

**National regulatory control systems**  
**Systèmes de lutte nationaux réglementaires**

## ***Heracleum mantegazzianum*, *H. sosnowskyi* and *H. persicum***

### **Specific scope**

This standard describes national regulatory control systems for *Heracleum mantegazzianum*, *Heracleum sosnowskyi* and *Heracleum persicum*. In the text the three species are referred to as *Heracleum* spp. in order to reduce repetitions.

### **Specific approval and amendment**

First approved in 2009–09.

### **Introduction**

*Heracleum mantegazzianum* and *H. sosnowskyi* (Apiaceae) are herbaceous, usually monocarpic (flowering only once in a lifetime), perennial, seed-propagated herbs. *Heracleum persicum* is a herbaceous, polycarpic (it blooms several times), perennial seed-propagated herb. The three species look alike but differ in size. The flowering stem of *H. mantegazzianum* is usually 2–3 m high and can reach up to 5 m tall and 10 cm in diameter. The main inflorescence (first-order) is a terminal compound umbel of 50–60 (80) cm in diameter with (40) 50–120 (170) unequal hairy rays, each 10–40 cm long. There are also up to 8 satellite umbels which usually overtop the main one. Plants of *H. sosnowskyi* are up to 3 m tall, and plants of *H. persicum* are most often 0.8–2 m in height, especially for newly established plants, but can be up to 3–4 m in height. These plants grow in similar conditions, and have high fecundity and survival potential.

In most of the EPPO region, these three species are considered invasive in managed and unmanaged ecosystems, being a threat to biodiversity, eroding riverbanks, decreasing recreational resources, causing economic losses and posing a health risk to humans as they cause skin blistering on contact. *Heracleum sosnowskyi* and *H. persicum* are registered on the EPPO A2 list. *Heracleum mantegazzianum* is not recommended for regulation.

*Heracleum mantegazzianum* is native to the Western Greater Caucasus (Russia, Georgia). It was introduced as a garden ornamental plant around 1817, and is now recorded in at least 19 European countries. It is also naturalized in Canada and in the USA.

*Heracleum sosnowskyi* is native to the Eastern and Central Caucasus, Eastern and Southern Western Transcaucasia, and Northeast Anatolia (Turkey). It was first introduced to Russia in

1947 as a highly productive fodder crop for livestock. Later it was introduced to other countries such as Belarus, Ukraine, the Baltic countries, and former Eastern Germany. Its cultivation has been abandoned.

*Heracleum persicum* is native to Turkey, Iran and Iraq. Its alien distribution is restricted to Scandinavia. It was the first *Heracleum* among the three species to be described, as early as 1829, and it is likely that some of the subsequent identifications as *H. persicum* were probably mistaken with other large *Heracleum* spp.

The main pathway of introduction for all three species is as ornamentals (especially for *H. mantegazzianum*) or as fodder crops, sometimes as honey plants (especially for *H. sosnowskyi* in Russia and in the Baltic countries) (Laivīņš & Gavrilova, 2003). They may also be introduced involuntarily, as contaminants of soil/growing media, from used machinery, vehicles, plants for planting or from footwear. Once introduced, these plants reproduce very efficiently from seed, which are spread by wind, water and the above quoted human activities (Laivīņš & Gavrilova, 2003).

Details on the biology, distribution and economic importance of *Heracleum mantegazzianum*, *H. sosnowskyi* and *H. persicum* can be found in EPPO (2009). Definitive species identification is very difficult because of the confusing taxonomy.

EPPO member countries at risk are advised to prepare a contingency or a management plan for the surveillance, eradication and containment of these pests.

This standard presents the basis of a national regulatory control system for the monitoring, eradication and containment of *Heracleum mantegazzianum*, *H. sosnowskyi* and *H. persicum* and describes:

- elements of the monitoring programme that should be conducted to detect a new infestation or to delimit an infested area
- measures aiming at eradicating recently detected populations (including an incursion)
- containment measures: to prevent further spread in a country or to neighbouring countries, in areas where the pest is present and eradication is no longer considered feasible.

