CONTINGENCY PLAN FOR INVASIVE ALIEN SPECIES OF UNION CONCERN

Terrestrial flatworms

A strategic plan developed and approved at national level, outlining the strategy after an observation of a new Union list species, is needed to assure a rapid response. This contingency plan contributes to fulfill the **obligation of Rapid eradication at an early stage of invasion under Article 17 of the Regulation (EU) n°1143/2014**.

Contingency planning and outbreak management starts with the anticipation and assessment of potential threats, includes preparation and response and finishes with withdrawal of specific response procedures.

So far there is only one species of terrestrial flatworm – ***Arthurdendyus triangulatus* (New-Zealand flatworm)** – listed as a species of Union Concern (sensu EU Regulation 1134/2014). The species is currently absent from Belgium and very difficult to manage

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1. Introduction

1.1. Scope

This contingency plan describes how the competent authorities will **respond** to a suspected or confirmed sighting of a terrestrial flatworm of the Union list on the territory of **Belgium in one of three scenarios**: 1) in a plant shop/breeding facility, 2) in nature and gardens (public or private) or 3) as contaminant of goods at the border. More specifically, the plan:

- Lists the **actions** that will be taken as part of the response;
- Sets out the **roles of the governmental institutions** (ANB, INBO, BE, SPF, SPW and DEMNA);
- Provides the contact details of all the **organisations that will be involved** in the response, alongside the **governance, roles and responsibilities**. It describes how these actors will work together and the actions that will be taken as part of the response.

1.2. Objectives

The aim of the plan is to **protect the Belgian soil dwelling fauna** from the non-native flatworms by implementing the necessary actions for rapid response upon an incursion on the Belgian territory. This involves:

- Eradicating specimens in nature or in private premises when deemed feasible;
- Containing infections of potted plants in trade with proper management and biosecurity measures at the nursery or seller in Belgium, or by temporarily suspending importation from the breeder;
- Containing and controlling an outbreak, if field evidence suggests that it is already well established in a defined but limited geographical area;

- Establishing the end of the contingency procedure and the transition to long term management when necessary;
- Capacity building of the relevant stakeholders (training and best practices on prevention measures and species control) and international collaboration.

2. Legal position

Species listed in ANNEX 1 are part of the list of IAS of Union concern and are therefore subject to restrictions and measures set out in the Regulation (EU) 1143/2014.

The species listed in ANNEX 1 are regulated by the following regional legislations:

- Brussels Ordinance on the conservation of Nature (Ordonnance relative à la conservation de la nature en Région de Bruxelles Capitale - Ordonnantie betreffende het Natuurbehoud in het Brussels Hoofdstedelijk Gewest)
- Arrêté du Gouvernement wallon exécutant le décret du 2 mai 2019 relatif à la prévention et à la gestion de l'introduction et de la propagation des espèces exotiques envahissantes
- Natuurdecreet en Soortenbesluit (Besluit van de Vlaamse Regering van 15 mei 2009 met betrekking tot soortenbescherming en soortenbeheer)

Concerning access to private property, the rules are different in each Region:

- In Brussels, there are currently no legal tools that can force private property owners to provide unrestrained access to their property for management actions. Granting access is dependent on the good will of the owner of the terrain and can be obtained by use of a written convention between the competent authority and the private owner. This might change with the introduction of a new ordinance regarding invasive alien species, which is currently in development.
- In Flanders, terrain managers can be obliged to (let) take action or make retributions (Natuurdecreet Art. 51) if there is a Management plan (Beheerregeling - Soortenbesluit, Art. 28) officially in place. Access to the terrain is always dependent on the approval of the owner or terrain manager. In the absence of such a Management plan, no retributions can be made. Such management plans are however only envisioned - so far - for already established species.
- In Wallonia, agents appointed by the Government for management actions are allowed to enter any place which does not constitute a home at any time, subject to prior warning to the owners or occupants at least forty-eight hours before the intervention (Décret EEE, Art. 24). Exceptionally, access is permitted without prior warning when it is essential to enable early detection or rapid eradication of the species. In the case of a home, the access is subject to the written consent of the owners or occupants.

There is currently no legal regime in place to ensure a mechanism of recuperation of costs in the case of management on private property.

3. Introduction pathways

The main introduction pathway of terrestrial flatworms is linked to the transport of plants with associated growing media. Other potential pathways of introduction and spread are transport or contaminants of growing substrates, silage bales and farm machinery.

Below is a summary of the introduction pathways for *A. triangulatus* [1] [2]*:*

- Contaminant nursery material (Transport contaminant): High estimated frequency, with high confidence
- Transportation of habitat material (Transport contaminant): Medium estimated frequency, with high confidence
- Machinery-Livestock (Transport stowaway): Low estimated frequency, with low confidence

4. Preparation

4.1. Existing resources

Some material has been produced to support identification of the species, and some actions have already been put in place to increase detection capacity and potential observations of non-native flatworms.

