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Heracleum sosnowskyi (*Apiaceae*) seed productivity and establishment in different habitats of central Lithuania

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A dangerous invader *Heracleum sosnowskyi* successfully spreads along roads, riverbanks and has naturalized in Lithuanian habitats and plant communities. It out-competes native species, thus changing ecosystems diversity, pushing autochthone species from native habitats, decreasing biodiversity and transforming landscape. This paper aims to evaluate *H. sosnowskyi* spread and establishment on habitat scale in Lithuania. Data on abundance, spatial distribution and contribution of *H. sosnowskyi* to plant biodiversity were collected from natural and anthropogenic habitats. Another objective was to evaluate the speed of spread in an infected landscape. Local assessments of the abundance of *H. sosnowskyi* by estimating variables of spatial penetrating and establishment in native plant communities on an individual block scale were carried out. Four population types with different density and coverage of species individuals were found. Species abundance was structured according to the distance from highway and significantly correlated (r = 0.7) with native plant community type. This species finds opportunities for colonization and reproduction resulting in decrease of natural diversity.

Key words: ecology, invasion, *Heracleum sosnowskyi*, habitat, Lithuania

INTRODUCTION

Biological invasions are one of the most significant environmental issues of the 21st century. Increasing human activity and transportation have resulted in a concomitant increase of alien plant spread into new habitats (Gulezian, Nyberg, 2010; Landis, 2003; Miller et al., 2010). Consequently, expansion of hemerophilous species changed native flora composition and represents one of the greatest threats to biodiversity worldwide and is considered a major driver of global change (Foxcroft, Pickett, Cadenasso, 2011; Mack et al., 2000; Mooney, Hobbs, 2000). Plant species ranked as invasive have a diversity of life cycles, habitats, etc. (Kącki, Michalska-Hejduk, 2010; Pyšek et al., 2004; Rejmánek et al., 2005). Invasive alien (non-native) species (IAS) overcome a different category of barriers, produce reproductive offspring, sustain populations and thus have the potential to spread over a considerable area (Kowarik, 2003; Moravcová et al., 2005; Richardson et al., 2000; Pysek et al., 2007). Moreover, about 10% of invasive plants that change the character, condition, form, or nature of ecosystems over substantial areas may be termed 'transformers' and thus must be taken under control (Morse et al., 2004; Pyšek, Richardson, 2008).

Heracleum sosnowskyi Mand. (cow parsnip, Sosnovskyi hogweed) has been included into EPPO List of invasive alien plants since 2006 and considered to raise the greatest threat to native species, biodiversity and ecosystems in the EPPO region and in Lithuania.

Several species of the genus *Heracleum* (*Apiaceae*) were introduced into Europe from south-west Asia in the 19th century and are now widespread

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in many countries (Jahodová et al., 2007; Kabuce, Priede, 2010). *H. sosnowskyi* is an invasive tall forb listed among 18 dangerous invader species successfully spreading across roadsides, natural riparian zones and forest edge habitats in Lithuania (List…, 2012). After successful naturalization in Lithuanian habitats and plant communities it acted compressively on native species and changing community composition as well as structure due to its high competition qualities. *H. sosnowskyi* originates in the central and eastern Caucasus and western, central, eastern and southwestern Transcaucasia and in northeastern Turkey where it occurs in the upper forest belt of the southern slopes, mainly in meadows, clearings and forest edges (Jahodová et al., 2007; Nielsen et al., 2005). When expanding into new territories the species establishes in fertile soils and completely changes habitats, making huge damage on native flora and landscape. This giant plant is able to form pure stands and to change ecosystems diversity by pushing autochthones species from native habitats. Since plant competition is mainly for access to light therefore a plant that grows higher biomass (adds to the leaf area index) also creates negative feedback in the form of more self-shading and shading of its neighbours. Consequently, only shade-tolerant species persist in the community (Finnoff, Tschirhart, 2009). Since this species accumulates hard biomass, the growth of neighbouring native species becomes less effective in absorbing energy and nutrient materials owing to shading from giant invader plants of *H. sosnowskyi*. It establishes in the following habitats: pastures, river banks, roadsides and rail networks, wastelands. When the plant is established, its huge size, rapid growth and voluminous green mass suppress neighbouring plant species, hence forming a single-species stand.

