

PLANNING AND USE OF AREAS INFESTED WITH INVASIVE PLANTS: CASE OF LATVIA

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Abstract

Sustainable development of the national economy is based on the reasonable use of natural resources. Increase area of uncultivated agriculture land is one of the risk factors of land degradation in Latvia. Land degradation prevention measures, including restriction of invasive plant species, are carried out to fulfill overall interests of the society. In conditions of globalization, previously unknown plants purposely or accidentally propagate into Latvian environment, and their proportion is increasing. Many of these species are growing, multiplying and spreading rapidly in our climate, displacing native species, causing significant biological pollution and becoming dominant. Such aggressive species are called invasive. They have become a serious problem in natural ecosystems, creating problems for the protection of native plant species, preserving the visual value of traditional landscapes, and causing significant economic damage to the economy.

The aim of research is to analyse indicators characterizing abandoned economic activity territory – spread of invasive plants, their limitation and elimination. Restoring brownfields can improve land use and quality of landscape.

Keywords: invasive plants, land degradation, landscape, native species.

1. INTRODUCTION

To save the land as sustainable resource, in each country, also in Latvia, is confirmed own land policy, which is governed by the Environmental policy guidelines for 2014 to 2020, developed according to the Environmental Protection Law. As one of the land policy implementation measures is the land management, the aim of which is to promote sustainable land development and protection. In its turn, sustainable land use is the creation of appropriate conditions in order the land could be used for a longer period of time without losing ground biodiversity and possibility to use the land as a resource by future generations, and obtain from its all possible benefits. Sustainable development of the national economy is based on reasonable use of natural resources. Increase area of uncultivated agriculture land is one of the risk factors of land degradation in Latvia.

Since 2015 in Latvia entered into force Land Management Act, which states, that land degradation prevention measures, including restriction of invasive species, are carried out to fulfil overall interests of the society (Land Management Law, 2006). The landowners have to undertake activities to preserve the land and soil quality and prevent its degradation, as well as fulfil requirements of the soil re-cultivation.

In Latvia are in the force a number of laws and regulations, governing restrictions of the spread of invasive plant species. By the regulations of the Cabinet No. 468 “The list of invasive plant species”

(30.06.2008) is approved list of invasive plant species in Latvia. Now it contains only one plant - *Heracleum sosnowskyi* Manden (hereinafter – hogweed) (Fig.1).

In the article are analysed indicators characterizing abandoned economic activity territories – spread of invasive plants, their limitation and elimination.

2. MATERIALS AND METHODS

The **purpose** of the article is to evaluate Latvian and foreign experience in limitation and elimination of spread of invasive plants on the basis of scientific literature and other information, as well as analyse its benefits. To achieve this goal **tasks** were performed as follows:

- to gather and analyse the sources of scientific literature on hogweeds and their spread;
- to develop possible solutions in regeneration of brownfields;
- to analyse benefits of brownfield regeneration for development and sustainable use of the land.

To achieve the aim of study, information about types and sub-types of land degradation had to be summarized. Authors have evaluated the information about territories infested with invasive plants, they also examined existing experience and had discussions and interviews with competent specialists in public institutions of Latvia (Ministry of Agriculture, Ministry of Environmental Protection and Regional Development, State Plant Protection Service, etc.).

The **object** of research is spread of invasive plants as one of types of degraded build-up area. At the moment in Latvia does not exist accepted on governmental level classification of brownfields. Public discussions on proposals of classification of types of land degradation and methods for its evaluation have been opened by Cabinet of ministers in 2019 (Table 1).

