

SPREAD AND CONTROL OF SOSNOWSKY'S HOGWEED IN REZEKNE MUNICIPALITY

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Abstract. As the area invaded by Sosnowsky's hogweed increased in Rezekne municipality, an increasing number of local residents, including agricultural land owners/managers could suffer from coming into contact with this plant. According to research studies, invasive species promote uncontrolled changes in the ecosystem, endangering agriculture and negatively affecting the economy. The research aim is to examine the spread of Sosnowsky's hogweed and the opinions of local residents on the control of this invasive species in Rezekne municipality. Sosnowsky's hogweed spreads in Latvia as a whole, including Rezekne municipality. In the rural territory of Berzgale of Rezekne municipality, Sosnowsky's hogweed has spread the most. A survey of randomly selected territories did not identify considerable differences in the spread of Sosnowsky's hogweed between 2012 and 2016. According to a survey of residents living in Rezekne municipality, the residents chose mainly the cheapest methods to control Sosnowsky's hogweed, and only a small proportion of them believed that they had sufficient knowledge of control methods for Sosnowsky's hogweed. The present research employed the following research methods: monographic and descriptive, analysis, synthesis, statistical analysis and a sociological method – a survey. The Wilcoxon test was employed to analyse field data and compare territories. The Statistical Package for the Social Science (SPSS) and the tools of the R program and Microsoft Excel were employed to process the data. The research was based on the survey of residents, research papers, field studies, State Plant Protection Service data, information provided by Rezekne municipality and other information sources.

Key words: Sosnowsky's hogweed, agricultural land owners/managers, residents, weed control.

JEL code: Q5, Q1

Introduction

The spread of invasive species is a global problem. The Plant Protection Law of the Republic of Latvia (Augu aizsardzības likums, 1999) defines an invasive species as an untypical species for the nature of Latvia that endangers local species and their habitats or causes economic losses and harm to the environment or human health.

The spread of invasive species that displace local ones is increasingly discussed.

One of such species is Sosnowsky's hogweed (*Heracleum sosnowskyi Manden*), which is included in Latvia's list of invasive species (Invazīvo augu sugu saraksts, 2008) and causes problems for agricultural land owners and managers, as well as local residents in Rezekne municipality.

Researchers Sims C., Finnoff D. (Sims C., Finnoff D., 2013) point out that invasive species promote uncontrolled changes in the ecosystem, endanger farming and negatively affect the economy. For this reason, a number of countries as well as their municipalities and other administrative organisations address the

identification, assessment and reduction of damage caused by the invasive plant species.

As the area invaded by Sosnowsky's hogweed increased in Rezekne municipality, an increasing number of local residents, including agricultural land owners/managers could suffer from coming into contact with this plant.

Researchers Haight R.G., Mehta S.V., Homans F.R., Polasky S. (Haight R.G., et al., 2007) point out that in the past decades in the world, both scientists and governments and their responsible institutions focused mainly on the control of the species that became too uncontrollable rather than on timely identification of the spread of the species. If more resources are exploited especially for the identification of danger caused by plant species when they only start spreading in a particular territory, it would be possible to save large amounts of funds on controlling the plants later.

Research hypothesis: Rezekne municipality residents, including agricultural land owners/managers have sufficient knowledge about how to control Sosnowsky's hogweed.

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Research aim: to examine the spread of Sosnowsky's hogweed and the opinions of local residents on the control of this invasive species in Rezekne municipality.

Specific research tasks:

- 1) To summarise information on the spread of Sosnowsky's hogweed in Rezekne municipality as well as to selectively assess Sosnowsky's hogweed control areas in the municipality.;
- 2) To conduct a survey of Rezekne municipality residents, including agricultural land owners/managers, and analyse the survey results.

Research methods employed: monographic and descriptive, analysis, synthesis, statistical analysis and a sociological method – a survey. The Wilcoxon test was used to analyse field data in comparison of territories. The Statistical Package for the Social Science (SPSS) and the tools of the R program and Microsoft Excel were employed to process the data. The research was based on the survey of residents, research papers, field studies, State Plant Protection Service data, information provided by Rezekne municipality and other information sources.

Research results and discussion

1. Spread of Sosnowsky's hogweed in Rezekne municipality

The State Plant Protection Service has performed an assessment of the spread of an invasive plant species – Sosnowsky's hogweed – in the territory of Latvia. In Latvia, 10801 ha of land invaded by Sosnowsky's hogweed were identified in 2016, which was 1.5 % more than in 2013. Sosnowsky's hogweed has spread the most in the regions of Vidzeme and Latgale (Table 1).