This species was originally described by Mandenova in 1944 (Mandenova, 1951; Lapiņš et al., 2002; Oboļeviča, 2001). It was promoted as a crop for northwest Russia, where it was intentionally first introduced in 1947. From the 1950s (Satsyperova, 1984) onwards, it was introduced as a potential forage crop to Latvia, Estonia, Lithuania, Belarus, Ukraine and the former German Democratic Republic (Nielsen et al., 2005). Initially *H. sosnowskyi* was introduced as fodder plant in the sixth decade of the last century at the Institute of Biology and Botany (Biologijos ir…, 1953), Research Station of Lithuanian University of Agriculture (Krikščikas, 1970 unpubl.) and as honey plant by personal initiatives in other places of Lithuania. The species therefore has been spreading over Lithuania probably through several independent introductions: formerly escape from cultivation and currently spread from roadside (Gudžinskas, 1998). *H. sosnowskyi* has two major impacts: 1) it suppresses growth of native plants and associated fauna; 2) similarly to other genus species, the plant contains bioactive composites, since allergic furanocumarine is accumulated in all parts (Burlėgaitė et al., 2012; Firuzi et al., 2010; Langley, Criddle, 2006; Langner, Maibach, Maier, 2010). Direct skin contact with the plant induces extreme photosensitivity, which in turn can lead to severe, slow to heal burns and scarring. Costs are incurred therefore both for medical treatment and in implementing to keep the plant under control (EC 2001).

The rapidly increasing number of alien species and their tremendous costs to the environment and society suggests an urgent requirement for decision-making tools for the management of plant invasions and the regulation of plant trade in order to diminish the risks of new introductions (Pimentel, Zuniga, Morrison, 2005). In accordance with one of the foremost EU goals to prevent degradation of biodiversity, it is important to find effective measures to cut off the spread of neophyte *H. sosnowskyi* in Lithuanian natural grassland and forest habitats.

The objective of this study was to assess the invasion and impacts of *H. sosnowskyi* on native habitats and to record the distribution and abundance of the species in the most heavily invaded landscapes with regard to different habitat types.

MATERIALS AND METHODS

H. sosnowskyi and other allied species belonged to *Heracleum* sect. *Pubescentia* (*H. pubescens, H. mantegazzianum, H. sosnowskyi and H. sommieri*). Their recent anthropogenic habitats cover near all Europe except Arctic, Mediterranean regions and temperate zone of Asia and North America.

Lithuania is situated in the very centre of Europe on the Baltic Sea and has a temperate climate

with 660 mm precipitation (Lithuanian climate, 2007), 17 °C and 4 °C summer and winter mean temperature, respectively. A plant data set (6 km × 10 km area) was pre-selected for screening in the central part of Lithuania, in Akademija, Kaunas district, near important invasion corridor–intensive traffic highway *Via Baltica* during 2000–2010. Species biodiversity was registered by the most widely used method of habitat general vs. species list. Relevés (200.0 m^2) in 5 replications were set out along transects in each study site. The sample therefore encompassed 55 plots / relevés in total recorded in six habitats (abandoned grasslands, open riverbanks, open roadsides, wastelands, forest edges, housing areas) (Table 1). The initial test data were obtained during summer (June–July) at the flowering stage of species. The registered plant species were listed following the commonly used taxonomical and nomenclature interpretation (Jankevičienė, 1998). The following criteria of modified Braun-Blanquet scale (Kent, Coker, 2003) were used as the basis for plant relevance: species diversity / abundance and frequency in six habitats. Invasion percentage of *H. sosnowskyi* was defined as the ratio between the area of species stands and the total area of the respective habitat type (Table 1) within the study areas (Thiele, Otte, 2008). Habitat saturation was defined as the ratio of the area covered by *H. sosnowskyi* within the stands and the total area of the habitat type (Pyšek, Pyšek, 1995). Data of *H. sosnowskyi* invasion regional patterns were used to create a ranking of invasion intensity by summing up weights allocated to estimated frequency classes and maximum stand sizes, with higher frequencies and larger stand sizes receiving higher weights. This plant data set *H. sosnowskyi* as an invasive species of EPPO present in Lithuania. This species is enlisted in EPPO A2 (A2/355) since 2006 (Kabuce, Priede, 2010) and in Lithuanian National List (2012) of exterminate plants. Both published and unpublished floristic data were analyzed. The alien plant was ranked using the categories of classification system of Richardson et al. (2000). Additionally, the generative productivity of *H. sosnowskyi* was evaluated by counting mericarps in compound umbels per plant (terminal and lateral) and measuring umbels diameter (cm) in three replications. Seed number was obtained by multiplying that of mericarps by two.