1. **Identification:**

- Identification booklet of IAS of Union Concern for inspectors (NL/FR)
- Identification key for flatworms (pdf - NL/FR)
- Interactive, online identification key for flatworms (NL/FR)
- Identification sheets for flatworms (pdf - NL/FR)

2. **Surveillance:**

- Recording portal on www.waarnemingen.be/www.observations.be and on the dedicated website for Wallonia
- Citizen science project "FlatwormWatch" initiated in 2024 aiming at increased awareness, surveillance and recordings of observations of non-native flatworms in Belgium
- Guidelines to detect flatworms in gardens and in nature (NL/FR)
- Development of a DNA barcoding protocol for detection of flatworms in potted plants that can be used for interception at the border or in plant shops or at nurseries

3. **Rapid response:**

[1] National Scientific Secretariat on Invasive Alien Species - Belgium. (2023). Pathways of unintentional introduction and spread of 88 invasive alien species of union concern in Belgium: identification and prioritization. National Scientific Secretariat on Invasive Alien Species - Belgium. https://doi.org/10.5281/zenodo.10255054

[2] EU Risk Assessment for *Arthurdendyus triangulatus* (2017)

- *Arthurdendyus triangulatus* was included in the 2023 manageability assessment for the Belgian territory. In that assessment, 2 management scenarios have been assessed for an imaginary invasion situation in which the species was recorded in multiple private gardens and an adjacent pasture. One management scenario aims at eradication while the other aims at spread limitation. Both scenarios were scored based on seven risk management criteria (such as effectiveness, feasibility, cost, practicality) by experts.

4.2. Staff resources and costs

The competent authority will provide the initial emergency response capability. If necessary they will seek assistance with relevant experts or external contractors.

The costs associated with a response will be dependent on the circumstances of the invasion and increase proportionately with the size of the affected area. Costs for eradication are estimated to be moderate to high, but since eradication has not been attempted for flatworm species, implementation cost and cost-effectiveness have not been evaluated. Cost estimates should take into account staff time, the hire of a mechanized digger and mobile heating or scorching equipment. This could roughly be estimated at 205 euro/m2 , in line with the costs reported for a similar treatment for Japanese knotweed that includes digging, heating of the soil and reuse of the soil at the location, though that method also includes additional steps such as removal of the vegetation (Penninkhof et al., 2022).

These costs will need to be covered by dedicated funding and/or by reallocation of existing resources. The source of any such funding or reallocation of staff should be resolved in advance of an outbreak.

4.3. Training

Response and operational staff should be familiar with this plan and trained in its execution. Operational staff should be familiar with relevant management techniques and obtain relevant training where necessary.

4.4. Equipment

The competent authority is responsible for ensuring suitable equipment is available to deliver responses to the species identified in ANNEX 1. This could include maintaining a stock of equipment, or ensuring there is a ready supply of stock to be brought in as necessary.

5. Detection

Sightings can be **generated through a few different sources** including the employees of the ornamental plant sector, the general public, citizen scientists or official government employees at monitoring institutes. These suspected sightings can be relayed to competent government **through different routes**:

- Recording portals such as waarnemingen.be/observations.be, iNaturalist and the dedicated portal for Wallonia
    - **It is paramount that officials have set alerts on the species of concern to ensure a rapid response**
- Directly reported in the mailbox of competent authority employees (ANB, INBO, BE, DEMNA, DNF) or of NSSIAS
- Reported sightings by FAVV-AFSCA or customs in traded goods at the border, with two possible scenarios:
    - Visual observation of living individuals/eggs cocoons
    - Suspicion of presence after detection via DNA barcoding protocol

6. Response

This section sets out how the response to a sighting will be managed: **initial actions** following a suspect sighting and **actions on confirmation**. A summary of actors and contacts is available in ANNEX 3 and detailed technical guidelines are available in ANNEX 4.

6.1. Official action on suspicion

6.1.1. In nature, gardens or shops

- The regional competent IAS policy officer needs to be contacted by the first person that receives the warning. The regional officer in turn, notifies the NSSIAS.
- The competent IAS policy officer contacts the initial observer to obtain as much circumstantial evidence as possible to allow the reporting to be confirmed or discounted.
    - In the instance the observation was made in nature, the officer also asks questions to gain a better picture of where the observation was made. If necessary a site visit is carried out.
    - In the instance the observation was made on private premises or in a shop, the officer makes an appointment to carry out a site visit.
- The regional IAS policy officer - or the expert within the regional administration designated by the policy officer - travels to the location to secure a sample and verify the observation.
- If no specimens can be found during the visit, the person will conduct a survey of the spot by installing shelter traps and checking them after a few days for five days in a row.
    - If nothing can be found, the action is repeated under optimal circumstances in cool and humid weather. In the instance of a suspected sighting on private premises or in a shop, this follow-up can also be made by the initial reporter. In the event that the follow up is made by the initial observer, sampling tubes are

left with the original observer as well as guidelines on how to take a picture of the flatworm.
    - If no individual can be found after the survey, the procedure is stopped here, but contact is kept with the observer to organize regular monitoring actions (at least every month)

- In the event an individual is found:
    - If sampling is done by the original observer: someone is charged with collecting the sample at the private premises
    - If sampling is done by the charged employee, he takes pictures of the specimen and puts it directly on ethanol

- The sample is transferred or sent to the predefined facility to determine the species identity and determine the specimens origin.
    - **BRU:** *RBINS, BopCo*
    - **FLA:** *INBO (Linkebeek facility)*
    - **WAL:** *RBINS, BopCo*

- If the specimen is identified as *A. triangulatus,* actions set out in 6.2 are implemented. If it is confirmed it is not *A. triangulatus*, the procedure is stopped here, but **all other competent authorities and NSSIAS are informed of the specimen's identity**. Depending on the species identified, the competent authority can still decide to take action.