According to the information provided by Rezekne municipality, which was submitted by land surveyors in 2012, Sosnowsky's hogweed was present in 16 out of 25 rural territories of the municipality in a total area of 84.34 ha. In 2016, according to the State Plant Protection Service, the area overgrown with Sosnowsky's hogweed in the administrative territories of Rezekne

municipality totalled 239.29 ha. It has spread the most in Berzgale rural territory – in an area of 57.38 ha in 2012 (Rezeknes novada., 2016). and 176.11 ha in 2016 (Valsts augu., 2016) (Table 1). (Rezeknes novada., 2016).

Table 1

Administrative territories invaded by Sosnowsky's hogweed in the regions of Latvia in 2013 and 2016

Administrative territory	Area in 2013		Area in 2016		2016/2013 (+/- %)
	ha	%	ha	%	
Kurzeme region	938.29	8.82	915.64	8.48	-2.4
Latgale region	2360.98	22.18	2373.53	21.97	0.5
Riga region	1750.36	16.45	1732.51	16.04	-1.0
Zemgale region	1358.53	12.76	1334.44	12.35	-1.8
Vidzeme region	4234.82	39.79	4445.29	41.15	5.0
Total	10642.98	100.00	10801.41	100.00	1.5

Source: authors' calculations based on State Plant Protection Service data, 2016

Table 2

Spread of Sosnowsky's hogweed (ha) in the rural territories of Rezekne municipality in 2012 and 2016

No	Rural territory	Hectares 2012	Hectares 2016
1	Berzgale	57.38	176.11
2	Silmalas	7.99	3.85
3	Nagli	7.3	8.3
4	Makonkalns	4.6	15.46
5	Cornaja	3.14	10.22
6	Ozolmuiza	3.12	17.74
7	Ozolaine	0.9	1.4
8	Feimani	0.55	1.31
9	Veremi	0.5	0.49
10	Luznava	0.31	0.75
11	Griskani	0.27	1.38
12	Malta	0.11	0.03
13	Nautreni	0.1	1.24
14	Kaunata	0.06	0.97
15	Lendzi	0.05	0.02
16	Struzani	0.014	0.02
Total		84.39	239.29

Source: authors' construction based on information provided by Rezekne municipality; State Plant Protection Service data, 2016

Sosnowsky's hogweed present in the specially protected natural territories of Rezekne municipality as well as outside the territories negatively impacts their biodiversity and visual landscape values (Figure 1), reducing their aesthetic and biological quality. In Razna National Park, which is located in Rezekne municipality, Sosnowsky's hogweed is mainly present in unfarmed and abandoned areas, as well as in biotopes with specially protected species (Tripane E., 2013; Zvaigzne A., et al., 2016).

The research summarised information on 33 areas overgrown with Sosnowsky's hogweed in Rezekne municipality, of which 16 were located in Razna National Park and 16 in the nature reserve "Lubans Wetland", as well as a territory in the nature park "Lake Adamova". The data acquired in 2016 were compared with the data on Sosnowsky's hogweed-invaded areas obtained in 2012 from the master's paper "Spread and Control of Sosnowsky's Hogweed in Razna National Park and the Influencing Factors" written by Elina Tripane (Tripane E., 2013).



Source: Zvaigzne A., et al., 2016.

Fig. 2. Lake Lubans bank overgrown with Sosnowsky's hogweed in Rezekne municipality in June 2016, photo: A. Mezaka

Sosnowsky's hogweed control measures are implemented in Latvia, yet there is a lack of comparable data on its spread over time for particular sites.

The territories were represented by diverse biotopes: grassland, roadsides, shrubs, populated places, forest, the edge of a forest, watercourse banks, power-line paths, ditch banks, young forest stands and lake banks. The land survey identified seven Sosnowsky's hogweed control methods employed in Rezekne municipality: polythene sheeting, partial moving, full moving, partial road reconstruction, ploughing and bank strengthening; however, no Sosnowsky's hogweed control was done in some territories. The research found that in the territories surveyed Sosnowsky's hogweed was spread in a total area of 39.15 ha in 2012 (Tripane E., 2013) and 37.27 ha in 2016 (Zvaigzne A., et al., 2016).