The significance of species response to *H. sosnowskyi* invasion was verified using one-way analysis of variance (ANOVA). Standard error (SE) of the presentation of each species was recorded in investigated sites at statistical significance $p < 0.05$.

RESULTS

H. sosnowskyi was found established in differently anthropogenized habitats. More specifically, the species established in natural habitats (open riverbanks, forest edges) as well as in human affected territories, namely abandoned grasslands, open roadsides, wastelands and housing areas (Table 1).

The species seed maturity occurred in August–September of 2nd or 3rd vegetation period, consequently indicating complete plant acclimatization to the Lithuanian temperate climate (Table 2).

Table 1. **Assessed habitats and other land-cover types**

Habitat type	Location	Key traits
Abandoned grasslands	54°90'27"-83N, 23°83'09"-12E; 54°90'30"-60"N, 23°83'66"-63"E	More or less nutrient rich sites which have not been subject to regular land use in recent years
Open riverbanks	54°90'30"-60"N,23°83'66"-63"E; 54°90'34"-37"N, 23°83'18"-23"E	Unshaded Nemunas riverbanks with herbaceous vegetation
Open roadsides	54°90'3"-50"N, 23°83'46"-48"E; 54°90'33"-75"N, 23°83'69"-95"E	Unshaded roadsides (verges, embankments) with herbaceous vegetation
Wastelands	54°90'27"-83"N, 23°83'09"-12"E; 54°89'60"-97"N, 23°83'25"-97"E	Heavily disturbed sites, such as sand pits, rotated areas, etc.
Forest edges	54°89'35"-41"N, 23°8'29"-67"E; 54°89'22"-33"N, 23°83'36"-37"E	Ecotonal zone between forest and adjacent vegetation and the outermost 10 m of the forest itself
Housing areas	54°89'34"-92"N, 23°82'14"-71"E	Areas of coherent plots used for housing

Table 2. ***H. sosnowskyi* growth stages in Lithuania**

Growth stage	Date
Germination	April–September
Seedlings	First vegetation season
Leaf clusters (rosette plants)	Each year (for 2–5 years) until the plant flowers
Maturity	On 2- or 3-year (on 4–6-year under unfavourable conditions: cuts, etc.)
Flowering	June–July (after cutting – in August–October)
Seed producing	August–September

Site-origin mature seeds were specific with a rather high quality, which was indicated by a significant germination (78% ± 0.15) after dormancy. This germination rate corresponded with rates (71–94%) determined by Moravcová et al. (2007) irrespective of the temperature regime and dormancy period following cold-stratification (≤2 months). Moreover, that ensured the early spring massive germination of *H. sosnowskyi* seeds, observed during research both in Lithuania and the Czech Republic.

Seedling growth began in early spring before the start of vegetation of other plants. Thus *H. sosnowskyi* attempted to out-compete photophilous native species by shading during the 1st year. Indeed, seedling development was characterized by a rapid root growth during the first year. Seedling roots received over 0.4 m in the end of the 1st year vegetation period (Fig. 1).