- The specimen is placed in RBINS collection following guidelines of the Distributed System of Scientific Collections (DiSSCo).

6.1.2. At the border

All steps are taken according to the **'Protocol to operate and reinforce front-line controls at border control points (BCP)**' established between FPS Environment, FASFC and Customs, which includes the following actions:

- The NSSIAS and the competent IAS policy officer need to be contacted by the border control officer

In the case of visual observation

- The shipment is blocked until results of the identification are available
- A photo of the specimen is taken according to the guidelines set out in the sampling manual for border inspectors and sent to secretariat@iasregulation.be
- A DNA sample is taken according to the guidelines set out in the sampling manual for border inspectors
- The sample is transferred to BopCo (or another predefined facility) to determine the species identity and determine the specimen origin.
- If the specimen is identified as *A. triangulatus,* actions set out in 6.2 are implemented. If it is confirmed it is not *A. triangulatus*, the procedure is stopped here and the shipment is released. **The NSSIAS is informed of the specimen's identity**.

In the case of suspicion after DNA barcoding protocol

- The consignment of suspicious potted plants is seized at destination (if not yet done) and is manually inspected for the presence of flatworms. Manual inspection entails a visual check of the plant and the external side of the pots, followed by uprooting of the plant and sifting through the soil and rootball. Alternatively potted plants could be submerged in water overnight, forcing the worms out of the growing media. Care must be taken that escaping flatworms are confined within the setup.
    - If no specimen can be found, the procedure is stopped here, but note is taken of the origin of the consignment and similar shipments are thoroughly checked in the future.
    - If a specimen was found, the individual is sampled according to the sampling manual for inspectors and the sample is transferred to BopCo (or another predefined facility) to determine the species identity and determine the specimen origin.
- If the specimen is identified as *A. triangulatus,* actions set out in 6.2 are implemented. If it is confirmed it is not *A. triangulatus*, the procedure is stopped here, and the **NSSIAS is informed of the specimen's identity**.

6.2. Official action on confirmation

After confirmation (visually by experts or through DNA by the predefined facility) that the species has been observed, the following actions are taken:

- Information is relayed to NSSIAS (secretariat@iasregulation.be) who is then in charge of informing **all the other Belgian competent authorities.**
- The sighting is reported to the European Commission via the **NOTSYS system** by the competent authority.
- An urgent meeting, including members of the NCIAS, is set up by the NSSIAS to assess the need for coordination between the partners (monitoring, management and communication).
- Insight is gained by the competent authority on the origin of the introduction. If the introduction pathway is identified, prevention measures are taken by the competent authority to reduce risks associated with the pathway (see ANNEX 4). The NSSIAS is informed of the measures taken and if relevant shops and/or importers are contacted by the competent authority.

Then, depending on the scenario in which the species was found, other steps are put in place. Technical details of each step are presented in ANNEX 4.

In nature or in gardens:

- If located on private property, contact is taken with the owner to explain the situation and request permission to access the property.
- Insight is gained on the extent of the contaminated area.

- Site specific conditions are characterized to evaluate the feasibility of applying eradication measures.
- If eradication is deemed feasible, management measures are applied to the site, at the expense of the competent authority.
- If eradication is not deemed feasible, derogation is requested and measures for limiting spread are implemented.
- Proper biosecurity measures are put in place: no soil or habitat material should be transported off the premises/location.

In shops:

- Insight is gained on the extent of the infection in the shop and trade restrictions are temporarily put in place, transport of any (habitat)material off site is also temporarily suspended.
- Insight is gained into the origin of the infection.
    - If a potential origin of infection is identified, the competent authority takes appropriate measures to reduce risks associated with the pathway.
- Measures are taken to eradicate the flatworm from the premises, at the expense of the seller or importer.
- Proper biosecurity measures are put in place.

At the border:

- Insight is gained into the origin of the infection and the trader is identified.
- The trader is contacted and provided with guidelines on how to manage the infection.
- If possible, imports from that location and trader are blocked until it can be guaranteed that future imports will be free of contaminants. Other Member States are informed to avoid trade deviation.
- It is assessed if the importer has previously received imports from the trader. If that is the case, the regional authorities are notified of the shops and facilities that have received shipments from the trader, in order for them to implement surveillance measures.

7. Evaluation and review

This section sets out the evaluation of the on-going response, how to go back to the **new business as usual** (after eradication or long-term management) and the review of the workflow.

In nature or gardens:

First, the success of eradication or spread limitation measures is evaluated with monitoring of the site for at least two years.

- **If measures are successful**:
  - Eradication: return to business as usual
  - Spread limitation: prevention measures are applied indefinitely
- **If measures are not successful**:
  - Eradication: reevaluate feasibility and apply management measures again if necessary
  - Spread limitation: analysis of the failure of spread limitation is performed and measures are refined according to the outcome of the analysis

In shops:

The success of the eradication measures are evaluated. If eradication was successful, return to business as usual with lifting of the biosecurity measures and trade restrictions. Monitoring of the site is performed for at least one year. If eradication measures were not successful, potential refuges are identified and measures are either repeated or adapted.

