

# NOBANIS – Invasive Alien Species Fact Sheet

## *Heracleum sosnowskyi*

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**Author of this species fact sheet:** Nora Kabuce, Latvian Environment, Geology and Meteorology Agency, Maskavas Str. 165, Riga, LV-1019, Latvia, +371 7032030, nora.kabuce@lvgma.gov.lv and Agnese Priede, Nature Conservation Agency, Meza maja, Kemeru, Jurmala, LV-2012, Latvia, Phone: +371 29640959, E-mail: agnese.priede@daba.gov.lv

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### Species description

**Scientific names:** *Heracleum sosnowskyi* Manden, Apiaceae

**Synonyms:** None

**Common names:** Sosnowski's hogweed (GB), Rundlobet bjørneklo (DK), Sosnovska latvānis (LV), Sosnovsky karuputk (EE), Sosnovskio barštis (LT), barszcz Sosnowskiego (PL), борщевик Сосновского (RU).



**Fig. 1.** Stands of *Heracleum sosnowskyi* in Latvia, photo by Normunds Rustanovičs.



**Fig. 2.** Stands of *Heracleum sosnowskyi* in Latvia, photo by Normunds Rustanovičs.



**Fig. 3 and 4.** *Heracleum sosnowskyi* flowers and growth form, photos by Normunds Rustanovičs

### **Species identification**

*Heracleum sosnowskyi* is biennial or perennial plant. Height is usually 100-300 cm. The stem is ridged and sparsely hairy with purple blotches. On the upper surface the leaves are hairless and below slightly hairy. Lower leaves divided into three segments that are non-deeply divided into oval shortly sharply pointed parts. The leaf margins have short rounded teeth. The flowers are white, sometimes pinkish. Outer petals radiate, 9-10 mm long. Slightly convex compound umbels, 30-50 cm across. 30-75 rays with only short hairs. Flowering typically lasts from June to August. The fruits are egg-shaped or oval; 8-10 mm (-15 mm) long, when they are unripe they are densely hairy. Ripe

fruit wings with numerous spines situated on small spherical or ovoid swellings. Fruits have very conspicuous oil ducts that do not reach the fruit base (Nielsen *et al.* 2005). Several botanists consider *H. sosnowskyi* only as the subtaxon of *H. mantegazzianum* or *H. pubescens*. Therefore, *H. sosnowskyi* does not appear in the lists of weedy flora of many West-European countries. *H. sosnowskyi* was described as a separate species by I. Mandenova in 1944 (Lapiņš *et al.* 2002, Oboļeviča 2001).

### Native range

*Heracleum sosnowskyi* originates in the central and eastern Caucasus and western, central, eastern and southwestern Transcaucasia and in northeastern Turkey (Gavrilova 2003, Jahodová *et al.* 2007a, 2007b, Fig. 5).