*Table 1. Classification of types of land degradation
(draft, developed by Cabinet of Ministers of Latvia)*

Type of land degradation	Sub-type of land degradation
Degraded build-up area	Degraded residential or public build-up area
	Degraded industrial area
	Degraded military territory
Degraded mineral extraction site	Non-recultivated mineral extraction site
Waste disposal at non-designated for this purpose sites	Waste disposal, preservation and storage in non-designated for this purpose sites
Land pollution	Pollution of the territory by hazardous substances
Spread of invasive plants	Territory infested with invasive plants

Term “Degraded territory” is a relatively new in Latvia, the terminology is not yet fully developed, recognized and used in policy documents, legislation and education (Jankava et al., 2018; Pomelov, 2013). Analysis of elimination of land degradation is based on information recorded in the Cadastre Information System, such as situation plans, soil maps, maps of qualitative assessments of the land, as well as regulations of Land Management Law on processes causing land degradation. Economic justification of measures of elimination of spread of invasive plants processes is approbated in specific area (Kekava municipality).

There general scientific methods of theoretical research: analysis and synthesis, induction and deduction, as well as historical and monographic method of research have been used, as well as document analysis. The research is based on investigations of specific databases, legislative regulations and scientific and professional literature.

3. RESULTS AND DISCUSSIONS

Land and soil degradation is widely distributed across the world. The most important international instrument in the world on land and soil protection policies is UN Convention. This Convention represents land degradation as decline or disappearance of economic or biological productivity due to land use, human activity or change of plant species proportion, or due to combination of several processes (Nikodemus et al., 2009).

Land Management Law states that land degradation is decreasing or even extinction of economic and ecological value of land and land-related resources. Human action or inaction as well as natural processes may cause land degradation. Brownfield is the territory with destroyed or damaged land surface, or abandoned built-up, mineral extraction or economic territory.

Abandoned economic activity territory in rural area mainly causes due to overgrowing of agricultural land by bushes and invasive plant species, bogging of the soil due to incorrect maintenance of drainage systems. Brownfields are sites, which can be returned to productive use as a result of re-cultivation (Vojvodikova, 2010; Jankava et al., 2019). According to the analysis made by Ministry of Environmental Protection and Regional Development, it was found that about 6 thousand hectares of total brownfield area are those recovery is considered as appropriate (Teritoriju revitalizācija, reģenerējot degradētās teritorijas atbilstoši pašvaldību integrētajām attīstības programmām, 2020).

As one of the territories degrading factors is the spread of invasive plant species. Invasive alien species are species of origin, which is characterized by aggressive behavior in local ecosystems and they are able rapidly reproduce and dominate over native species (Regulation Regarding Restricting the Spread of the Invasive Alien Plant Species - *Heracleum sosnowskyi* Manden, 2008; Parsova et al., 2019). The spread of invasive plant species facilitate land abandonment, because it can not be properly managed. According to the UN Convention invasive plant species belong to such land degradation process as loss of natural vegetation for a long time, because invasive species spread rapidly and suppress native species, which shows a decrease in natural vegetation. They worsen quality of the landscape, as well as are dangerous to health and even life.

One of the most important international documents that determine the state's role in restriction of invasive species is "Convention on Biological Diversity", where is defined national responsibility to prevention of introduction of alien species which threat local ecosystems and other species, as well as determine the need to control the spread of alien species or destroy them (Kļaviņš et al., 2008; Valsts un iedzīvotāju loma latvāņu ierobežošanā, 2020).

Regulations determine the procedures to be carried out destruction and containment of hogweeds. Hogweeds reduce biodiversity, cause economic damage, worsens the quality of recreational resources and reduces the visual value of landscape. In Latvia hogweed is widely distributed on abandoned agricultural and forest land, anthropogenically disturbed habitats, as well as in urban and open areas, bushes, forests, roadsides, ditches, along rivers and other water bodies. Hogweed is able to effectively spread the seeds over a wide area. Area polluted with hogweed, doubles during 14-year period. State information system of crop monitoring contains information on more than 15 thousand ha (2.7 thousand land parcels) with hogweed (Fig.2). The largest hogweed area is located in Vidzeme region, while the smallest - in Zemgale and Kurzeme region. As positive fact to be noted that in 215 municipalities hogweed has not been found yet.