At the border:

If the importer proves that measures for risk reduction have been applied (e.g. through a change of breeder or eradication measures), there is a return to the business as usual scenario and import from that trader can resume.

The competent authority notifies the NSSIAS of the outcome of the evaluation (secretariat@iasregulation.be). Finally, the NSSIAS coordinates with the relevant competent authorities to conduct a review of the response workflow in order to identify challenges and points of improvement.

8. External communication

The European Commission and other Member States will be notified by the competent authority via NOTSYS.

The competent authority is in charge of communicating towards the actors and the press, if deemed necessary. They therefore identify the relevant target audience for the communication (shops, importers, local authorities, general public,…).

9. Reporting

At every critical point of the response process – as outlined above – the NSSIAS should be informed by the competent authority.

NSSIAS will hold a registry of early detections with relevant information on the actions of the contingency planning.

Annexes

- ANNEX 1 – Species to which the plan applies
- ANNEX 2 – Flowchart of contingency planning response
- ANNEX 3 – List of organizations and contacts
- ANNEX 4 – Technical guidelines
- ANNEX 5 – Species Manageability Fiche
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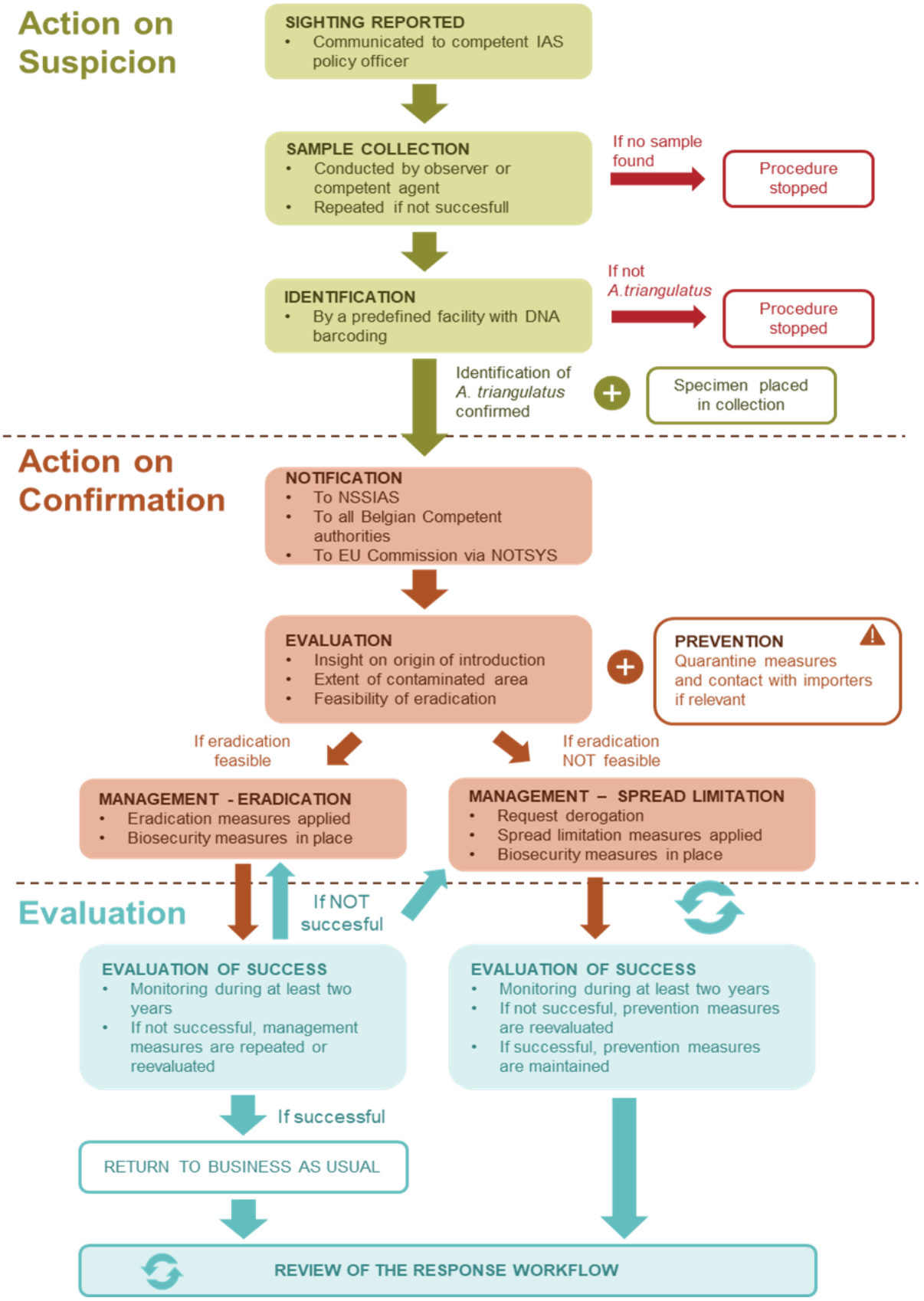
ANNEX 1 – Species to which this plan applies

Scientific name	Dutch name	French name	Feasibility of eradication
Arthurdendyus triangulatus	Nieuw-Zeelandse platworm	Ver plat de Nouvelle-Zélande	**Low**. Conditions for derogations described in article 18 should be carefully checked within 2 months of species detection on the Belgian territory.