Regional cooperation is important and it is recommended that countries should communicate with their neighbours to exchange views on the best programme to implement, in order to achieve the regional goal of preventing further spread of these pests.

For the efficient implementation of monitoring and control at a national level, cooperation between the relevant public bodies (e.g. NPPOs, Ministries of Health, Ministries of Environment, Ministries in charge of transport, water management, etc.), as well as with other interested bodies (associations) should be established.

### Monitoring of *H. mantegazzianum*, *H. sosnowskyi* and *H. persicum*

Owing to their large size, stands of *Heracleum* spp. are very visible for most of the year, both alive and dead, and especially during flowering in early summer. Nevertheless, developing plants (without the umbel) can be difficult to find and staff should be trained to recognize the plants in their vegetative stage. Surveyors will often look for large stands, however, they can be present as single individuals scattered along a river bank, railway line or road verge.

Regular delimiting surveys (according to ISPM no. 6 *Guidelines for surveillance*) are necessary to determine the geographical distribution of these plants and their prevalence. Monitoring should concentrate on areas that are most vulnerable to invasion (abandoned grassland, fringes along watercourses, woodlands, roads and railways, nature conservation areas) and areas susceptible to colonization (adjacent to known infestations, agricultural areas where any of these three *Heracleum* spp. have been cultivated or used for apiculture, gardens where it is cultivated, nurseries; within wind dispersal distance of existing stands (i.e. 4 m); within the flood zone of water courses where the species occurs; road or railway borders within 2 km of stands; and other high risk points of entry).

### Eradication of *H. mantegazzianum*, *H. sosnowskyi* and *H. persicum*

The eradication programme for *Heracleum* spp. in the case of recently detected populations (including an incursion) is based on the delimitation of an area within the country and the application of measures to both eradicate and prevent further spread of the pest. The feasibility of eradication for *Heracleum* spp. depends on the size of the area infested, the density of the plants, and accessibility of the site.

As *H. persicum* is polycarpic, it is considered to be more difficult to manage and may demand a longer period for eradication

measures as the plant lives longer than other invasive *Heracleum* spp. and may be more resistant as it is able to store more nutrient reserves in the root system (Fremstad & Elven, 2006).

Measures are described in Appendix 1 and summarized in a table in Appendix 3.

### Containment of *H. mantegazzianum*, *H. sosnowskyi* and *H. persicum*

The containment programme for *Heracleum* spp. in the case of established populations is based on the application of measures to prevent further spread of the pest in the country or to neighbouring countries. These measures are described in Appendix 2 and summarized in a table in Appendix 3.

### Communication

The three species are very easily recognizable, and professionals (administration, road and railroad services, garden centers, farmers, gardeners, etc.) as well as the public should be informed about the threats these three species of *Heracleum* can pose to human health and the environment (e.g. in schools, pharmacies, public places, etc.). A broad audience could take part in monitoring the species.