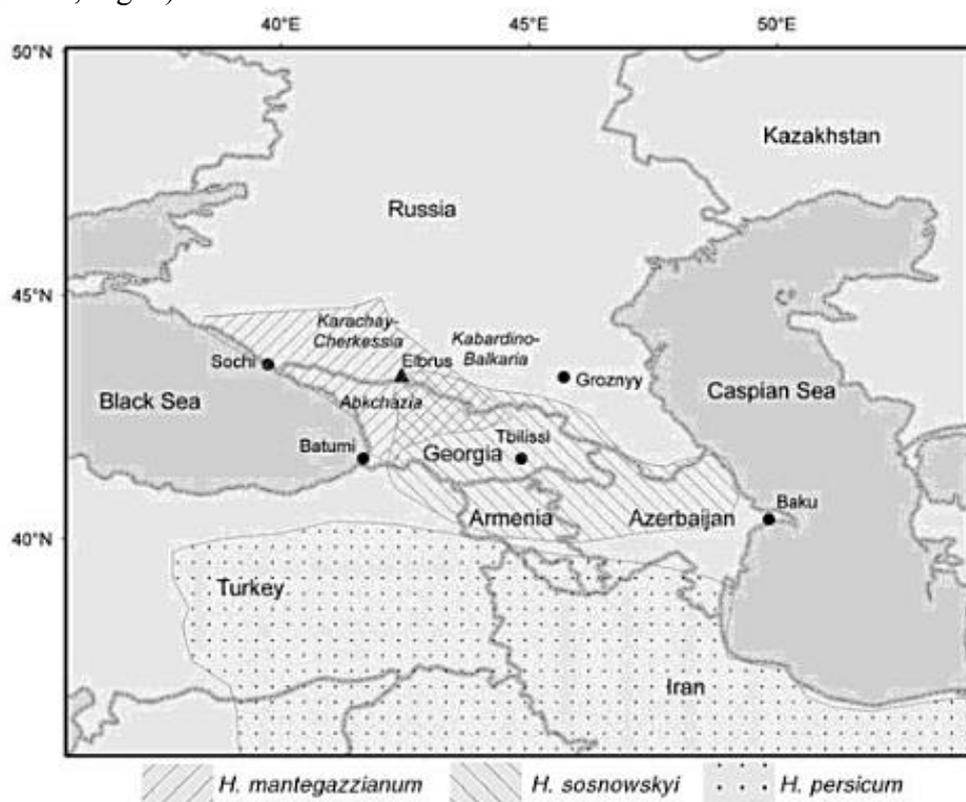


Fig. 5. Native ranges of three hogweed species (Jahodová *et al.* 2007a).

### Alien distribution

#### History of introduction and geographical spread

*H. sosnowskyi* was originally described in 1944. The plant is hardy and can thrive in a cold climate. It was promoted as a crop for northwest Russia, where it was first introduced in 1947. From the 1940s onwards, it was introduced as a fodder plant to Latvia, Estonia, Lithuania, Belarus, Ukraine and the former German Democratic Republic (Nielsen *et al.* 2005).

In Russia the first herbarium sample was collected in 1948 from Serpukhov region of Moscow district. Before the 1970s *H. sosnowskyi* was rare, but since 1970s it was recorded in many sites (Игнатов *и др.* 1990). Apart from crop reason (livestock fodder) it was cultivated in many botanical gardens and sometimes as ornamental plant in gardens (Бялт 1999; Григорьевская *и др.* 2004).

In Poland *H. sosnowskyi* was introduced in the second half of the 20th century. In 1958 studies aimed at determining remedial properties of *H. sosnowskyi* began in the Garden of Therapeutic Plants of Medical Academy in Wrocław (Kosteczka-Mądalska 1962, Kosteczka-Mądalska and Bańkowski 1963). The study plots were established in areas characterized by high precipitation. In Southern Poland such study plots were laid out in Zakopane (Lutyńska 1980, Walusiak 2005) and in Nidzica (Podhale region) as well as in Grodziec Śląski of Cieszyńskie Foothills. The plant was cultivated as an ornamental due to its attractive appearance.

In Latvia *H. sosnowskyi* was sown as a fodder (silage) plant for the first time in 1948, and was grown on experimental agricultural farms. In 1956 E. Eihe described it for the first time as a fodder plant (Gavrilova and Roze 2005) and in the 1960s cultivation for forage needs began (Laiviņš and Gavrilova 2003). In some regions in Latvia, the plant was cultivated as a honey plant and with the purpose to use its seeds as fowl forage, in many cases also as an ornamental.

In Estonia the first report of *H. sosnowskyi* is from 1957, when it was introduced as a silage and honey plant, and the plantations were promoted up to the 1980s (M. Linnamägi, pers. comm.). In Lithuania the plant was introduced in the 1950s (Nielsen *et al.* 2005), though the first herbaria specimen was collected considerably later in 1987 (Gudžinskas 1998).

Plantation schemes were eventually abandoned in the Baltic States, partly because the anise scented plants affected the flavour of meat and milk from the animals to which it was fed and partly because of the health risk to humans and cattle. In the Baltic States by the end of the 20<sup>th</sup> century the plant was spread over considerable areas invading also natural habitats, therefore in the 1980s it was first considered as somewhat noxious weed. In 1986 in Latvia (Rasiņš 1986) and 1987 in Estonia it was first time defined as an aggressive weed.

*H. sosnowskyi* is present also in Germany (Nielsen *et al.* 2002, Jahodová *et al.* 2007b, Lambdon *et al.* 2008) and Hungary (Lambdon *et al.* 2008), though occurring only in few sites. In the Nordic countries the species is known only from Denmark (Fröberg 2009).

