individuals. Judas animals can also be recommended as a very effective early warning system, to detect and find immigrating IAS in an area or on an island. There are few, if any, side effects of the measure, but while disclosed wild animals can be culled humanly, the impact on the welfare of Judas animal is mild-moderate. People's perception of the ethical side of the measure may however differ between countries.
12. Stupefying bait	The use of stupefying baits, and in particular Alphachloralose, have posed problems in the past. The delivery of the correct dosage to target species and impacts on non-target impacts were the main issues encountered. Public relations problems, with both target and non-target species dispersing from the capture site, have also caused problems. Where the correct dosage can be delivered to the target species, and where non-target species can either be avoided or managed to keep any casualties to an acceptable level, stupefying baits are a very cost effective way of capturing large numbers of animals with comparatively low levels of effort. For IAS management, it is unlikely that stupeficients would be the only technique used to control or eradicate a population, although there could be cases where a rapid eradication of IAS from a single site could be accomplished using stupeficients. It is more likely that stupeficients could be used on particular sites as part of a larger programme which employed other techniques at sites where the issues often encountered with stupeficients could not be overcome.

13. Chemical treatment of habitats	Aluminium phosphide – APP is already licensed in the EU, however not for the application to any of the species of Union concern. It is effective against rabbits, moles, voles, and rats, has mild to moderate humaneness impacts, and is relatively cheap. However, its effectiveness against species of Union concern, in particular <i>M. coypus</i> or <i>O. zibethicus</i>, which is the likely potential target for this toxin, is unknown. In addition, its effectiveness and practicality as part of an IAS eradication, control or containment programme is unknown. Chemical piscicides and CO₂ – One key drawback is that none of these measures are currently approved for use under the BPR. They are all effective in killing fish and other freshwater species, but the only evidence for the species of Union concern is for rotenone (<i>P. parva</i>, <i>L. catesbeianus</i>), chlorine (<i>P. glenni</i>), ammonia (<i>L. catesbeianus</i>) and CO₂ (<i>L. catesbeianus</i>), however they are likely to be effective for the other freshwater species if applied at the correct rates. They are most cost-effective in small lentic (enclosed) systems, though there is evidence of their effective use in larger lakes and in lotic systems. In terms of their humaneness, ammonia and antimycin seem to lead to mild distress, and ammonia has a relatively quick time to death. Rotenone and CO₂ both lead to visible behavioural changes and distress, with longer time to death. In terms of side effects, all measures negatively affect/kill native species, however they are all (apart from ammonia) quick to degrade.
14. Poisons and toxins in bait	[...] There are currently no method types, involving the use of poisons and toxins in bait, available to contribute to managing any IAS of Union concern. Hence, until such time that regulatory approval of a substance with relatively low non-target and welfare impacts emerges, the overall recommendation of this assessment is that the use of poisons and toxins in bait to manage IAS of Union concern is unsuitable for a modern control program.
15. Shooting	Shooting is widely used as a wildlife management tool and can be highly cost-effective. This reflects its selective nature, its ability to control animals at a distance, and the flexibility offered by the range of weapons and applications available. Shooting has provided the main method for the control of the Ruddy Duck, Sacred Ibis and is widely used for the control of large alien mammals such as deer and coypu. It has also been used to supplement other methods for the control of reptiles and amphibians. If used appropriately, shooting should result in a rapid death for the majority of animals, with only mild to moderate consequences for their welfare. Shooting carries the risk of wounding with potentially severe consequences for the welfare of the animal concerned. This risk can be reduced by the selection of appropriate firearms and ammunition, the training of the shooters, and measures to ensure wounded animals are followed and quickly despatched with a second shot
16. Drowning traps	The use of drowning traps causes severe suffering in target and non-target animals. Death by drowning induced hypoxia is not considered an acceptable method of euthanasia by veterinary and laboratory researchers which have consistently recommended to develop new muskrat traps that can meet better criteria of animal welfare. Live trapping and the humane dispatch of the animals is a more humane lethal method already applied for muskrats or other semi-aquatic mammals, like the coypu in Italy. In addition, large numbers of non-target animals are inhumanely killed as well, directly or indirectly, as side-effects of the muskrats' trapping by drowning traps. The evaluation of the cost-effectiveness of controlling muskrat populations compared to the implementation of measures to prevent damages deserves further consideration.