The area of new territories where Sosnowsky's hogweed was identified for the first time was smaller than the area of the territories where the spread of Sosnowsky's hogweed decreased or increased.

No significant difference ($p > 0.05$) in the area with Sosnowsky's hogweed between 2012 and 2016 was identified for the selectively surveyed territories.

An area with Sosnowsky's hogweed increased the most in Razna National Park (16.23 ha in 2012 (Tripane E., 2013) and 18.11 ha in 2016) where six biotopes were represented: grassland, roadsides, the edge of a forest, shrubs, populated places and watercourse banks. The largest new area with Sosnowsky's hogweed (0.32 ha) was identified in grassland and shrub biotopes where the spread of the weed was not controlled. The greatest decrease in the area with Sosnowsky's hogweed (2.10 ha in 2012 (Tripane E., 2013) and 0.739 ha in 2016) was reported in the nature reserve "Lubans Wetland", on roadsides and the bank of lake Lubans where bank strengthening works and partial road reconstruction works were done. Polythene sheeting as a control method for Sosnowsky's hogweed was used only in the nature park "Lake Adamova" for managing the grassland area; in the result, the area with

Sosnowsky's hogweed decreased by 84 % in the period 2012-2016.

The research allows concluding that long-term monitoring for at least ten years is necessary for objectively assessing the spatial spread of Sosnowsky's hogweed (Zvaigzne A. et al., 2016).

In her doctoral dissertation, researcher Priede A. (Priede A., 2008) has pointed out that invasive species have to be regularly managed and controlled at the initial stage, which considerably increases the effectiveness of their control and requires much less financial and labour investment.

The reduction of the spread of Sosnowsky's hogweed in Rezekne municipality is possible only if engaging all the owners and managers of land; therefore, it is necessary to identify the opinions of local residents, including land owners and managers, about the control of Sosnowsky's hogweed in this municipality.

2. Results of a survey of Rezekne municipality residents

A survey of residents was conducted within the research; the purpose of the survey was to ascertain how well-informed the residents in Rezekne municipality are about Sosnowsky's hogweed and its control.

The survey involved 749 individuals. The questionnaires were distributed in all the 25 rural territories of Rezekne municipality.

Mostly women were involved in the survey (63.2 %), while men comprised 36.8 %.

The age groups of the respondents were diverse – beginning with the age of 18 through to the age of 62 and older.

The survey data regarding the question "Are you a manager and/or owner of agricultural land?" revealed that 64 % were agricultural land managers and/or owners. The remaining 36 % replied that they were neither land managers nor land owners.

An analysis of the spread of Sosnowsky's hogweed in Rezekne municipality by means of replies given to the survey question "Does

Sosnowsky's hogweed grow in your neighbourhood?" showed that most of the respondents (52.2 %) had not seen the weed in their neighbourhood. However, 29.5 % believed that this weed grew there, and only 18.3 % had no opinion about whether Sosnowsky's hogweed grew or did not grow in their neighbourhood.

According to the survey, 92.7 % of the respondents did not control Sosnowsky's hogweed themselves, and this fact explains why only 15.9 % wished to build up or obtain knowledge about the hazards caused by Sosnowsky's hogweed.

Despite the fact that a relatively small proportion of the respondents controlled Sosnowsky's hogweed – only 7.3 % –, yet their replies to the survey question "Why do you use this particular control method?" allowed ascertaining why particularly such methods were used to control the weed.

The survey results showed that the most often reason (34.5 %) why any particular control method for Sosnowsky's hogweed was used was the fact it was cheap. However, in 23.8 % instances the choice was made because the particular method was effective. Almost the same percentage of the respondents (22.6 %) chose their method because it was easy to use, while 12.1 % gave another reply, e.g. "I control it chemically because I do not know any other method", "there were only a few hogweed plants", "my neighbours helped me" etc.

An analysis of the reasons for the choice of any particular control method for Sosnowsky's hogweed broken down by age groups allows concluding that most respondents who controlled the weed themselves were aged 46-61, which may be explained by the fact that this age group owned land as well as had more experience in controlling the weed, thereby preferring a method that, first of all, was cheap (31.0 %), followed by the methods being effective and easy to use (19.0 % and 13.1 %, respectively). Younger respondents (aged 25 or under)

preferred easy-to-use methods to control Sosnowsky's hogweed.

The respondent replies to the question "Do you think that your knowledge of control methods for Sosnowsky's hogweed is sufficient?" showed whether the respondents rated their knowledge of control methods for the weed as sufficient.