### **Pathways of introduction**

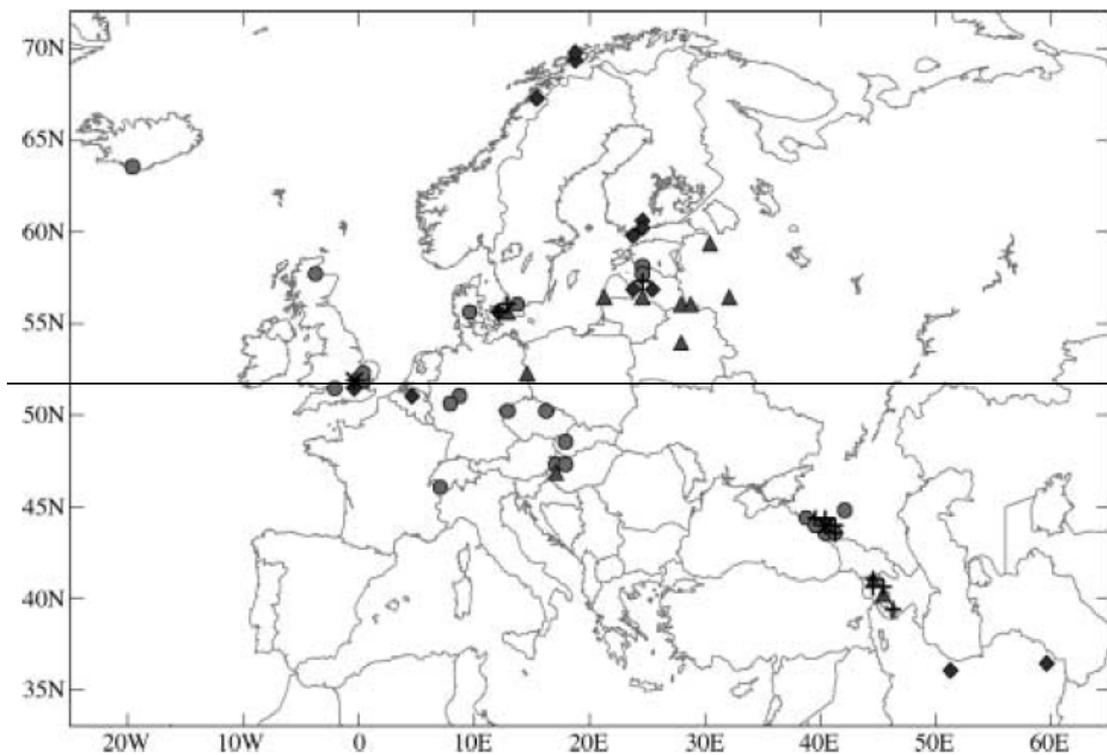
*H. sosnowskyi* was introduced as an agricultural crop to Europe where its large biomass was ensilaged to provide fodder for livestock (Nielsen *et al.* 2005).

### **Alien status in region**

The alien range of *H. sosnowskyi* covers the Baltic States, European part of Russia, Belarus and Ukraine, sporadically occurring in Poland, Hungary, Germany and Denmark. However, detailed distribution data could not be located (Nielsen *et al.* 2005). It has been naturalized in many regions of European Russia from Murmansk to Lipetz and Voronezh (Флора Восточной Европы 2004) (Fig. 6 and 7).



**Fig. 6.** Distribution of *Heracleum sosnowskyi* in Europe (Jahodová *et al.* 2007a). In the shaded countries the species is present, but the exact distribution is not known.



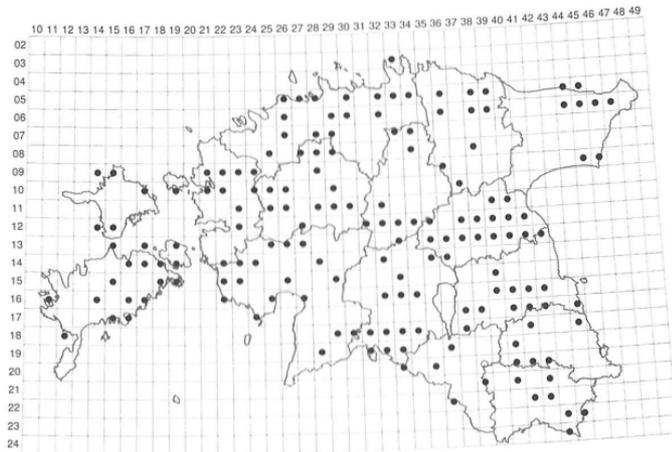
**Fig. 7.** Map of samples of *Heracleum sosnowskyi* collected in Europe (Jahodová *et al.* 2007b).

Map of the sampled populations: ● *Heracleum mantegazzianum*; ◆ *Heracleum persicum*; ▲ *Heracleum sosnowskyi*; + other *Heracleum* species; \* outgroup species.