17. Goodnature® self-resetting (M026c)	A18 Goodnature® traps are available for killing grey squirrels and small Indian mongoose among the IAS species. It has been suggested that they may potentially also be suitable for use with fox squirrels (<i>Sciurus niger</i>), although individuals of this species can be much heavier than grey squirrels and mongoose, and traps would need to undergo welfare testing for this species. Also, subject to appropriate testing, the A18 trap might be considered for Pallas squirrels (<i>Callosciurus erythraeus</i>) and the A24 for Siberian chipmunks (<i>Tamias sibiricus</i>), based on bodyweights. It is difficult to make firm conclusions about Goodnature® self-resetting traps at this stage as they have only been available for a few years and problems were reported with mechanical and other failures among some trap models in 2012 and 2013. These problems may have been resolved now but there have been few formal studies in the interim to produce data on effectiveness and non-target impacts for traps targeting any species, let alone the IAS species under focus here. However, the few more recent reports (mainly on trapping rats and possums) indicate that the traps are considered to be effective at significantly reducing target species numbers and maintaining them at lower levels. The only study identified for one of the IAS species (<i>Herpestes javanicus</i>), was conducted jointly between Goodnature® themselves and the USFWS, and only superficial results are reported. No results are available yet for humaneness testing of the A18 trap for this species although, according to the manufacturer, this is underway and the comparable A18 models for grey squirrels (<i>Sciurus carolinensis</i>) and American mink (<i>Mustela vison</i>) have passed humaneness testing (to AIHTS standards) in the UK. Until more evidence is available, the time to death and associated variation with these traps remains uncertain, although they have passed the legal thresholds of AIHTS and NAWAC testing. However, cases where immediate death may not occur (possibly leading to severe extreme suffering) cannot be ruled out. Injury or capture of some non-target species may be minimised by using exclusion measures, such as appropriate tunnels or setting traps above certain heights. Upfront costs for buying and installing these traps are multiple times that for traditional traps but using them is far less labour-intensive because of their self-resetting ability, and overall costs have been reported to be recouped compared to anti-coagulant rodenticides and snap traps over a few years.
18. Spring traps	Lethal spring traps are available for use with muskrats, raccoons, raccoon dogs, mongoose and grey squirrel and may be suitable for ring-tailed coati, fox squirrels, Siberian chipmunks or Pallas' squirrels, subject to appropriate testing. Spring traps are likely to be of variable welfare impact but this could range between no suffering and severe to extreme suffering. Some spring traps are reported to cause irreversible unconsciousness instantly. While some traps may not have not been formally approved, others are approved under the AIHTS or NAWAC standards but this could still mean that animals remain conscious for minutes and more detail is needed about time to irreversible unconsciousness. Until more evidence is available, it is difficult to assess the humaneness of many spring traps but potentially severe-extreme suffering cannot be ruled out in many cases currently. Spring traps do not seem to be the primary measure used with grey squirrels, muskrats or mongoose, because they may be less effective than other measures, they are more labour intensive and pose a threat to non-target native species where present. Spring traps may be cost-effective in the long-term and provided that eradication work is started early.