ANNEX 2 – Flowchart of contingency planning response



ANNEX 3 – List of organizations and contacts

Institution	Role and responsibilities
National Scientific Secretariat on Invasive Alien Species	• Facilitation of exchange of information and coordination between authorities • Information hub • Evaluation of the response workflow • Reporting: holding of a registry of all steps of the response
SPF Environnement - FOD Leefmilieu	Implementation of response at the border: • Information flow to NSSIAS • NOTSYS notification • External communication
Leefmilieu Brussel - Bruxelles Environnement	Implementation of response in Brussels: • Confirmation of the sighting • Information flow to NSSIAS • NOTSYS notification and other external communication • Implementation of management measures • Evaluation of the response
Agentschap Natuur en Bos	Implementation of response in Flanders: • Confirmation of the sighting • Information flow to NSSIAS • NOTSYS notification and other external communication • Implementation of management measures • Evaluation of the response
SPW ARNE - Département de la Nature et des Forêts	Implementation of response in Wallonia: • Confirmation of the sighting • Information flow to NSSIAS • NOTSYS notification and other external communication • Implementation of management measures • Evaluation of the response
AFSCA - FAVV	To be determined in collaboration with FPS Environement

ANNEX 4 – Technical guidelines

1) Evaluation of the case

- **Gain insight of origin of introduction at the site**:
    - In case the observation was made in nature
        - Get a good view on the surroundings: have plants or garden waste been dumped here recently?
        - Are there private gardens in the vicinity which look like they could harbor many exotics or have been planted relatively recent (up to 5 years)
        - Is there a nursery or plant shop in the vicinity?
    - In case the observation was made on private premises
        - Ask the owner if any works have been done recently in his garden (eg planting, soil import, …) and if yes, identify the source of the material that was brought in
        - Assess if adjacent gardens or premises have had recent work done
    - In case the observation was made in a shop
        - Check for recent arrivals of plant consignments from abroad

- **Delimit the extent of the contaminated area**
    - Search the location for the presence of flatworms by manually looking for flatworms under potential refuges (dark and humid places under pots, stones, planks,…). Additional trapping can be done via placing traps on the site. A shelter trap can be a strong polythene bag filled with approximately 6 kg gravel, placed on bare soil.
    - In case the observation was made in nature
        - Put traps 15 meters apart in a circle of diameter 20m, 50m, 100 m with the initial observation as a middle point. Visually check them at least 10 times (or less if you encounter a flatworm) under suitable weather conditions in the following 2 months. Make sure you are putting the traps in suitable habitat (damp spots).
        - If observations are made under the traps of 100 m, a new line of traps is put out at 200m and the protocol is repeated.
    - In case the observation was made on private premises
        - If the terrain is large, use the same protocol as when found in nature. if the terrain can rather be described as a small garden, put traps in adjacent premises, focussing on prime flatworm habitat (undisturbed, damp).
    - In case the observation was made in a shop
        - Outdoor: Visually inspect the whole facility for the presence of flatworms by checking potential refuges. Additionally, add additional traps at the edges of the facility. Select potted plants from the facility and submerge

them in water overnight to force the flatworms out of the growing media. Take care the flatworms cannot escape.

- Indoor: Visually check potted plants for the presence of specimens (underside pot, top layer growing medium, plant itself). Additionally, select potted plants from the facility and submerge them in water overnight to force the flatworms out of the growing media. Take care the flatworms cannot escape.

- **Site specific conditions**:
  - Evaluate if the contaminated zone can be isolated
  - Evaluate feasibility of excavation (size, nature of soil cover, access for machinery,...)
  - If the site is on private property, the access and feasibility of implementing management methods are discussed with the owner

2) Biosecurity and prevention measures

- **Avoid any new introductions:**
  - If the contaminated consignment is identified, take contact with the importer
  - Other associated consignments that could be potentially contaminated are also traced to verify if the species has not been introduced in other locations

- **Quarantine measures are applied to the contaminated area:**
  - Compost and growing media used on the premises are sterilized by heating
  - No plants, soil and growing media are allowed to be transported out of the site during the whole response process, unless a thorough check and a tracing system are applied to the materials.
  - If applicable, new plants coming from the same importers are treated to ensure that no flatworms or egg capsules are present, and ideally are immersed in warm (>30°C) water for 40 minutes.

3) Method for eradication (specific for *A. triangulatus*)

- **Treatment of soil of the contaminated area (nature, private premises, shop):**

The soil of the contaminated area is dug up with mechanical diggers and heated to temperatures above 30 °C. Although there is no mention of depth or duration of treatment in the literature, digging at minimum 30 cm and applying the treatment for 24h seems reasonable. Care must be taken to implement the proper biosecurity measures before moving any vehicle and other material or equipment off site (proper cleaning of machinery, hot water treatment). As high temperatures only kill the adult worms and not the eggs, the method is repeated 14 days later to destroy any hatchlings. Depending on the need of covering back the area quickly, new soil is brought to the site or the treated soil is brought back after treatment. Monitoring and surveillance by trapping and visual inspection underneath soil refugia are applied for at least two years.

- **Eradication from potted plants**: Individuals can be disposed of by dropping into hot water (> 40°C), or by sprinkling with salt or simply by squashing.