Mature *H. sosnowskyi* successfully spread and develop substantial competition facilities due to giant body and high seed productivity (Table 3). Mature plant has pinnately divided leaves of 1 m in size, a hollow flowering stem with height up to 3 m (4.5 m); plant regrows from the large fleshy tap root in spring; stem diameter in basal part is 12–15 cm. Insect-pollinated, hermaphrodite

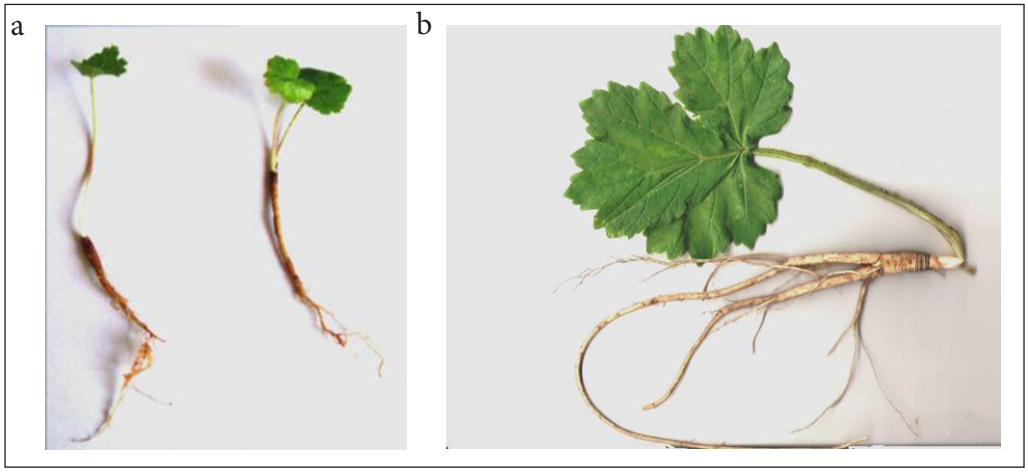

Fig. 1. *H. sosnowskyi* seedling growth during 1st year: a – at the end of June; b – in the beginning of November (Akademija, Kaunas distr.)

Table 3. **Seed productivity of *H. sosnowskyi* (* p < 0.05; ** p < 0.01)**

Habitat type	Terminal umbel			Lateral umbel			Fruit per plant, un.	Seed per plant, un.
	Diameter, m	Umbellet, un.	Fruit amount, un.	Diameter, m	Number per plant	Fruit amount, un.		
Abandoned grasslands	0.51	86	3 234	0.25	6	4 488	7 722	15 444*
Open riverbanks	0.84	72	3 224	0.30	7	4 858	8 082	16 164**
Open roadsides	0.51	86	3 126	0.32	8	4 944	8 070	16 140*
Wastelands	0.62	89	3 236	0.32	6	4 798	8 032	15 452*
Forest edges	0.58	87	3 234	0.31	7	4 490	7 726	16 064*
Housing areas	0.53	85	3 136	0.31	7	4 860	7 996	15 992*

flowers are arranged in compound umbels, with the terminal umbel being the largest one, up to 51–84 cm across its base (Table 3).

Some 6–7 lateral umbels are located below the terminal umbel. Umbels mature in sequence. The lateral inflorescence diameter ranged between 25 and 32 cm. Total plant generative production ranged between 7 722 and 8 082 mericarps with 15 444–16 164 seeds in all assessed habitats. As Moravcová et al. (2005) referred, *H. mantegazzianum* produces on average 10 000–20 000 fruits in Europe, with maximum occasionally reaching approx. 50 000 fruit. Being a smaller plant, *H. sosnowskyi* produces a lower amount of seeds compared to *H. mantegazzianum*. Additionally, it is also reported that an average plant of *H. sosnowskyi* produced 8 836 fruits in Leningrad area, Russia (Tkachenko, 1989). This number corresponds with our findings. Nonetheless, Moravcová et al. (2007) indicated that seeds are unable to survive for more than one season due to rapid germination in spring (95.2%) and later by the rapid decay of dormant seeds, thus the species seed bank might be classified as a short-term persistent.