19. Cage traps	Cage trapping provides a widely used, flexible and effective method to catch and restrain a wide variety of different species. It is a frequently used and successful method to support the rapid eradication, eradication, control and containment of many invasive alien species and has been the method of choice for many large scale control programmes. If used appropriately by trained personnel, cage traps offer a flexible and relatively humane method of animal capture and restraint. If checked regularly and used correctly, mortality rates associated with cage traps approach zero. Wounds appear to be less severe, than with other methods of animal capture or restraint, with most injuries confined to skin abrasions and broken teeth. The risks of these injuries can often be reduced by improved trap design and reduced mesh size as experience of their use on the species is gained. Risks to non-target species are less with cage traps than with lethal traps and other control methods. Cage traps also have a number of shortcomings. The requirement for regular checking brings significant implications for cost and their cost-effectiveness can be low in situations where the rate of animal capture is poor. For most species, a proportion of animals may also be trap shy and reluctant to enter traps. There are also likely to be areas where cage traps cannot be used, for example where there are significant levels of disturbance, which can limit their ability to achieve complete geographic coverage of an area. For eradication programmes these can be significant considerations and alternative methods are typically needed alongside trapping to overcome these issues.
20. Neck-hold, and snares	Snare traps are rarely used in Europe to manage IAS of Union concern. Their use is legal only in four Member States and most of the literature comes from North America. Individuals caught in non-lethal snare traps often sustain injuries from the wire ligature, which can in turn lead to tissue necrosis, strangulation and sometimes self-mutilation. Snares can also capture and stress several non-target species, causing serious injuries which can affect survival. Therefore, there is a great concern on their humaneness and a largely negative perception against the use of non-lethal snares due to the high rate of injuries they can cause. Though injuries could be reduced by well trained staff and egg traps were considered more effective than cage traps in a comparison study, the only IAS management project in Europe using this type of traps (on the eradication of raccoon) used mainly cage traps with a limited effort with egg traps.
21. Live decoy traps	Decoy traps provide an effective and selective method to catch certain species and most experience of their use relates to birds. They rely on species specific social or antagonistic behaviors which limit their use to particular species. The presence of a decoy improves capture rates compared to the use of baited trap alone, while rates of non-target captures, for some widely used designs at least, are low. They have been widely used worldwide and in Europe as the main method to eradicate and control <i>Acridotheres tristis</i>, there is developing experience of their use as a supplement to shooting to control <i>Alopochen aegyptiaca</i>, while experience of their use to control native corvids suggests they may have potential for use on <i>Corvus splendens</i>. [...] The presence of the decoy animal brings specific responsibilities for their care and welfare. Decoys require food, water, perches, space to stretch and shelter when in the trap and care is needed to ensure their welfare. Advice on the use of decoys emphasises the benefits of a healthy decoy animal which will be more active, vocal and visible, increasing its effectiveness, best practice recommends that decoys should be regularly replaced.. Like all live capture traps, they should be regularly checked, at least every 24 hours if not more frequently. Observations of the welfare of the decoys and other captured animals, mainly based on their use to capture native corvids, suggest that their physical condition is typically good, and that most trapping related injuries are minor and not life threatening. However, there are cases where birds in traps have been predated, raising particular concerns not only about predation but also about fear and distress as a result of predators investigating traps containing birds. The careful siting of traps and their regular checking should reduce these and other risks. Care is also needed to avoid trapping during periods when dependent young would be at risk of severe consequences should the parent be trapped. Food and water may need to be provided for captured as well as decoy birds, dependent on the species concerned and trap checking frequency.

	The safe and effective use of decoy traps requires some experience and skill, which can take time to develop. The data described in this review derives from their use by experienced, or professionally trained operatives. If they are used by untrained and inexperienced operatives, then their effectiveness is likely to be reduced and the risks of compromising the welfare of the animals increased.
22. Cervical dislocation	Cervical dislocation provides reliable and humane euthanasia of small to medium animals caught in traps or restrained with another method. It is a method potentially available for small mammals, birds, and fish of Union concern and already used for laboratory animals. However, practical applications with wild animals are scanty. This may be due to the need for well-trained personnel or because it may be aesthetically displeasing. Cranial depression is much more used for the euthanasia of restrained animals.
23. Cranial depression (dispatch by destruction of the brain)	[...] All methods of destroying the brain should produce reliable and instantaneous insensibility and death, demonstrated by the favorable comparison with methods of euthanasia and slaughter used for livestock. Even when the first strike/blow/shot fails to produce instantaneous death, insensibility and humaneness is assured, and death is guaranteed by the immediate re-application of the method. As well as representing one of the most humane means of dispatch, these methods are often very cheap to deploy and often very easy to carry out into the field to be used alongside traps where they are placed well away from roads and people. In addition, they often require limited training to ensure competence and can be used by local staff or volunteers where this is appropriate for the program of control. Importantly, they can usually be applied trap-side, avoiding any burdens to welfare of captive animals associated with moving them to any sort of processing station or facility. However, these methods must be skillfully executed to ensure a quick and humane death, because failure to do so can cause substantial suffering.
24. Decapitation	Decapitation is considered a humane method of dispatching animals and there is a large body of research on laboratory animals. The method is used to euthanize animals in laboratories and farms. However, the method is not used in wildlife management, possibly because it is aesthetically displeasing. When animals are captured during control operations, other killing methods are preferred, e.g. shooting, cervical dislocation, use of gases.
25. Electrocution	If properly applied the method is considered humane and is already used for dispatching farmed animals. The method is difficult to apply in animals that are not immobilized, therefore the application to wild animals is not easy and they should be trapped and immobilized beforehand. Electrocution may be hazardous to personnel or be ineffective in animals, therefore the method must be applied only by personnel familiar with appropriate placement of electrodes and use of equipment. Experience with wild animals is limited, probably due to the limitations of the method. Traps that kill animals with electricity without the need of human intervention have been developed for possums in New Zealand and flying foxes in Australia.
26. Freezing – rapid freezing and cooling (hypothermia)	No evidence could be found for the use of cooling or freezing with any of the mammalian or avian IAS of Union concern, and based on the limits of their use set out by the AVMA (<4g) these methods are unlikely to be suitable for use as part of an IAS mammal or bird eradication, control, or containment program. Rapid freezing (e.g. in liquid N₂) of very small amphibians and reptiles seems to be an effective and humane measure, however it is not clear which weight thresholds should be considered for its application as part of an eradication or management programme for IAS of Union concern. For example, it is not clear whether the recommended weight limit of 4g, which is based on rodent models would be applicable to amphibians and reptiles, which have a completely different physiology in relation to the response to lower body and environment temperatures. Cooling followed by freezing of small amphibians and reptiles and fish seems to have been a widely applied measure for euthanasia as part of wildlife management programmes, and food production, as it offers a cost effective way to kill a large number of individuals quickly. However this practice seems to have been broadly stopped for amphibians and reptiles due to welfare concerns, although studies suggest that this decision and the AVMA guidelines need revision and that more research is needed.