4) Method for spread limitation

Controlling flatworm numbers can be achieved through a number of mechanical methods such as frequent soil turning and cultivation, burning, removal trapping for smaller areas, and hot water treatment for potted plants.

If farmland is contaminated, mitigation measures preferencing the earthworms can also be applied:

- Frequent tillage with intervals that allow the earthworm population to recover;
- Increased fertilization such as farmland manure to support the earthworm population;
- Habitat manipulation to encourage predation by predatory beetles and/or other natural enemies or discourage flatworm colonization by increasing the possibility of drying out.

Inhospitable barriers are also set up around the infected perimeter, such as regular turning of the soil and thermal treatment to prevent further dispersal. Surveillance is set up in surrounding fields by visual inspection underneath soil refugia and strategically placed shelters at the edges of fields.

In private gardens, a recommended method for minimising their impact is to increase the number of refuges i.e. stones, logs, bricks, weighted down polythene lying on the soil surface and eliminate all flatworms found. This strategy relies on a regular and sustained campaign of searching for and disposing of flatworms. Individuals can be disposed of by dropping into hot water (> 40°C), or by sprinkling with salt or simply by squashing. Flatworms should not be cut in two, as they can regenerate.

5) Method for monitoring of eradication success

- In shops
  - Lift plants from their pots frequently to check for presence of flatworms or egg capsules.
  - Set traps consisting of a weighed down sheet of black plastic or plank of wood or a bag filled with sand and check the underside frequently for the presence of flatworms or egg capsules.

- In nature and private premises
  - Traps are put on the surface and these are checked regularly. The traps are preferably located near the center of the contaminated area. Additionally, the edges of the area are also trapped.
  - For *A. triangulatus*, this type of monitoring is preferably undertaken in autumn as chances of detection vary spatio-temporally.

References

- https://invasivespeciesni.co.uk/wp-content/uploads/2020/05/New-Zealand-Flatworm-Management-Tips.pdf

- Murchie, A. (2017). The management of New Zealand flatworm (A*rthurdendyus triangulatus*). Measures and associated costs. Technical note prepared for the European Commission.

ANNEX 5 – Manageability fiche

New-Zealand flatworm, Arthurdendyus triangulatus (Nieuw Zeelandse platworm, Ver plat de Nouvelle-Zélande)

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A. Invasion scenario

- Invasion situation and history in BE: The species has not been observed in Belgium to date. The imaginary invasion scenario is that the species entered Belgium through contamination of potted plants and subsequently established in a private garden. After 15 years, the species is detected there and upon scrutiny even in multiple private gardens and an adjacent agricultural land (pasture).
- Reliability of the BE distribution: As the species is not well known, very inconspicuous, and flatworms are not popular among nature enthusiasts, the presence of this species might have been overlooked and underestimated.
- Invasion situation in neighbouring countries: There are no known populations of *A. triangulatus* in mainland Europe, but the species is established in the United Kingdom and Ireland. The species is more widespread in the North of the British Isles than in the South. Additionally, it is also present on the Faroe Islands. Eight other species of terrestrial flatworms are known from Belgium - of which five are restricted to greenhouses - and even more from neighboring countries (Soors et al., 2019; 2022). The three that have already been found in the wild in Belgium are *Caenoplana variegata*, *Obama nungara* and most recently *Marionfyfea adventor.*

B. Management strategy – eradication

- Methods and techniques:

No widespread eradication campaigns against *A. triangulatus* have been attempted so far, nor have potentially effective methods been described (Murchie, 2017). Confidence associated with the measures described below is therefore low.

Arthurdendyus triangulatus is susceptible to heat and physical damage so removal of refuges, scorching and turning the soil could eradicate the flatworm, but only at the very early stages of infestation - which have already passed in this scenario. Murchie and Harrison (2004) estimated from mark-release-recapture studies that 44% of the flatworm population was hidden in the soil, rather than at the soil surface. Once the flatworm has gotten into the soil, the only feasible means of eradication is to dig the soil up with mechanical diggers and heat it to temperatures above 30 °C (Murchie, 2017). Care must be taken to implement the proper biosecurity measures before moving any vehicle and other material or equipment off site (proper cleaning of machinery, hot water treatment). As high temperatures only kill the adult worms and not the eggs, the method will need to be repeated multiple times.

In the private gardens adjacent to the pasture lands, scorching combined with removal trapping of *A. triangulatus* using shelter traps on the soil surface (Cannon et al., 1999) can be considered, though this method is ineffective on a large, commercial scale (Blackshaw et al., 1996). A shelter trap can be a strong polythene bag filled with approximately 6 kg gravel, placed on bare soil (Boag at al., 2010; Murchie et al., 2013) or a ceramic tile with a coat of 5 mm polystyrene (Cannon et al., 1999). Traps should act as cool, dark and damp refuges under which the flatworms can hide during the day, but every potential refuge (rocks etc) should either be checked or removed. As high temperatures only kill the adult worms and not the eggs, the method will need to be repeated multiple times.

No chemical measures are available to target the flatworm in the soil (Murchie, 2017).