### References

- Andersen UV & Calov B (1996) Long-term effects of sheep grazing on giant hogweed (*Heracleum mantegazzianum*). In: *Management and Ecology of Freshwater Plants. Proceedings, 9th International Symposium on Aquatic Weeds, European Weed Research Society, Dublin (EI), 1994. Hydrobiologia* (Eds Caffrey JM, Barrett PRF, Murphy KJ & Wade PM), 340, 277–284.
- Bērzinš A, Olukalns A, Lapinš D, Lejinš A, Spricina A, Gavrilova G & Liguts V (2003) Distribution of Hogweed (*Heracleum*) in Latvia. *LLMZA, Agronomijas Vēstis* 5, 86–93. (In Latvian; abstract in English).
- Caffrey JM & Madsen JD (2001) The management of giant hogweed in an Irish river catchment. *Journal of Aquatic Plant Management* 39, 28–33.
- Fremstad E & Elven R (2006) The alien giant species of *Heracleum* in Norway. *NTNU Norges teknisk-naturvetenskaplige universitet Vitenskapsmuseet Rapport botanisk serie* 2, 1–35.
- Holm B (2005) *Biology, Distribution and Control of Invasive Heracleum* Species. Master thesis in Estonian Agricultural University, Tartu (EE).
- Laiviņš M & Gavrilova G (2003) *Heracleum sosnowskyi* in Latvia: sociology, ecology and distribution. *Latvijas Vegetācija* 7, 45–65. (In Latvian; abstract in English).
- Lucey J (1994) Records of the giant hogweed, *Heracleum mantegazzianum* Sommier and Levier, along southern Irish rivers and streams with a revised distribution map for the region. *Bulletin of the Irish Biogeographical Society* 17(1), 2–6.
- Marcher S (2001) The Danish EPA's assessment and approval of glyphosate. *DJF Rapport, Markbrug* 41, 81–92.
- Nielsen C, Ravn HP, Nentwig W & Wade M (eds) (2005) *The Giant Hogweed Best Practice Manual. Guidelines for the management and control of an invasive weed in Europe*. Forest and Landscape Denmark, Hoersholm (DK), 44 pp. [http://www.giant-alien.dk/pdf/Giant\\_alien\\_uk.pdf](http://www.giant-alien.dk/pdf/Giant_alien_uk.pdf) [Last accessed May 2009].
- OEPP/EPPO (2009) Datasheet on *Heracleum mantegazzianum*, *H. sosnowskyi* and *H. persicum*. *EPPO Bulletin/Bulletin OEPP* 39, 489–499.

- Pyšek P, Cock MJW, Nentwig W & Ravn HP (2007) *Ecology and Management of Giant Hogweed (Heracleum mantegazzianum)*. CAB International, Wallingford (GB), 324 pp.
- Tiley GED, Dodd FS & Wade PM (1996) *Heracleum mantegazzianum* Sommier & Levier. *Journal of Ecology (Oxford)* **84**(2), 297–319.
- Tiley GED & Philp B (1992) Strategy for the control of giant hogweed (*Heracleum mantegazzianum*) on the river Ayr in Scotland. *Aspects of Applied Biology* **29**, Vegetation Management in Forestry, Amenity and Conservation Areas: 463–466.
- Treikale O, Vanaga I, Priekule I, Gurkina J & Pugacheva J (2005) Re-establishment of biological diversity after *Heracleum* spp. control in riverside Vaive (Gauja national park). *Acta Biologica Universitatis Daugavpiliensis* **5**(2), 113–124.
- Williamson JA & Forbes JC (1982) Giant hogweed (*Heracleum mantegazzianum*): its spread and control with glyphosate in amenity areas. *Proceedings British Crop Protection Conference – Weeds* **3**, 967–972.

## Appendix 1 – Eradication programme

The eradication process involves four main activities:

- surveillance to fully investigate the distribution of the pest
- containment to prevent the spread of the pest
- treatment and/or control measures to eradicate the pest when it is found
- verification of pest eradication.

### Surveillance

A delimitation survey should be conducted to determine the extent of the pest distribution. Infested areas and adjacent areas that might receive seed should be monitored. Special attention should be given to nature conservation areas.

### Containment

Preventive measures include the prohibition of sowing, growing, planting and trading of *Heracleum mantegazzianum*, *H. sosnowskyi* and *H. persicum*. Unintentional transport of seeds through the transfer of soil material, human activity and by vehicles should be avoided. Movement of soil from infested fields should be prohibited. Equipment and machinery should be cleaned to remove soil before moving to an uninfested area. Due to the very high likelihood of spread of seeds along rivers, it is important to ensure that upstream infestations are dealt with before attempting eradication further downstream (Caffrey & Madsen, 2001).

### Treatment and control programme

A key objective of *Heracleum* spp. control is to manage the seed bank. This usually means preventing the adult plants from flowering and therefore setting seed for a period long enough to ensure any remaining seeds are not viable. As *H. persicum* is perennial, it might be longer to control this plant.

Treatment should start early in the growing season and continue as long as regrowth is noted. Regular agricultural treatments, especially on field edges, along roads, water courses, etc. reduce the possibilities of spread of the plants to new localities. Chemical and mechanical controls are the two most effective

treatment measures for eradication. Combining different methods can prove more effective.