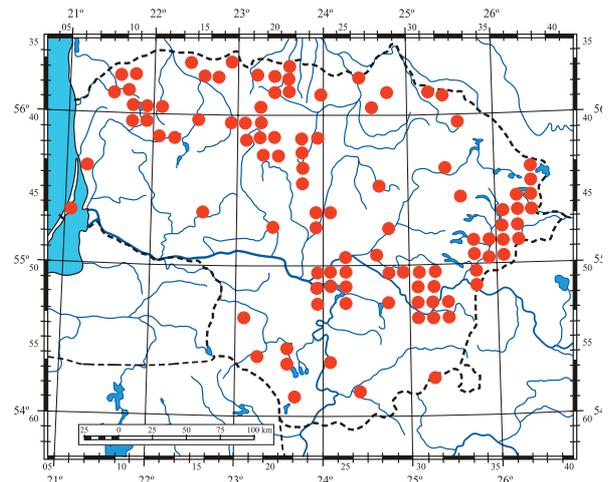
Currently, *H. sosnowskyi* in the Baltic States, especially in Latvia, has spread forming stands of hundreds and thousands of square meters and being widespread across all three countries (Fig. 8, 9,

10, Table 1). For example, the total area invaded by *H. sosnowskyi* in Latvia is 12 225 ha (estimated in 2001) (Bērziņš *et al.* 2003). According to the latest measurements, at the end of 2010 the invaded registered areas in Latvia comprised 10 230 ha (Anonymous 2010) which most probably not include more than 2/3 of the actual total invaded area. According to Bērziņš *et al.* (2003), invaded areas in Latvia increase every year by ca. 10%.

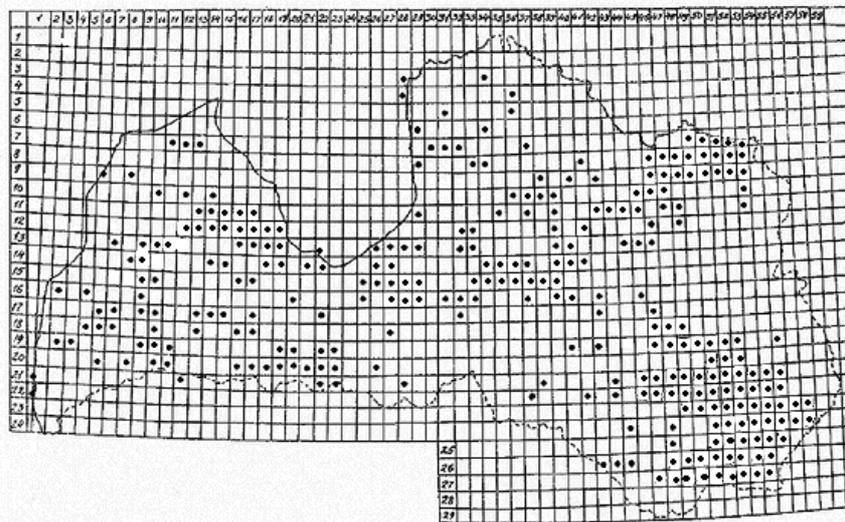
In Estonia in 2010 more than 1 300 ha were covered with over 1 000 known *H. sosnowskyi* colonies, and there are still probably unknown colonies (M. Linnamägi, pers.com.).



**Fig. 8.** Distribution of *Heracleum sosnowskyi* in Estonia (Kukk and Kull 2005).



**Fig. 9.** Distribution of *Heracleum sosnowskyi* in Estonia (Gudžinskas, unpubl.).



**Fig. 10.** Distribution of *Heracleum sosnowskyi* in Latvia (Gavrilova 2003).

In Iceland, *H. sosnowskyi* may or may not have escaped from cultivation. It was cultivated in the Reykjavik Botanic Garden for 12 years. Since the plants were spreading outside the planting, they were eradicated (D. Jakobsdottir, pers. comm.).

Country	Not found	Not established	Rare	Local	Common	Very common	Not known
Austria	X						
Belgium							X
Czech Republic							X
Denmark			X				
Estonia					X		
European part of Russia					X		
Finland	X						
Faroe Islands	X						
Germany		X					
Greenland	X						
Iceland							X
Ireland							X
Latvia					X		
Lithuania					X		
Netherlands	X						
Norway	X						
Poland				X			
Slovakia							X
Sweden	X						

**Table 1.** The frequency and establishment of *Heracleum sosnowskyi*, please refer also to the information provided for this species at [www.nobanis.org/search.asp](http://www.nobanis.org/search.asp). Legend for this table: **Not found** –The species is not found in the country; **Not established** - The species has not formed self-reproducing populations (but is found as a casual or incidental species); **Rare** - Few sites where it is found in the country; **Local** - Locally abundant, many individuals in some areas of the country; **Common** - Many sites in the country; **Very common** - Many sites and many individuals; **Not known** – No information was available.