	Cooling followed by freezing for fish is also a widely applied approach, however little evidence could be found on its welfare impact or on its application to any of the IAS of Union concern, with only one study on its use for pumpkinseed <i>Lepomis gibbosus</i>. Based on this and the AVMA guidance, it seems that freezing is an appropriate measure assuming that the animal is fully anesthetized first, but cooling may not be an effective or appropriate way of doing this at least for all cold-water species.
27. Injection euthanasia	The use of injectable euthanasia agents is one of the most rapid and reliable methods of performing euthanasia and is commonly used with experimental animals for its humaneness. The administration of drugs requires significant training and experience. Expertise is also required to evaluate conditions and doses for every species and situations. It is also fundamental to ensure the confirmation of death, and that the animal has not simply been sedated without being euthanized. It is therefore preferable, and in many countries mandatory, that such methods are administered by a qualified veterinarian. Euthanasia drugs are generally regulated and a register is needed. The veterinarian can either be present at the time the animals are captured, or be at the place where the animals will be transported to. Transportation will greatly increase fear and pain. Anyhow, the presence of a veterinarian will increase the cost of the project. Drug injection has already been used to anesthetize listed IAS in field research with generally low sample sizes low. In one case grey squirrels were effectively removed from two small woodlands (12 ha) and euthanised with injection. Data from large-scale projects is not available. In relation to application euthanasia agents directly to water for fish, MS222 and clove oil can both result in rapid death of individuals, however clove oil has been found to be more humane than MS222 in a study on zebrafish <i>Danio rerio</i>.
28. Keeping in captivity	Given capacity issues within licensed zoos, authorised rescue centres and sanctuaries and the long-term costs of keeping captive animals, this measure has only been used to support control of very small isolated IAS populations and the feasibility of this measure in other contexts is limited. The welfare impact of keeping IAS species in captivity can be considered to be mild-moderate, however given a lack of objective data on this topic, more severe welfare outcomes may be experienced by some individuals/species in some circumstances, with the need to assess welfare over an animals lifetime. Given the non-lethal nature of this measure, consideration should be given to lifelong welfare provision in captivity compared to other control methods. Application of best practices in a captive environment, informed by ongoing research, which considers both species-specific and individual needs will aim to reduce negative welfare impacts and promote positive welfare opportunities throughout the animal's lifetime. Further research which may inform best practices, is needed to quantify welfare outcomes imposed by captivity on wild-caught individuals of the 22 listed IAS species. [...] If the zoos/sanctuaries/rescue centres apply species-specific best practices, this method may represent a humane alternative to lethal measures in some limited contexts of small isolated populations.