### Chemical control

Herbicides can be used to kill *Heracleum* spp. plants, however repeated applications may be required as the plants are often tenacious. Careful monitoring and several repeated applications are recommended per year to tackle new plants which will quickly replace those killed off.

Depending on national legislation or authorization of plant protection products, the use of herbicides could be a possible control measure. There may be national regulations that rule or prohibit the use of herbicides on various types of land use.

It is recommended to treat the plants early in spring (when they reach 20–50 cm in height) and if needed to perform a follow-up spraying before the end of May to target new seedlings. This second application may be replaced by mowing or cutting. New plants will often quickly grow to replace those that have been controlled. Close monitoring during the first year of control is recommended to ensure no plants are able to set seed.

Herbicides considered effective for the control of *H. mantegazzianum*, *H. sosnowskyi* and *H. persicum* include glyphosate (considered to be the most effective herbicide for these species), triclopyr and imazapyr which can be applied early in the season (March–May) for best effect. Imazapyr has a residual effect in the soil that prevents further germination but may also impact on non-target plant species. Imazapyr is being phased out in many EPPO countries. Possible effects on successional crops or plant species should be considered. Glyphosate is the most widely used compound (Williamson & Forbes, 1982), but owing to risks of toxicity to fish and algae, an unsprayed buffer zone of at least 2 m should be left adjacent to any river or other water body (Marcher, 2001).

Individual plants at the rosette stage can be treated, using an applicator impregnated with the herbicide and covering the *Heracleum* spp. rosette on the surface of the emerging leaves with the active substance. For individual plants which have developed the main shoot, chemical control may be used by pouring the preparation into the mown stalk or by injecting it. The injecting should be performed with a veterinary medicine syringe to puncture a hole in the flower bearing part above the ground and introduce the liquid in accordance with the area of ground shaded, 4.5 mL of the preparation for 3 m<sup>2</sup> should be used (Bērziņš *et al.*, 2003).

Information regarding time requirements to apply different methods can be found in Nielsen *et al.* (2005).

### Mechanical control

Mechanical control is divided into three principal methods: cutting/removing the taproot of the plant (killing the affected plant immediately); cutting the above ground plant repeatedly over many years eventually depleting its resources; allowing plants to flower/set seed and removing the umbel carefully (therefore allowing the plant to die naturally while preventing replenishment of the seed bank).

Staff in charge of the control of the plants should be warned about the health risk associated with these species and should avoid touching the plants with bare skin and prevent ultraviolet from reaching exposed skin. All body parts should be covered with protective clothing, synthetic water-resistant material being preferred since cotton and linen fibres soak up the plant sap and can be penetrated by plant hairs. Gloves with long sleeves should be worn, and when cutting the plants, protective glasses must be used to prevent drops of plant sap entering the eyes (Nielsen *et al.*, 2005). After control, clothes should be taken off and rinsed in order to avoid any contact of the sap of *Heracleum* spp. that may be on the clothes with the skin.

**Hand-pulling** (with gloves) is effective with young seedlings but impractical with larger plants.

**Mechanical cutting** that is undertaken too early provides no long-term control as there is rapid re-growth from below ground, and it may also encourage the perennation of flowering shoots which would otherwise die after flowering. The cutting should be postponed until the first green seeds start to emerge on the top flower of generative plants. By that time the plant has practically depleted its resources and the control is more effective compared with cutting in early growing phase (Holm, 2005).

An innovative practitioner has developed a special “Hogweed tool”, consisting of a curved saw blade on a long handle that cuts the stem while the user stands at a safe distance away from the plant (Nielsen *et al.*, 2005).

Information regarding time requirements to apply different methods can be found in Nielsen *et al.* (2005).

**Root cutting** is effective but labour intensive and is recommended for single plants or small stands (<200 plants). It is usually performed with an ordinary spade and takes place in early spring with a repeated treatment in mid summer. The roots must be cut at least 10 cm below soil level otherwise the plants may regrow. Cut parts of the plants are either destroyed or left to dry. Digging or ploughing to destroy the crown (below 10 cm soil depth) can completely kill the plant (Nielsen *et al.*, 2005).