## Ecology

### Habitat description

The species is mostly found in human-created habitats (roadsides, disturbed habitats, agricultural fields, abandoned farm yards and gardens) and semi-natural habitats (shrublands, grasslands, parks, pastures, abandoned orchards) (Gavrilova 2003).

*H. sosnowskyi* has invaded riverbanks and adjacent floodlands, and in many cases also secondary or disturbed forests. Nowadays, the naturalization of *H. sosnowskyi* is out of control, and the plant has spread almost all over the Baltic States, mainly on abandoned agricultural lands often migrating down the streams (Oboļeviča 2001).

In natural habitats *H. sosnowskyi* develops large stands, e.g. in meadows, river valleys and forest fringes as well as on flood-plains of rivers and lakes. Hogweeds form dense stands vigorously invading and overwhelming the native plant communities. The newly emerged neophyte community is often nearly monodominant and poor in species (Laiviņš and Gavrilova 2003).

## **Reproduction and life cycle**

There are differing opinions about the life span of this species in Latvia. One opinion is that it is a biennial plant - in the first year it forms a large rosette and strong root system, in the second - great size and inflorescence with a considerable number of seeds. After fruiting the plant dies. Another opinion is that *H. sosnowskyi* is a perennial plant. Evidence supporting this opinion is the different rate of seed germination in the period of post-maturation, which can last 2 - 4 years. Another support for this view is the competition between the hogweeds in which some plants are not able to produce inflorescence 2 - 5 years after another. Therefore, seed production and life span lasts between 3 - 6 years, sometimes even longer.

Studies have been carried out in which the seedset was excluded by mowing before the inflorescence was formed. The results showed that in the second and following years the species was able to survive the winter and produce seeds and then die after flowering.

Many practical workers consider that even when the mother plant dies, the off-root buds are able to produce shoots giving rise to new plants and in such a way become perennial plants. The new shoots of *H. sosnowskyi* are rather cold resistant and can survive -4 to -7 °C. It is found that starting from the second year they can survive down to -25 °C and under a snow cover even down to -45 °C. *H. sosnowskyi* is a light demanding plant and at the beginning of their growth they do not survive in shade (Oboļeviča 2001).

## **Dispersal and spread**

Several main modes of seed dispersal are known, some are natural and some are human assisted. The description of seed dispersal is based on studies on *H. mantegazzianum* but the same of them applies to *H. sosnowskyi*. Populations often occur along streams and then water can spread seeds very efficiently, in large numbers and over considerable distances. Long-distance dispersal events that transport the seeds far from the source population are important mechanisms of plant dispersal, e.g. during extreme events such as floods. Wind is an important vector of local dispersal, especially in winter when seeds are blown over the frozen or snow-covered soil surface.

*H. sosnowskyi* is also spread by various human activities. Roadside ditches and margins are among the most typical habitats and seeds may stick to tires of passing cars and can be spread far from the place where they were produced. Other mechanisms of seed dispersal by human activities are translocation of seeds with soil or dispersal of seeds attached to clothes or animal fur, e.g. sheep and cattle. If suitable sites are available, a high rate of spread is possible on both local and regional scales (Nielsen *et al.* 2005, Laiviņš and Gavrilova 2003). *H. sosnowskyi* is used as a decoration when dry which also perhaps contribute to the human-assisted dispersal of seeds.

## **Impact**

### **Affected habitats and indigenous organisms**

*H. sosnowskyi* stands may range in extent from square metres to hectares, and small patches, linear stands or fringes can be found, e.g. along a streams, or scattered individuals. Even narrow stands may be conspicuous owing to the large stature of the species. The density of populations of hogweed may also vary considerably. In large stands, density may range from sparse growth (1-3 adult individuals/10 m<sup>2</sup>) to covering almost the entire ground area (more than 20 adult individuals/10 m<sup>2</sup>) (Nielsen *et al.* 2005).

Over the last 20 years *H. sosnowskyi* communities have spread intensively in Latvia mostly in human-created and semi-natural habitats (Laiviņš and Gavrilova 2003). The enormous height and leaf area of *H. sosnowskyi*, extraordinary for herbaceous species, enable them domination over most of indigenous plant species and hence make them strong competitors for light. In dominant stands, up to 80% of the incoming light is absorbed by hogweed, thus suppressing other light demanding species (Nielsen *et al.* 2005). When the hogweeds have taken root they thus form their own community (Oboļeviča 2001). *H. sosnowskyi* often reaches high densities in abandoned grasslands and ruderal habitats, leading to a strong decline in the species richness of the invaded habitats (Nielsen *et al.* 2005).