29. Modified atmospheres	Euthanasia using modified atmospheres is never as quick as most other methods of dispatch, with all animals subjected to the method experiencing periods of distress lasting for some time (a number of 10s of seconds). Similar durations of distress in individual cases following other methods of dispatch, e.g. cranial dispatch, cervical dislocation or even many injected drugs would be considered a case of failure. Whilst animals do not commonly display gross signs of distress, the final stages of consciousness, especially for anoxiant gases such as nitrogen, argon and even carbon dioxide may produce distress similar to that produced by mechanical anoxia (strangling or drowning) and the narcosis associated with hypercarbia may be of very variable expression in different species, only significantly mitigating the distress of anoxia in some. Reviewing a large number of studies on the use of individual gasses, as well as gas mixtures (mainly carbon dioxide in variable mixtures with nitrogen, argon, xenon) it is clear that important differences in the experience of animals is produced by seemingly small changes in the mixture used to modify the atmospheres of animals which lead to insensibility and death. These differences are species specific, combinations which work well for geese may cause significant and avoidable harm to another species. Thus one requirement for the use of modified atmospheres in dispatching such a diverse range of species as the IAS of Union concern would be research to determine, for each species, either the optimal combinations of gasses and filling rates (including the benefits of using an anesthetic gas as part of the gassing protocol), or to identify those combinations produce unnecessary additional harm. It is also clear that the principle of humane euthanasia using modified atmospheres, a well-regulated supply of gas, of known purity, introduced at an appropriate temperature and rate to a chamber of known volume is incompatible with either trap-side euthanasia, or mass deployment using homemade equipment. For this measure it is likely that cheap tools are likely to be sub-optimal, thereby causing unnecessary suffering
30. Shooting to dispatch restrained animals	Shooting cage (or net) trapped animals provides a reliable and humane method for euthanasia. It was used in two mink control projects that were implemented over large areas and it is used also for coypu and grey squirrels. It requires trained staff to ensure the lethality of the first shot. State and local laws may restrict the use of firearm air rifles. The method is applicable to most mammal and bird species, including those listed as IAS of Union Concern.
31. Slaughter with a knife	[...] Slaughter with a knife should be considered a terminal procedure to be used only in stunned or anesthetized animals. The method has been used during research involving the dispatch of animals, including <i>S. carolinensis</i>, but not during management projects.
32. Surgical sterilization	Although surgical sterilization generally has greater public acceptance than culling in the context of IAS management, it remains financially expensive due to the use of veterinary staff, drugs and facilities, with potential welfare issues associated with the use of anaesthetics. However, in the case of phallectomy in <i>T. scripta</i> populations, it has been found to be both economically viable and applicable to large numbers of animals. Whilst the advantages of rendering an IAS population permanently infertile are clear, there is a lack of data concerning the welfare of such individuals in the long-term. Application of this measure on free-living populations of animals has been limited, however examples do include; reducing European rabbit (<i>Oryctolagus cuniculus</i>) populations experimentally, preventing sheep attacks through coyote (<i>Canis latrans</i>) sterilization and reduction in urban Eastern grey kangaroo (<i>Macropus giganteus</i>) populations. Due to the economic implications of this approach, this measure has been used in conjunction with other measures to help improve public perception of a wider IAS management programme. Surgical sterilization is not applicable to all situations and requires a complex set of actions, related to the regulation of animals to be removed daily with the availability of veterinarians for the procedure, the containment and care of the animals in the pre and post-operative periods and the necessity to maintain them in captivity for their life or release into controlled areas. The population biology and trapability of the IAS of Union concern may allow the technique to contribute to their management, at least in some local scale contexts. For instance, the raccoon (<i>Procyon lotor</i>) is relatively easy to live trap. However, this potential would need to be explored further through an initial species-specific feasibility study.

Composition of the Council

The Council on Animal Affairs (RDA) is an independent council of experts that provides solicited and unsolicited advice on multidisciplinary issues in animal welfare, including animal health and ethical issues, to the Minister of Agriculture, Fisheries, Food Security and Nature. The Council consists of scientific experts and professional practitioners, whose membership is in a personal capacity and not bound by any instructions or binding mandate. The draft advisory report was submitted to the full Council for review. As such, this report is a product of the Council as a whole.

Suggestions for references: Dutch Council on Animal Affairs (RDA, 2026). Balancing Biodiversity and Animal Welfare. Ethical and Societal Challenges in the Management of Invasive Alien Species. The Hague, the Netherlands. 86 pages.

On 1 April 2026, the RDA comprised the following members:

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The Hague, June 2026.

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