Information regarding time requirements to apply different methods can be found in Nielsen *et al.* (2005).

**Mowing techniques** are used for large infested and accessible areas. Mowing must be repeated 2–3 times during the growing season for several years, otherwise the plants regrow from nutrient reserves contained in the roots, and may develop inflorescences. For populations which are small or situated in unsuitable locations for mechanical mowing (e.g. along rivers or slopes), plants can be cut manually.

When plants are continuously grazed or cut, the roots contract, pulling the crown down to about 10 cm below the soil surface.

Another efficient and less laborious method recommended for smaller populations, is to **remove the umbels of flowering plants**, except for *H. persicum*. Timing is crucial and should be done at the peak of flowering – when the seeds are formed but not yet mature. When the removal of umbels is performed too early (before full inflorescence), regeneration is very vigorous; when performed too late, seeds may be released while manipulating the umbels. Cut umbels must be destroyed (burned) as soon as possible as seeds may lie on the ground and ripen, even from

umbels cut early in the flowering stage. Cutting the main inflorescences is considered equivalent to mowing the plants 3 times. After the treatment, stands should be checked carefully to ensure that plants do not regenerate and produce viable seeds; regenerating umbels must be destroyed in the same way. If a long-term programme is feasible, only flowering plants can be targeted in subsequent years until the population is depleted (Pyšek *et al.*, 2007).

**Ploughing of the soil** up to 24 cm in agricultural lands will bury the seeds and will therefore significantly reduce their germination. Rototilling and harrowing will cut the roots into pieces, preventing young and grown plants to establish. The treatment should be selected according to the characteristics of the agricultural land. The measures shall be repeated until the stands are completely eliminated.

**Black polythene covers** can be used to kill individuals of *Heracleum* spp. or small stands. This does not allow plants to photosynthesise, and would raise the temperature to kill both the plants and their seeds. This method should be used at the start of the vegetative period (April till the beginning of May). The opaque polythene should be carefully fixed to resist wind effects, and should be checked regularly to ensure it is not damaged. This method is considered to be rather expensive. In Latvia, after applying this method one year, all plants died (Pyšek *et al.*, 2007). After control measures, sowing of species with good competitive abilities to fill the gaps in vegetation may be considered (i.e. grass species, see Appendix 2).

## Verification of pest eradication

Eradication is considered to be achieved when there are no signs of *Heracleum* spp. plant growth. Since the seeds can survive for some years in the soil, follow-up monitoring should be undertaken for at least 7 years for *Heracleum* spp., corresponding to field observations for not finding viable seeds in fields (Andersen & Calov, 1996).

## Appendix 2 – Containment programme

In the case of an established population, eradication is difficult to achieve. Containment measures aiming to prevent further spread of the pests to endangered areas or to neighbouring countries should be applied.

### Surveillance

Large populations along transport lines (watercourses, highways) should be managed as a priority, in order to prevent the dispersal of seeds. Special attention should be given to nature conservation areas.

### Containment measures

As for eradication, treatment should start early in the growing season. Chemical control and mechanical control (as described in Appendix 1), as well as grazing and integrated control, may be

implemented to contain populations of *Heracleum* spp. Applying a combination of different measures may prove more effective.

### Grazing

*Heracleum* spp. are not effectively controlled by light grazing. However, intensive grazing especially by sheep and goats can be highly effective (Tiley *et al.*, 1996). Sheep were found to greatly reduce *Heracleum* spp. after 2 years and completely eliminated it after 7 years when no viable seeds remained in the soil (Anderesen & Calov, 1996). The plants may be slightly less palatable to cattle, but grazing by cattle as well as pigs is recommended in Ireland (Lucey, 1994).