The main spread corridor of *H. sosnowskyi* was located on the roadside of highway and river bank (Table 4). Initial populations of *H. sosnowskyi* generally occurred near roads and were composed of 1–2 individuals. The species established the largest populations in wasteland, rangeland, along roadsides. It also penetrated into semi natural and natural habitats (slopes, meadows, river banks, forest edges) where formed large populations during a longer period of 6–10 yrs in absence of interferences. Uncontrolled species formed large pure colonies composed from a few to several dozens of individuals and having high cover percent of 60–80% (100%). Along the roadside of *Via Baltica* (central Lithuania), *H. sosnowskyi* spread over 600 m during 2000–2010, i. e. with average linear speed of 60 m per year.

Different species were adjusted across the invaded habitats (Table 5).

Table 4. **Population types of *H. sosnowskyi* in Lithuania**

Population type	Habitat type	Area, m^2	Fructiferous individual, individual 10 m^{-2}	Density, plant 10 m^{-2}	Coverage, %
Solitary individuals	Roadside, abandoned grassland, forests, housing areas	n × m^2	1–2	1–3	5–10
Groups of individuals	Roadside, abandoned grassland, forests	1–10 m^2	1–3	3–8	20–30
Strips	Open riverbanks, forests edges, roadside	1–10 m width × n × 10–100 m length	1–3 – n × 10	2–8 – n × 10	10–30
Large pure colonies	Roadside, abandoned grassland, wastelands		n × 10–100	1–3 (20) – n × 10– 1 000 individuals	60–80% (100%)

Table 5. **Frequency (%) of adjusted constant species in different communities with *H. sosnowskyi* (mean ± SE, p < 0.5)**

Habitat type	Constant species	Frequency, %
Abandoned grasslands	*Anthriscus sylvestris*	51.9 ± 0.11
	Aegopodium podagraria	79.8 ± 0.20
	Artemisia vulgaris	80.9 ± 0.13
	Cirsium arvense	56.9 ± 0.10
	Dactylis glomerata	76.2 ± 0.20
	Festuca pratensis	77.1 ± 0.18
Open riverbanks	*Artemisia vulgaris*	66.5 ± 0.21
	Oenothera biennis	55.7 ± 0.14

Table 5 (continued)

Habitat type	Constant species	Frequency, %
Open roadsides	*Aegopodium podagraria*	79.8 ± 0.20
	Dactylis glomerata	80.9 ± 0.13
	Festuca pratensis	76.9 ± 0.10
Wastelands	*Artemisia vulgaris*	51.9 ± 0.11
	Erigeron canadensis	79.8 ± 0.20
Forest edge	*Acer platanoides*	65.0 ± 0.18
	Geum rivale	62.5 ± 0.12
	Lysimachia nummularia	62.5 ± 0.15
	Plagomnium undulatum	62.4 ± 0.19
Housing areas	*Anthriscus sylvestris*	51.9 ± 0.11
	Aegopodium podagraria	77.8 ± 0.12
	Artemisia vulgaris	48.9 ± 0.16
	Dactylis glomerata	76.2 ± 0.20

Comparison of species lists with historical data documenting pre- and post-invasion by *H. sosnowskyi* indicated that herbaceous species in grass-communities were less resistant than those of tree-communities (forest edge). Additionally, a number of native species exhibited reduced cover abundance resulted by *H. sosnowskyi* invasion in different habitats (Fig. 2).

The highest reduction (43%) of relative cover was observed in invaded grasslands, meanwhile it composed 75% in forest edges. Consequently, the highest invasion percentage (12.3%) was found in open roadsides and was followed by abandoned grasslands (6.70%), wasteland areas (2.40%), open riverbanks (1.20%) (Fig. 3).