### **Genetic effects**

Species of the genus *Heracleum* can hybridize causing confusing in species identification (Gavrilova 2003; Anonymous 2009). Hybridisation with the native *Heracleum sibiricum* and *H. spondylium* and other introduced hogweeds are possible (Z. Gudžinskas, pers. comm.).

### **Human health effects**

*H. sosnowskyi* represents a serious health hazard for humans. The plant exudes a clear watery sap, which contains several chemicals that are activated in sunlight known as photosensitising furanocoumarins (synonym for furocoumarins). In contact with the human skin and in combination with ultraviolet radiation, these chemicals cause burnings of the skin. The content of furanocoumarins varies among plant parts; however, during the season skin contact should be avoided at any time even in the absence of sunlight (specifically ultraviolet radiation). The phototoxic reaction can be activated by ultraviolet radiation only 15 minutes after contact, with a sensitivity peak between 30 min and two hours. In addition, several furanocoumarins have been reported to be carcinogenic (i.e. they cause cancer) and teratogenic (i.e. they cause malformations in the growing embryo).

After a period of about 24 hours, flushing or reddening of the skin (erythema) and excessive accumulation of fluid in the skin (oedema) appear, followed by an inflammatory reaction after three days. The reaction of the skin will also depend on individual sensitivity. Approximately one week later, hyperpigmentation (unusual darkening of the skin) occurs on the affected areas, which can last for months. The affected skin may remain sensitive to ultraviolet light for years. Moisture, e.g. sweating or dew, and heat enhance the skin reaction (Nielsen *et al.* 2005).

### **Economic and societal effects (positive/negative)**

In the former Soviet Union *H. sosnowskyi* was cultivated in experimental farms as a prospective forage (silage) crop and honey plant. In parts of northern Russia, cultivation of the plant is still continued (Nielsen *et al.* 2005). In Estonia there are still bee keepers who believe it is a good honey plant and refuse to let eradicators on their land (M. Linnamägi, pers. com.).

Today majority of the escaped *H. sosnowskyi* populations are out of human control throughout the east Baltic region. There are several methods to control *H. sosnowskyi*, but all of them require resources (Nielsen *et al.* 2005). In open areas the hogweed control is mostly an economic and agriculture organizing problem, than a technological one. The elimination of the species is more complicated on shores, in ditches and on roadsides, where the use of herbicides is restricted or not allowed (Oboļeviča 2001). The cost of controlling all invasive hogweeds varies considerably depending on the control method used (Nielsen *et al.* 2005).

## Management approaches

### Prevention methods

*H. sosnowskyi* is included in the lists of the most aggressive alien species in all Baltic States (Gavrilova 2003). It is also included in the European and Mediterranean Plant Protection Organization (EPPO) list of invasive alien plants.

It is necessary to raise public awareness on the rapid spread of this species and at the same time motivate land managers by providing control methods, work safety regulations and financial support. It is particularly important to eradicate the established populations from river banks to restrict the rapid spread into natural riparian habitats.

In Estonia and Latvia *H. sosnowskyi* is listed as invasive species and systems for its control and monitoring are established. Cultivating, importing and selling of this species in both countries are prohibited by law.

In Estonia the species is listed as non-native invasive species in the Estonian Nature Conservation Act (2004) followed by action strategy and eradication guidelines including preliminary mapping of species distribution all over the country (M. Linnamägi, pers. com.). In Latvia the National Program of Hogweed Control (2006-2012) aimed at controlling and eradication of *H. sosnowskyi* was approved in 2005. The program proposes establishment of a coordinated hogweed control system including the responsibilities and administration of financial resources. In 2008 in Latvia two regulations regarding *H. sosnowskyi* were issued defining its invasivity, the responsible national executives, eradication methods, information and monitoring.

### Eradication, control and monitoring efforts

Currently used control methods comprise a variety of manual and mechanical methods, grazing and herbicide application (Table 2). Rather than recommending a single control method, a control program based on an Integrated Weed Management Strategy is preferred. The selection of control methods depends on the area covered by the plant, plant density and accessibility of the stand. Regardless of the control method, the management usually requires repeated and correct application in order to obtain satisfactory control. Accordingly, to make the most of the control efforts, the treatment of plants should be started early in the growing season and continue for several years until the soil seed bank is depleted and the root system has died. The cost of controlling tall invasive hogweeds varies considerably depending on the control method used. Differences in availability of equipment and price of labour will influence 'best choice' (Nielsen *et al.* 2005).