Have to be solved restoration of brownfields, because they can be restored, so that they can be reused. Experience of other countries shows a positive impact on sustainable development.

Restoring brownfields, it is possible to prevent the risks to the environment, to protect the historical and cultural values and improve the quality of life. The destruction and containment of hogweed depends on several factors. To completely destroy hogweed stand, it is necessary to choose the most appropriate method. There are following methods of destruction and containment of hogweeds - mechanical, biological, chemical and combined (Regulation Regarding Restricting the Spread of the Invasive Alien Plant Species - *Heracleum sosnowskyi* Manden, 2008).



Fig.1. Siberian hogweed
(*Heracleum sosnowskyi* Manden)

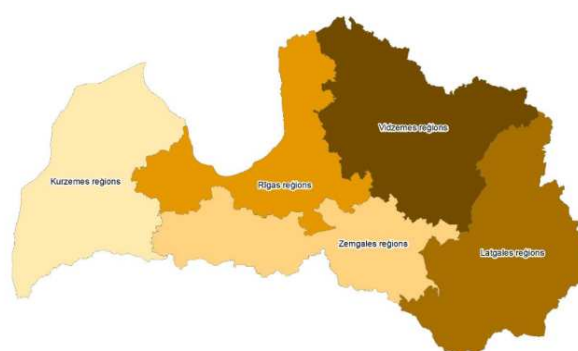


Fig. 2. Dissemination of hogweeds in Latvia

Mechanical method involves cutoff of hogweed flower clusters, punching of hogweed central rosette, tiling of area with mulch or a black opaque film, hogweed mowing or cultivation - plowing, cultivation, milling, peeling, harrowing and sliding (Fig.3.).



Fig. 3. Destruction of hogweeds using mechanical methods

Using chemical method may be used only products containing specific substances. Chemical hogweed treatment should be used at least two to three times during growing season, first time using at the beginning of growth stage. Chemical method is used in the long term, until hogweed has been completely destroyed.

Organic method is based on grazing principle - to graze cattle, sheep or goats (Fig. 4). Usually grazing process starts early in the spring, but to completely destroy the hogweeds, in addition should be used other methods, for example - mowing.

Research area was chosen in specific place of Kekava municipality, taking into account the spread of hogweed sites - forest areas, orchards, land under ditches, meadows and arable land. Also considered organizational plan on hogweed spread containment measures for 2013 to 2020, developed by Kekava municipality council. On research area are located 6 land parcels, total area of which is 112 ha. 31 ha are contaminated with hogweed.

In control process also is involved Kekava municipality council, performing monitoring and control of hogweed areas – how there have been carried out activities on destruction and containment of hogweed. If hogweed destruction activities are promptly and conscientiously carried out, the landowner receives 90% relief of real property tax. Hogweed destruction methods were selected in accordance with existing land use and spatial planning (Table 2).



Fig. 4. Destruction of hogweeds using organic method – grazing

Table 2. Measures of hogweed destruction

Period	Season	Methods	Additional activities
1 st year	Spring	Ploughing, cultivating, sowing of oil radish	
	Autumn	Ploughing	
2 nd year	Spring	Ploughing, cultivating, sowing of oil radish	
	Autumn	Ploughing	
3 rd year	Spring	Ploughing, cultivating, sowing of grass mixture	Punching of central rosette
	Autumn	Ploughing	
4 th year	Spring	Mowing	Punching of central rosette
	Autumn	Mowing	
5 th year		Monitoring	

There were calculated financial resources necessary for hogweed destruction measures (Table 3).

Table 3. Economic justification of hogweeds destruction measures

	Technical service	Costs, EUR per ha
1.	Mowing, using tractors	34
2.	Mowing with a manual technique	500
3.	Ploughing	47
4.	Cultivation	29
5.	Sowing	28
6.	Soil sliding	21
7.	Herbicide spraying	20

Investigation showed that combating of hogweeds on area of 30 ha generally cost around 170-180 thousand EUR, it is expensive (around 1500 EUR per ha) and a time-consuming (at least 5 years) process.