DISCUSSION

Determined biological peculiarities and high seed fecundity contribute to the species rapid spread and thus place it amidst the minority of invaders which are extremely successful (Pyšek et al., 2004; Moravcová et al., 2005; Mandák, Pyšek, Bímová, 2004). Moreover, due to long lignified tap root this monocarpic perennial plant is resistant to cutting and fire. However, the species

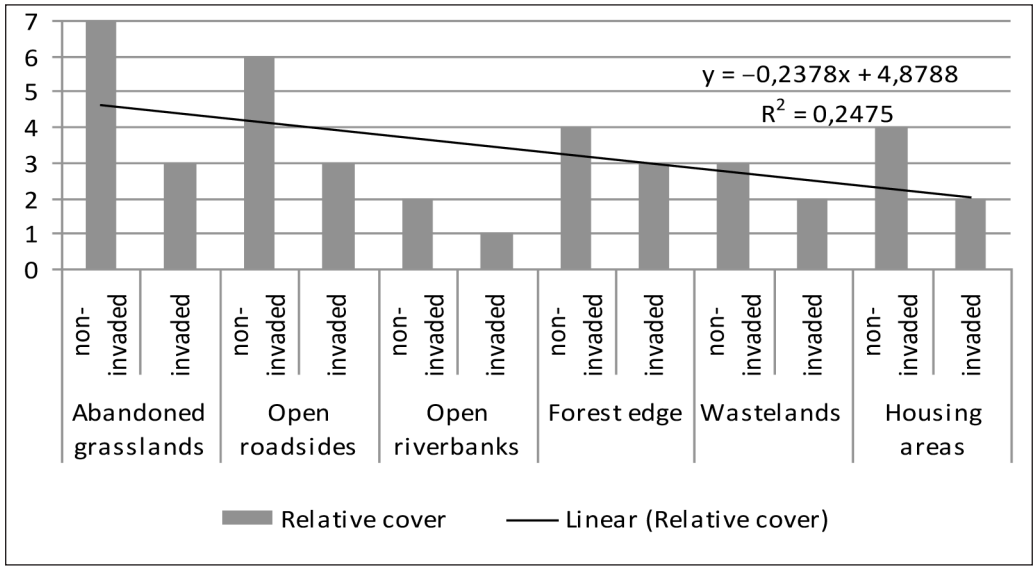

Fig. 2. Mean diversity (species number) of native species in non-invaded and invaded habitats

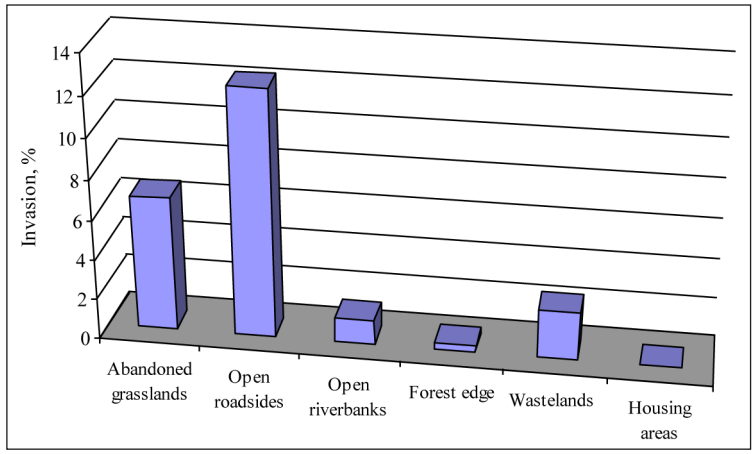

Fig. 3. Invasion (%) of *H. sosnowskyi* in different habitat

does not spread vegetatively and grows rather heavily in the 1st year seedlings. Plant starts to grow intensively in the 2nd or 3rd year of complete maturity, bringing up only basal leaves and producing high seed yield. Approximately a half of this amount produces the main inflorescence. Studies of the traits of invasive plants have documented that certain reproductive characteristics are crucial for their success (Šerá, Šerý, 2004). Mandák et al. (2004) argue that certain alien species rely exclusively on vegetative reproduction, however the majority depend on seed dispersal. *H. sosnowskyi* was originally introduced intentionally for economic purposes and even though it does not spread vegetatively, it is reported to live up to 6 years when planted for biomass and silage production (Satsyperova, 1984). Relatively long persistence of this monocarpic invading species provides access to available resources. Moreover, Foxcroft et al. (2011) highlighted that the invasive species peculiar with greater success in resident community can minimize other aliens' chances of invasion within the site.