Afforestation is a special case of cover crop strategy that could be applied against such weeds as tall invasive hogweeds. There is variation among the different tall invasive hogweed species with respect to shade tolerance: *H. mantegazzianum* is less shade tolerant than *H. sosnowskyi* (Nielsen *et al.* 2005).

Population size	Control options	Estimated time effort	Notes
Few plants, 5-100 individuals	Root cutting	100 plants/hour (plants in their second growing season)	Labour expensive, but an effective and efficient method
	Mechanical cutting	100-200 plants in less than one hour when using a scythe	Less labour expensive than root cutting, but less effective
	Chemical control, spot treatment	100-200 plants/hour	Needs to comply with national rules and guidelines for herbicide use
Small colony, 100-1000 plants	Root cutting	100 plants/hour (plants in their second growing season)	Labour expensive, but efficient
	Mechanical mowing or cutting	Mechanical mowing by flail mower: 0.25-1 ha/hour Mechanical cutting by scythe: High density: 1500 plants/hour Medium density: 1,000 plants/hour Low density: 500 plants/hour	Machinery is required
	Chemical control	300 m <sup>2</sup> /hour	Hand-held equipment
	Grazing	(see below for scale of effort)	Should be considered if neighbouring areas are grazed
Large colony, >1000 plants	Ploughing, milling or mechanical mowing	Mechanical mowing by flail mower: 0.25-1 ha/hour	Machinery is required. Not all stands are accessible for heavy machinery
	Chemical control	0.5-1 ha/hour	Machinery is required
	Grazing	1000 hours per year for daily inspection and moving of 170 sheep distributed on 10 different areas	Total cost depends on the price of fencing, maintenance and inspection of the animals

**Table 2.** Recommended control options (Nielsen *et al.* 2005).

In Estonia the mapping of *H. sosnowskyi* colonies started in 2003 and was continued in the following years. Eradication works in Estonia started in 2005 as a small scale testing year and have continued ever since with enlarging of the eradication area annually. Area with eradicated colonies in the following years was 235 ha in 2005, 605 ha in 2006, 609 ha in 2007, 886 ha in 2008, 861 ha in 2009 and 1 210 ha in 2010 with about 435 000 EUR eradication budget. Since 2006, the eradication work has been done all over Estonia (M. Linnamägi, pers.com.).

In Latvia up to 2007 the distribution data and areas invaded by *H. sosnowskyi* were based on botanical records (*e.g.* Laiviņš and Gavrilova 2003, Priede 2008) and approximate estimations by local municipalities (Oboļeviča 2001). In 2007, the Latvian [State](#) Plant Protection Service began mapping of invaded areas allowing to estimate the actual distribution, rate of spreading and to monitor the eradication efforts (A. Garkāje, pers. comm.). In Latvia the eradication actions are ongoing throughout the country, though impeded by lack of continuous financial support and therefore being rather local, than nationwide.

In Estonia numerous problems appeared in practical eradication actions, *e.g.* eradication of *Heracleum* in rocky riversides (cannot use herbicides, manual removal nearly impossible), closed territories, border areas (inaccessible or successful eradication on the Estonian side is followed by

cross-border species immigration of new colonies) and eco-farms (use of herbicides is not allowed, while the invaded areas are too large for manual digging) (M. Linnamägi, pers.com.).

### **Information and awareness**

Only during the last few years the community has been informed about the negative impacts caused by *H. sosnowskyi*. Over the last decade, there have been numerous publications in press, information given on television and about this problem in the Baltic States. Documentary films on the best control methods and human health effects of *H. sosnowskyi* have been produced in Lithuania and [Estonia](#). In the Baltic States over the last years there have been a growing number of publications on hogweed in brochures, information in media and on the internet (see *Links* below).

### **Knowledge and research**

The Giant Alien Project (2002-2005), an EU research program, had as its main objective to develop an integrated management strategy that comprises effective, practicable and sustainable means of controlling an alien non-agricultural weed (*H. mantegazzianum*). One of the results was “The Giant Hogweed Best Practice Manual”, which includes descriptions and keys of invasive *Heracleum* species in Europe, gives guidelines for the management and control of *H. sosnowskyi* in Europe, provides examples of successful control of the plant by soil cultivation, chemical control and revegetation. The recommendations are especially suitable for former agricultural land that has not been cultivated for several years and other areas set aside from agriculture with heavy infestations of *H. sosnowskyi* (Nielsen *et al.* 2005).