- Post-intervention verification:

Monitoring and surveillance of *A. triangulatus* by visual inspection underneath soil refugia such as stones, wood, and shelter traps on the soil surface as described in the methods and techniques can be utilised, preferably near the edges of the field as flatworm densities are higher due to increased shelter possibilities (Boag et al., 1999; Murchie et al., 2003). This type of monitoring is preferably undertaken in autumn as chances of detection vary spatio-temporally (Boag et al., 2005) and hot, dry conditions force the flatworms to bury deeper into the soil (Murchie et al., 2013).

C. Management strategy – spread limitation

- Aim: *Option 1 - Stand-still principle with a single or a few patches.*

In this scenario, flatworm numbers in the infected pastures and gardens are managed and effects mitigated, flatworms are discouraged from moving outside of the pasture and biosecurity measures are implemented to avoid secondary spread caused by human intervention.

- Methods and techniques:

Controlling flatworm numbers can be achieved through a number of methods as described in the methods for eradication such as frequent soil turning and burning, and removal trapping for smaller areas. On the farmland, mitigation measures preferencing the earthworms can also by applied:

  - Frequent tillage with intervals that allow the earthworm population to recover;
  - Increased fertilization such as farmland manure to support the population;
  - Habitat manipulation to encourage predation by predatory beetles and/or other natural enemies or discourage flatworm colonization by increasing the possibility of drying out.

Additionally, as the species can move up to 17 meter per hour under laboratory conditions (EU PRA) and populations can move 1 meter per day once established in a field (Boag and Neilson, 2014), inhospitable barriers are set up around the infected perimeter (such as regular turning of the soil and thermal treatment to prevent further dispersal. Surveillance is set up in surrounding fields by visual inspection underneath soil refugia and strategically placed shelters at the edges of fields.

Care is taken to prevent further dispersal of the species due to human intervention by avoiding the transfer of topsoil between sites and by thoroughly cleaning machinery.
On the private premises (gardens), regular removal trapping should be practiced, as described above.

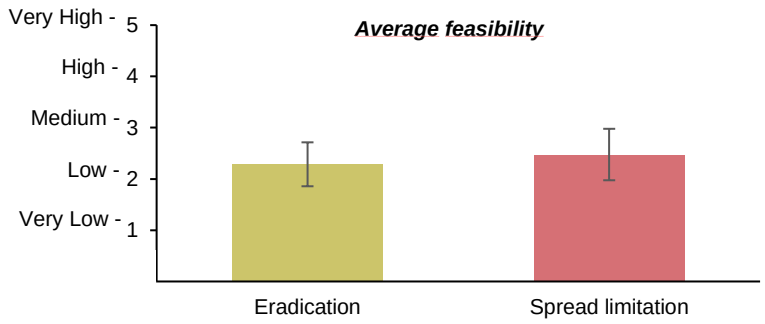
- Post-intervention verification:

The methods described above need to be applied indefinitely.

D. Assessment results

The average feasibility scores of the eradication and spread limitation scenario were between low and medium. Two experts scored the feasibility of spread limitation slightly higher than eradication, while the third expert scored in the opposite sense. It is the lowest eradication feasibility score reached amongst emerging IAS included in this report, due *e.g.* to low species detectability in the field and low effectiveness of available management techniques.

On average, the spread limitation scenario scored better on effectiveness while there were no other major differences between scenarios. The lowest scores for the eradication scenario were for effectiveness, practicality and window of opportunity.



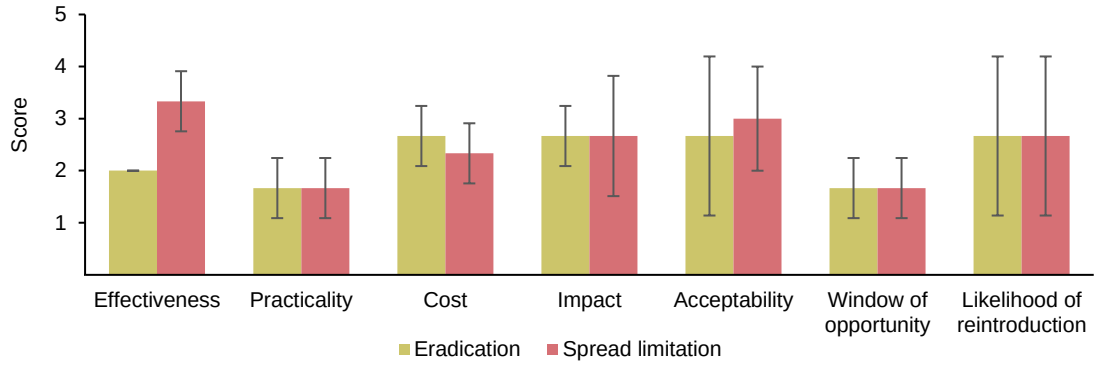


***Figure 8**. **Top:** Average feasibility scores for the eradication and spread limitation scenario of Arthurdendyus triangulatus; **Bottom:** Breakdown of average feasibility scores into average scores of the seven key criteria for management of A. triangulatus*

E. Recommendations for management

Since the species is not yet present in Belgium, the default management option stipulated by the European Regulation is eradication. However, **since feasibility of eradication is scored as low – with both low effectiveness and practicality – we estimate that the probability of success is very limited.** The spread limitation strategy could be more effective, but only if the species is rapidly detected (even earlier than described in the invasion scenario under discussion) and the population is still very small and localized (short window of opportunity, 2 months – 1 year). Prevention of transfer of soil from contaminated areas is crucial for this.