4. CONCLUSIONS

1. Restoring brownfields can be improved land use and quality of landscape.
2. Further use of agricultural and forestry land, which is polluted with hogweed, can be realized on the basis of hogweeds destruction and containment projects.
3. Local governments should be financially involved in processes of hogweed destruction in order to reduce costs of land owners.

5. REFERENCES

- Jankava, A., Parsova, V., Berzina, M., Palabinska, A. (2019) Role of brownfields regeneration in sustainable use of natural resources. International scientific journal “*Baltic Surveying*”, Volume 11, Jelgava (Latvia), 31 – 38.
- Jankava, J., Parsova, V., Laizane, E., Berzina, M., Palabinska, A. (2018) Proposals for classification and evaluation of land degradation in Latvia. International scientific journal “*Baltic Surveying*”, Vol. 9, Jelgava (Latvia), 30– 37.
- Kļaviņš, M., Nikodemus, O., Segliņš, V., Melecis V., Vircavs M., Āboliņa K. (2008) *Vides zinātne [Environmental science]*, Rīga: LU Akadēmiskais apgāds, 599.
- Land Management Law (2006). Latvijas Vēstnesis, 228 (5288), 15.11.2014. Retrieved March 20, 2020, from <https://likumi.lv/ta/en/en/id/270317-land-management-law>
- Nikodemus, O., Kārklīš, A., Kļaviņš M., Melecis V. (2008) *Augsnes ilgtspējīga izmantošana un aizsardzība [Sustainable use and protection of soil]*, Rīga: LU akadēmiskais apgāds, 254.
- Parsova, V., Pukite, V. (2019) Brownfields as Environmental Quality Indicator: Case of Latvia. Book of Proceedings of IX International Scientific Agriculture Symposium “*Agrosym 2019*”, Jahorina, Bosnia and Herzegovina, 1265 – 1271. Retrieved March 20, 2020, from <http://agrosym.ues.rs.ba/index.php/en/>
- Parsova, V., Stoiko, N., Kuryltsiv, R., Kryshenyk, N. (2019) Differentiation of land cover degradation in Ukraine and Latvia. Proceedings of the 18th International Scientific Conference “*Engineering for Rural Development*”, Jelgava: LLU, 798 – 803.
- Pomelov, A. (2013) Land Management Against Land/ Real Estate Degradation. Proceedings of the International Scientific Conference *Baltic Surveying'13*., Jelgava: LLU, 60-66
- Regulation Regarding Restricting the Spread of the Invasive Alien Plant Species - *Heracleum sosnowskyi* Manden: Regulation of Kabinet of Ministers No 559(14.07.2008). Latvijas Vēstnesis Nr.122 (3906). Retrieved March 20, 2020, from: <https://likumi.lv/ta/en/en/id/179511-regulation-regarding-restricting-the-spread-of-the-invasive-alien-plant-species--heracleum-sosnowskyi-manden>
- Teritoriju revitalizācija, reģenerējot degradētās teritorijas atbilstoši pašvaldību integrētajām attīstības programmām [Revitalization of territories by regenerating brownfields in accordance with integrated municipal development programs] Retrieved March 20, 2020, from http://www.varam.gov.lv/lat/fondi/kohez/2014_2020/?doc=18637
- Valsts un iedzīvotāju loma latvāņu ierobežošanā [The role of the state and the people in restricting hogweed]. Retrieved March 20, 2020, from: <http://www.vaad.gov.lv/313/section.aspx>
- Vojvodikova, B. (edit.) (2010) Degradētās teritorijas [Brownfields]. *Rokasgrāmata*. VŠB-Ostravas Tehniskās universitātes Būvniecības fakultāte. 140.