Numerous studies on different aspects of *Heracleum* species in their invaded range in Europe were published in the *Ecology & Management of Giant Hogweed (Heracleum mantegazzianum)* by Pyšek *et al.* (2007).

In Latvia, studies on the species morphology, distribution and control methods were conducted at the Institute of Biology (Gavrilova 2003, Laiviņš and Gavrilova 2003), Latvian University of Agriculture (Bērziņš *et al.* 2003) and [Latvian](#) State Plant Protection Service. Since 2006, the administration of the nature-protected area North Vidzeme Biosphere Reserve organizes a public monitoring involving the local population in gathering the data on the distribution of *H. sosnowskyi*. Furthermore, investigations on plant communities with *H. sosnowskyi* were performed in 2002 – 2004 all over Lithuania (Gudžinskis and Rašomavičius 2005) and in 2002-2003 in Estonia (Holm 2005).

The history of invasion and actual status of *H. sosnowskyi* and *H. mantegazzianum* has been investigated in the area of the Sub Tatra Trough by Edward Walusiak (Walusiak 2005).

### **Recommendations or comments from experts and local communities**

See Giant Alien Project (Nielsen *et al.* 2005), Pyšek *et al.* (2007) and [EPPO](#) Bulletin.

## **References and other resources**

### **Contact persons**

Hans Peter Ravn (DK), Forest & Landscape Denmark, University of Copenhagen, Hoersholm Kongevej 11, DK-2970 Hoersholm, Denmark, E-mail: [hpr@life.ku.dk](mailto:hpr@life.ku.dk)

Bert Holm (EE), Institute of Agricultural and Environmental Sciences, Estonian University of Life Sciences, Riia 181, 51014 Tartu, Estonia, E-mail: [Bert@zbi.ee](mailto:Bert@zbi.ee)

Arto Kurtto (FI) Finnish Museum of Natural History, Botanical Museum, P.O.Box 7, FIN-00014 University of Helsinki, Phone: +358-9-191 8630, E-mail: [arto.kurtto@helsinki.fi](mailto:arto.kurtto@helsinki.fi)

Dora Jakobsdottir (IS), curator, Reykjavik Botanic Garden, Laugardalur, IS-104 Reykjavik, E-mail: [dora.jakobsdottir@reykjavik.is](mailto:dora.jakobsdottir@reykjavik.is)

Zigmantas Gudžinskas (LT), Institute of Botany, Žaliųjų Ežerų Str. 49, LT-08406 Vilnius, Lithuania, E-mail: [zigmantas.g@botanika.lt](mailto:zigmantas.g@botanika.lt)

Gertrūde Gavrilova (LV), Institute of Biology, University of Latvia, Miera 3, Salaspils, LV-2169, Latvia, E-mail: [gga@email.lubi.edu.lv](mailto:gga@email.lubi.edu.lv)

Svein Båtvik (NO) Directorate for Nature Management Tungasletta 2. NO-7485 Trondheim, Phone: +73 58 05 00, E-mail: [Svein-T.Batvik@dirnar.no](mailto:Svein-T.Batvik@dirnar.no)

Edward Walusiak (PL), Institute of Nature Conservation Polish Academy of Sciences, Department of Flora Conservation, Mickiewicza 33, PL-31-120 Kraków, Poland, E-mail: [walusiak@iop.krakow.pl](mailto:walusiak@iop.krakow.pl)

Olga Morozova (RU), Institute of Geography Russian Academy of Sciences, Laboratory of Biogeography, Staromonetny, 29, Moscow, 119017, Russia, E-mail: [biogeo@igras.geonet.ru](mailto:biogeo@igras.geonet.ru)

Melanie Josefsson (SE) Swedish Environmental Protection Agency, c/o Dept. of Environmental Analysis, P.O. Box 7050, SE 750 07 Uppsala. Phone: +46 18 67 31 48 Fax: +46 18 67 31 56, E-mail: [Melanie.Josefsson@snv.slu.se](mailto:Melanie.Josefsson@snv.slu.se)

## Links

[Giant Alien Project](#) (in eight languages)

[Heracleum mantegazzianum](#), *H. sosnowskyi* and *H. persicum* (EPPO Bulletin)

[Distribution of \*H. sosnowskyi\*, its control and limitation in Latvia](#) (in Latvian)

[Sites](#) invaded by *Heracleum sosnowskyi* in Estonia (photo gallery)

[Information](#) leaflet (in Estonian)

[Information leaflet \(in Estonian\)](#)

[Documentary film \(in Estonian and Russian\)](#), 2 links at the bottom of the page)

## References

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