Derogations from the obligation of rapid eradication – *sensu* article 18 of the EU Regulation – might need to be sought for *A. triangulatus* depending on local conditions.

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ANNEX 6 – ID sheets

ESPÈCE EXOTIQUE ENVAHISSANTE DE LA LISTE EUROPÉENNE × FICHE D'INFORMATION

INVERTÉBRÉS

Ver plat de Nouvelle-Zélande

Arthurdendyus triangulatus

Nieuwe-Zeelandse platworm × New Zealand flatworm × Neuseeland-Plattwurm

© Pascale Golinvaux @ RBINS

Origine
Nouvelle-Zélande

Voies d'introduction
Transport de substrat de culture et de plantes ornementales en pot.

Usages en Belgique
Pas d'usages spécifiques connus.

Distribution en Belgique
Absent.

Habitat potentiel en Belgique
Jardins, potagers, pépinières, prairies et cultures pérennes ; présent dans la couche supérieure du sol.

Nuisances
Prédateur responsable d'une forte diminution des populations de vers de terre dans le sol. Il en résulte une dégradation de la structure et de la fertilité du sol, ce qui peut conduire à une diminution du rendement des cultures.

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Caractéristiques
Ver terrestre, aplati, collant, de couleur brune avec des marges beiges

- → Taille quand allongé: 20 cm de long et 1 cm de large (plus étroit au niveau de la tête)
- → Structure: corps non annelé disposant d'un orifice unique (bouche-anus) au milieu de la face ventrale
- → Couleur: brun marron, avec les marges et la face ventrale beige, tachées de gris. Coloration rosée sur l'extrémité antérieure avec une rangée de minuscules taches noires sur les côtés
- → Œuf: de couleur noir brillant et de forme ovoïde; taille: 4-8 mm de diamètre
- → A tendance à s'enrouler sur lui-même

Espèces ressemblantes
Dans l'environnement, cette espèce peut être confondue avec d'autres espèces de vers plats telles que celles du genre *Microplana*, *Bipalium* ou *Platydemus* (qui sont moins larges que *A. triangulatus*). Elle peut aussi être confondue avec les espèces de sangsues terrestres (mais ces dernières sont segmentées).

Pour plus d'informations

IDENTIFICATION ET ESPÈCES RESSEMBLANTES (NL)
- → https://ecopedia.s3.eu-central-1.amazonaws.com/fiche%20TerrestrischePlatwormen_NL_final%20version.pdf

SITES RÉGIONAUX
- → Wallonie: http://biodiversite.wallonie.be/liste-invasives
- → Flandre: https://www.ecopedia.be/pagina/uitheemse-invasieve-dieren (NL)

MISE EN ŒUVRE DU RÈGLEMENT EUROPÉEN EN BELGIQUE
- → http://www.iasregulation.be/fr

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Invasive Alien Species
National Scientific Secretariat

INVERTEBRATEN

Nieuw-Zeelandse platworm

Arthurdendyus triangulatus

Ver plat de Nouvelle-Zélande × New Zealand flatworm × Neuseeland-Plattwurm

© Pascale Golinvaux @ RBINS

Herkomst
Nieuw-Zeeland

Introductie
Als contaminant van aarde van ornamentele planten in pot en van kweeksubstraat.

Gebruik in België
Geen gebruik van de soort gekend.

Verspreiding in België
Afwezig.

Potentiële habitat in België
In de bovengrond van bodems (tuinen, niet omgeploegde rand van velden, boomkwekerijen, ...).

Problematiek
Predator die de diversiteit en biomassa van aardwormen vermindert. Dit kan een sterke degradatie van de kwaliteit en structuur van de bodem veroorzaken, wat de opbrengsten van cultuurgewassen verlaagt.

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Kenmerken
Afgeplatte, plakkerige, terrestrische worm met een beige rand

- → Grootte: tot 200 mm lang en 10 mm breed (volledig uitgerokken); wordt smaller naar voren toe
- → Lichaam: niet geleed, slechts 1 lichaamsopening in het midden van de onderkant
- → Kleur: leverbruin met een bleke, beige rand en onderkant. Deze bleke delen zijn doorvlekt met grijs; naar de voorkant toe krijgt de worm een rose tint, met zwarte oogvlekjes aan weerskanten van de kop
- → Eicapsule: eivormig; 4-8 mm doorsnede; glanzend zwart
- → Veelal opgerold

Gelijkende soorten
A. triangulatus kan verward worden met andere platwormen zoals die van het genus *Microplana*, *Bipalium* of *Platydemus* maar deze zijn minder groot. Ook terrestrische bloedzuigers zouden verwarring kunnen veroorzaken, maar deze zijn gesegmenteerd.

Voor meer informatie

LOOK-A-LIKES EN IDENTIFICATIE
- → https://ecopedia.s3.eu-central-1.amazonaws.com/fiche%20TerrestrischePlatwormen_NL_final%20version.pdf

REGIONALE PORTALEN
- → Vlaanderen: https://www.ecopedia.be/pagina/uitheemse-invasieve-dieren
- → Wallonië: http://biodiversite.wallonie.be/liste-invasives

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- → www.iasregulation.be

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