Almost a fourth (22.6 %) believed that their knowledge of control methods for Sosnowsky's hogweed was sufficient. However, 36.6 % believed that their knowledge of such methods was not sufficient. Most respondents (40.9 %) did not know whether they had sufficient knowledge about the hazards caused by Sosnowsky's hogweed, as they never needed such a kind of knowledge.

To ascertain the opinions of the respondents on whether they would wish to build up their knowledge of methods for controlling Sosnowsky's hogweed, the authors summarised their replies to the question "Do you wish to build

up (or obtain) your knowledge of control methods for Sosnowsky's hogweed?".

Regardless of the fact that the reply "certainly not" was given by 10.7 % of the respondents, a high percentage of them replied "certainly yes" (11.3 %) and "rather yes" (44.9 %). However, 33.1 % replied "rather not". Accordingly, one can conclude that most of the respondents would wish to build up their knowledge of control methods for Sosnowsky's hogweed.

Table 2 3 shows the distribution of the replies of the respondents regarding whether their knowledge of the control methods for Sosnowsky's hogweed is sufficient and whether they would wish to enhance or acquire the knowledge.

As shown in Table 3, 73.4 % of the respondents who revealed that their knowledge of control methods for Sosnowsky's hogweed was insufficient wished to acquire the knowledge, giving the replies "certainly yes" and "rather yes".

Table 3

Distribution of the replies of the respondents regarding their knowledge of control methods for Sosnowsky's hogweed and their wish to build up or acquire the knowledge (n=749) (authors' calculations)

Questions, replies			I wish to acquire knowledge about the control methods for Sosnowsky's hogweed				Total
			Certainly yes	Rather yes	Rather not	Certainly not	
I have sufficient knowledge about control methods for Sosnowsky's hogweed	yes	Number	17	68	57	27	169
		Percentage	2.3	9.1	7.6	3.6	22.6
	no	Number	57	144	64	9	274
		Percentage	7.6	19.2	8.5	1.2	36.6
	I do not know because no such a knowledge was needed	Number	11	124	127	44	306
		Percentage	1.5	16.6	17.0	5.9	40.9
Total	Number	85	336	248	80	749	
	Percentage	11.3	44.9	33.1	10.7	100.0	

Source: Zvaigzne A., et al., 2016

It has to be mentioned that 44.1 % of the respondents who revealed that they did not ever need such a knowledge wished to acquire relevant knowledge, replying "certainly yes" and "rather yes".

The respondents who wished to acquire knowledge of control methods for Sosnowsky's hogweed provided replies to the question "In what way would you like to acquire such a knowledge?". This was a multiple choice question, and the respondents might give

multiple answers: articles in newspapers and magazines; booklets; special seminars; experience sharing trips; information in a book form or on websites.

According to the survey, most respondents (28.0 %) replied that they preferred obtaining information about control methods for Sosnowsky's hogweed on a special website for agricultural land management. The next most popular ways of obtaining information were as follows: booklets and newspaper articles (25.1 %) and magazines (23.7 %). However, the respondents aged 46-61 preferred receiving information about control methods for Sosnowsky's hogweed in a booklet form, while those aged 62 and over preferred newspapers and magazines. The respondents aged 19-25 equally preferred articles in newspapers and magazines as well as booklets.

Conclusions, proposals, recommendations

- 1) Local plant species are endangered with the spread of Sosnowsky's hogweed. In Rezekne municipality, Sosnowsky's hogweed was present in 16 out of the 25 rural territories in an area of 84.39 ha in 2012 and 176.11 ha in 2016.
- 2) No significant difference ($p > 0.05$) in the area with Sosnowsky's hogweed between 2012 and 2016 was identified for the selectively surveyed territories.

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- 3) Long-term monitoring for at least ten years is necessary for scientists to objectively assess the spatial spread of Sosnowsky's hogweed.
- 4) The hypothesis was not proved, as the survey showed that only a small proportion of the respondents believed that they had sufficient knowledge about control methods for Sosnowsky's hogweed, while 74.4 % thought they had insufficient relevant knowledge.
- 5) To enhance the knowledge of residents, including agricultural land owners/managers, about Sosnowsky's hogweed and the control methods for it, relevant information has to be available on websites for agricultural land management, e.g. those of the Ministry of Agriculture, the Rural Support Service and the Latvian Rural Advisory and Training Centre, so that all interested individuals could get the information fast and easily.

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