As many other IAS (Wadsworth et al., 2000; Weber, 2003), *H. sosnowskyi* generally spreads from road and establishes the largest populations in wasteland, rangeland, along roadsides occupied by herbaceous species which invader easily competes. Low *H. sosnowskyi* penetration and abundance occurred in undisturbed natural habitats (slopes, meadows, river banks, forest edges). Similar proliferation has been reported for different exotic species such as *H. mantegazzianum* (Pimentel, Zuniga, Morrison, 2005). The observed species initially spread across disturbed anthropogenized habitats which, indeed, make up most of the modern landscapes according to Rejmánek et al. (2005), who defined several factors contributing to the success of invasive plant species. Contrary to the previous studies (Grotkopp, Rejmánek, 2007), the invader spread at a high rate, viz 60 m per year, which contributed to invasion into slopes along roadside of *Via Baltica* and neighbouring habitats. Such robust spread of *H. sosnowskyi* is mostly determined by certain advantageous biological characteristics: intensive light competition due to giant height and diameter (3 m); high seed germination (78 ± 0.15) and seedling growth in early spring before the start of vegetation of other plants; high survival of juvenile individuals; just one seedling is enough to proceed new invasion; high seed production and penetration into new territories. Similar competition outcomes are specified for other invader species, e. g. *H. mantegazzianum* (Moravcová et al., 2005). Furthermore, the invader is able to form developed plantations (0.5 ha) of different size and density which expand by 1 200 m^{-2} per year. These plant peculiarities resulted in high invasiveness capacity and thus successful spread over the territory of Lithuania throughout 20–30 years.

Depending on environmental conditions and population age *H. sosnowskyi* forms populations of different type and size covering from several m^2 to several ha and including several hundred matured fructiferous individuals. According to Grotkopp and Rejmánek (2007), such productive populations guarantee high yields of seed and thus

intensive species penetration into neighboring territories. Therefore extermination of mature plants and thus interrupting seed formation might be an effective control measure for spread prevention of this monocarpic plant.

H. sosnowskyi successfully passed habitats filters demonstrating high ecologic plasticity and invasiveness extent such as penetration into anthropogenized, semi natural and natural communities as described by Godefroid (2001), Kolar and Lodge (2001), Landis (2003) for other alien species.

It was estimated that 80% of *H. sosnowskyi* colonies were established in anthropogenized areas, namely wastelands, roadsides, and housing areas, whereas merely 20% of the colonies penetrated into natural habitats: forests and their edges (about 200 ha), riverbanks, meadows, etc. Consequently, the spread of exotic species into natural communities is a threat to native biological diversity and the functioning of ecosystems. Moreover, it occurs at a risk rate in some studied sites. Thus, invasive species management and control are increasingly urgent when facing the need to handle new plant invasions.

This study was focused on comparison of resident species composition and cover across invaded habitats. Whereas direct control of habitat was impossible, comparison of species lists with historical data documenting pre- and post-invasion by *H. sosnowskyi* indicated that herbaceous resident communities were specific with higher reduction in cover abundance of native species compared to those of forest edge. These findings are related to different competing and shade-tolerant characteristics of resident species (Kolar, Lodge, 2001; Weber, 2003).

The most evident floristic changes occurred in pine forest habitats: specific for this forest type mosses (*Pleurozium schreberi, Ptilium crista-castrensis*) were superseded by species specific for deciduous and mixed forests (*Plagomnium undulatum, Eurhynchium angustirete, Atrichum undulatum*). *H. sosnowskyi* transformed plant communities of forest edges therefore resulting in establishment of spring ephemerides (*Anemone nemoralis, Ficaria verna*), shade-tolerant (*Geum rivale*, *Glechoma hederacea, Lysimachia nummularia*) and ruderal (*Anthriscus sylvestris, Cirsium arvense, Urtica dioica*) species. The results showed that hogweed out-competed native species by limiting their diversity as well as cover abundance in community. This invasive plant hence needs development of monitoring and control in order to prevent its spread in Central Europe (Nehrbass, Winkler, 2007).