Sheep and cattle prefer young and fresh plants. In general, livestock need a period of time to become accustomed to *Heracleum* spp. before they regularly eat these species. However, the animals soon develop a preference for *Heracleum* spp. In areas with dense infestation, mowing is recommended in order to allow the establishment of other plant species, since the grazers are less likely to be negatively affected by eating *Heracleum* spp. if the diet is mixed. Livestock with pigmentation of the bare skin (e.g. black-faced sheep) should be chosen in order to reduce inflammation due to the plants. If symptoms of poisoning in grazers are detected (e.g. skin inflammation), affected animals must be removed from the field temporarily (Nielsen *et al.*, 2005).

Grazing pressure should be adjusted according to the density of the stand and to the period of the year. It is recommended to use a dense regime of animals in spring (20–30 sheep ha<sup>-1</sup>) and to reduce grazing pressure at the end of June (5–10 sheep ha<sup>-1</sup>), when the plants are weakened and most of the biomass has been removed.

Information regarding time requirements to apply different methods can be found in Nielsen *et al.* (2005).

### Integrated control

In former fields and pastures, integrated control combining mowing/cutting, chemical control, soil cultivation and sowing of grass

mixtures has given good results. After management of *Heracleum* spp. by herbicides and/or soil cultivation, grass mixtures should be sown at high densities (4000 emerging seedlings per metre square) and include competitive native grass species to avoid soil erosion or re-infestation. Examples of suitable grass mixtures can be found in Nielsen *et al.* (2005). The application of a selective herbicide suitable for broadleaved weeds in the developing grass sward would kill newly emerging seedling of *Heracleum* spp. (Treikale *et al.*, 2005).

In natural habitats (e.g. along riversides), herbicide treatments are not recommended. The creation of a strong plant community is achieved by additional cutting treatments (above-ground cutting in spring, and frequent cutting after sowing when new seedlings of *Heracleum* spp. reach 20–30 cm) and increasing sowing rates of grass mixtures. The best grasses for such mixtures are local varieties that are resistant to flooding, well-adapted to the habitat, and able to compete with *Heracleum* spp.

Moreover, shading by trees may be deleterious to populations of *Heracleum* spp. *Fagus sylvatica* is very capable of shading out tall *Heracleum* spp., while *Abies* sp. and *Salix* sp. are considered less capable (Nielsen *et al.*, 2005).

As mentioned in the eradication section, when plants are continuously grazed or cut, the roots contract, pulling the crown down to about 10 cm below the soil surface. Digging or ploughing to destroy the crown (below 10 cm soil depth) can completely kill the plant (Nielsen *et al.*, 2005).

Tiley & Philp (1992) described an integrated 2-year programme of spraying with glyphosate in April/May, combined with cutting below ground when or where spraying was not feasible. Large flowering plants are dealt with before vegetative plants.

### Biological control

According to present state of the knowledge, it appears that no biological control agent can be identified (Pyšek *et al.*, 2007).

### Appendix 3

The management techniques are summarized in the table below, according to the size of the populations of *Heracleum* spp., and the habitats in which they can be implemented (adapted from Nielsen *et al.*, 2005):

Size of populations	Techniques	Time of the year or age of population	Habitats	Remarks
Single plants to small stands (<1000 plants)	Black polythene cover	Start of the vegetative period (April till the beginning of May) or after mowing	Any habitat	Rather expensive. Check if no damage to the cover
	Hand pulling	Young seedlings	Any habitat	
	Root cutting	Early spring with a repeated treatment in mid summer	Any habitat	Labour expensive, but effective
	Removal of umbels	At the peak of flowering (when seeds are not mature)	Any habitat	
	Chemical	Early in the season (March–May)	Agricultural land, pastures	Can be followed by sowing of grass mixture or root cutting. National recommendations on the use of herbicides need to be followed
Large infestations (>1000 plants)	Mowing	2–3 times during the growing season	Accessible areas	Can be followed by grazing, chemical control or other methods
	Chemical	Early in the season (March–May)	Agricultural land, pastures	
	Intensive grazing	From the start of the vegetative period (April till the beginning of May) as the animals prefer young plants. It may be continued through the summer	Any habitat suitable for grazing	In areas densely infested, mowing is necessary to allow the establishment of other species
	Ploughing of the soil	Spring and autumn	Agricultural lands	Can be followed by sowing of grass mixture