Hogweed indicated that native communities change their structure and composition by pushing out indigenous species or tolerating only some of shade-tolerant plants. The landscape, consequently, lost its original habitats (Kopeć, Halladin-Dąbrowska, Zając, 2011). Such aggressive invaders that change character, conditions, form or nature of ecosystems over substantial areas may be named 'transformers' (Pyšek et al., 2004; Richardson et al., 2000; Weber, 2003).

Higher abundance percentage of invader indicated lower resistance of native herbaceous plants in habitats. In a wider approach (Kącki, Michalska-Hejduk, 2010; Crossman, Bryan, Cooke, 2011; Słowińska, Słowiński, Lamentowicz, 2010), a global transition of climate resulted in a concomitant increase of *H. sosnowskyi* spread and establishment level into new habitats, e. g. in Lithuania. Invasion percent lower than 1% was observed in the remaining invaded habitat types (housing areas, etc.), possibly due to management measures in accordance with Poschlod et al. (2005). In summary, high level of invasion intensity in roadsides and abandoned grasslands indicated invasion success and therefore stressed the need for more attention of nature conservation authorities for those habitat types.

CONCLUSIONS

H. sosnowskyi is an aggressive invader in Lithuania and therefore can be considered as transformer and noxious invasive species. Highway roadsides present the main invasion corridor of *H. sosnowskyi* in central Lithuania. Abundant seed production (7 722 and 8 082 mericarps with 15 444–16 164 seeds) and significant germination (78% ± 0.15) after dormancy provide species effective generative propagation and spread across the invaded habitats. 80% of *H. sosnowskyi* colonies were established in anthropogenized areas: wastelands, roadsides and housing areas, and merely 20% of colonies penetrated into natural habitats. Significantly ($r = 0.7$) the highest invasion percentage (12.3%) was found in open roadsides and was

followed by abandoned grasslands (6.70%), wasteland areas (2.40%), open riverbanks (1.20%). As rapidly increasing number and linear spread (60 m per year) of *H. sosnowskyi* has significant negative consequences for both human enterprise and native ecological systems there is a pressing need to mitigate the impacts of species biological invasion by finding effective control measures. Evaluation of this IAS representing ecological risk is an urgent task for future studies at the national level and local analyses covering larger area are also necessary.

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HERACLEUM SOSNOWSKYI (*APIACEAE*) SĖKLŲ PRODUKTYVUMAS IR ĮSITVIRTINIMAS ĮVAIRIOSE VIDURIO LIETUVOS AUGAVIETĖSE

S a n t r a u k a

Pavojingas invazinis *Heracleum sosnowskyi* sėkmingai plinta pakelėmis, upių šlaitais ir įsitvirtina Lietuvos augavietėse bei augalų bendrijose. Jis nukonkuruoja vietines rūšis, keisdamas ekosistemų įvairovę, išstumia autochtonines rūšis iš natūralių augaviečių, mažindamas bioįvairovę ir transformuodamas kraštovaizdį. Šio darbo tikslas yra įvertinti *H. sosnowskyi* plitimą ir įsikūrimą Lietuvos augavietėse. *H. sosnowskyi* gausumo, erdvinio paplitimo ir reikšmės augalų bioįvairovei duomenys buvo nustatyti natūraliose ir antropogeninėse augavietėse. Kitas tikslas buvo įvertinti plitimo greitį pažeistame kraštovaizdyje. Vietiniai *H. sosnowskyi* gausumo tyrimai buvo atlikti nustatant erdvinį įsiterpimą ir įsikūrimą atskiruose natūralių augalų bendrijų plotuose. Nustatyti keturi rūšies individų įvairaus tankumo ir padengimo populiacijų tipai. Rūšies gausumas apibrėžtas pagal atstumą nuo greitkelio ir reikšmingai koreliavo su natūraliu augalų bendrijos tipu (r = 0,7). Nustatytos *H. sosnowskyi* galimybės kolonizuoti ir daugintis mažinant natūralią bioįvairovę.

Raktažodžiai: ekologija, invazija, *Heracleum sosnowskyi*, augavietė, Lietuva