

## EVALUATION OF REED RESOURCES IN KURZEME REGION IN LATVIA

Edgars Čubars, Gotfrīds Noviks

Rezekne Higher Education Institution

edgars.cubars@inbox.lv; gotfrids.noviks@ru.lv

### Abstract

The increasing demand for energy, limited resources of fossil fuel, as well as pollution of the environment and changes in the global climate have raised more interest about the renewable resources. Support to the use of renewable resources has become a very important part of European Union policy. The aim of this paper is to analyse the quantity of reed resources in Kurzeme region in Latvia, to produce clean energy. The use of reeds as a renewable energy resource allows economizing fossil fuels. The paper presents research results of reed resources in lakes of Kurzeme. The investigation of reed resources shows that in the region they are scattered and rational usage of them is connected with environmental aspects. There are 16 significant lakes for reed harvesting in Kurzeme region. The greatest amounts of reed resources are concentrated in the four lakes - Engures, Papes, Liepājas and Tosmares. Using distance control methods, it was stated that reed beds in Kurzeme exceeds an area of more than 7000 hectares. The potential yield of reed biomass is more than 50000 tons per year. Balanced harvesting of reed gives a positive influence on the environment.

**Key words:** renewable energy, environment quality, common reed, reed resources.

### Introduction

Lakes of Latvia are characterized by eutrophication that often has a negative impact on lake biotopes. In Latvia there is no special interest in reeds. They grow on lake and river banks and in almost every pisciculture farm. Currently, insignificant amounts of reed are used in building. Reeds die off every year and decompose on the banks of lakes and pisciculture farms, creating emission of CH<sub>4</sub> in atmosphere. Nevertheless, as the costs of fossil energy resources are growing, the interest in possibilities of using the local biomass in power supply is also increasing. Previous studies show that reeds can be used as raw material in fuel production. (Čubars et al, 2009, Komulainen et al., 2008). In many countries the reed (*Phragmites australis*), the most widespread reed in Latvia, is considered to be an invasive species. Reeds form big mono-specific growths that supersede other plants and endanger the biological diversity in biocenosis. There are special reed monitoring and control activities in many countries. To stop the reed invasion, such methods as mechanical removal, drainage, cultivation with discs, granulation, burning, abatement by herbicides, as well as biological control methods, are used.

In Latvia there is no monitoring or accounting system of reed growths. Eutrophication processes are taking place in natural lakes and in artificial water bodies of Latvia, but the intensity of these processes is not clarified. The reed-covered areas in Latvia are not explored yet. To evaluate the reeds as renewable resources and their amount in lakes of Kurzeme region that are potentially important for reed extraction, the reed-covered areas were analyzed and potential reserves of biomass in these lakes were calculated.

### Materials and Methods

The object of study is the lakes, common reed *Phragmites australis*. Reed is a perennial, tall (usually 120-250 cm) grass caulescent family plant.

The rootstock type is decumbent. The straw is bare, sharp, firm, slightly glazy, and thick (d= 0.7-1.2 cm). Leafs are lanceolate (20-40 cm length, 2-4 cm wide), aeruginous, nibbed, the lower side is mat, volva is long. The trigger of leaf is furry. Panicles are long (20-40 cm), dense and reddish brown.

Reeds are widespread in Latvia. Usually they are routed in large, mono dominant beds in water reservoir and sea shores, moist woods, marshes and wet meadows. With its decumbent rootstock (vegetative sprout can reach 10-15 m) they rapidly occupy new areas. This species (mostly mono dominant) belongs to plant sets in forested fens and overgrown shallow waters: Cl. Phragmitetea, All. Phragmition, and other unities of this class. (*Phragmites Australis*, 2011).

The research on reed distribution was made in natural and artificial water bodies of Kurzeme region that are potentially important for the extraction of reed biomass. Potentially important lakes were identified using literature analysis. (Database of Latvian lakes, 2011). The most important criteria for the evaluation of importance: the mirror surface of lake is more than 100 ha and the level of overgrowth is more than 3%. Lakes that do not correspond to these criteria were not considered to be important and were not used to calculate the total potentially usable reed resources. A reed amount in lakes with a smaller surface area and a lower overgrowth level are relatively insignificant and currently their use in Latvia is not topical. At first, we need to study the most important resources that are concentrated in relatively small territory and



Figure 1. Reed growths in the Southern part of Liepājas Lake

currently are not used appropriately. Reed extraction in small lakes with insignificant reed surfaces involves high transportation costs and may be economically unprofitable. The suitability of every lake for the extraction depends on extraction technology and specifications.

The detection of reed surfaces was made using the method of distant survey in computer program ARC GIS. The reed-covered areas in every lake were identified using orthophotos of 2010. (Figure 1)

The bushed reed growths were not taken into account, whereas the areas covered with clubrushes were used to calculate the total reed surfaces.

To calculate the potential reed biomass in Kurzeme region, the results of reed studies in the lakes of Latgale region were used. The method of direct measurement in nature helped to define the amount of reed resources extractable from 1m<sup>2</sup> of reed growth in lakes and pisciculture farms. Studies were made in 20 lakes and pisciculture farms of Latgale region. The part of

Table 1

## Characteristics of reed resources in Kurzeme region

Lake	Total area of lake, ha ( Database of Latvian lakes, 2011)	Middle deep of lake, m ( Database of Latvian lakes, 2011)	Reed area, ha	Reed biomass potential, tons**	Average overgrow, %
Engures L.	4130.7	0.4	3194	22997	77.3
Liepājas L.	3715	2	1554	11189	41.8
Papes L.	1205	0.5	2087	15000	71.5*
Durbes L.	670	3.9	60	432	9
Puzes L.	520.5	12.1	42	302	8.1
Tosmares L.	405	0.5	314	2261	77.5
Būšnieku L.	330	1.2	38	274	11.5
Rimzātu p.	277	No data	12	86	4.3
Cieceres L.	276.8	7.2	18	130	6.5
Sasmakas L.	252	3.8	19	137	7.5
Vilgāles L.	242.5	1.9	36	259	14.8
Spāres L.	201.1	2.3	24	173	11.9
Liekna L.	200	No data	8	58	4
Laidzes L.	170.5	4.4	36	259	21.1
Lubezers	129.6	1.7	9	65	6.9
Gulbju L.	115.5	1.5	13	94	11.3
<b>Total</b>	<b>12841.2</b>		<b>7464</b>	<b>53716</b>	

\* - The level of overgrowth in Papes Lake was calculated adding the areas of wetlands located nearby and covered with reed, to the mirror surface of the lake.

\*\* - The potential amount of reed biomass was calculated using the average indexes of biomass in the lakes of Latgale region. For every lake, the indexes may differ, it depends on characteristics of reeds in the concerned lake.

reeds that in wintertime is placed above ice was used to make calculations. Measuring and weighting of samples was performed in 10 sampling plots of every lake. The area of sampling plot was 25m<sup>2</sup>. The plots were chosen in places where density of overgrowth was average. The density of overgrowth was determined inspecting the reed area. The studies of lakes in Latgale region show that reeds are different. Their biomass is 0.51-0.93 kg m<sup>-2</sup> from the reed growth (the relative humidity 15-20%). The average biomass of lakes is 0.72 ± 0.32 kg m<sup>-2</sup> (Čubars, 2010).

### Results and Discussion

Lakes cover 1.5% of the territory of Latvia, i.e. 1000 km<sup>2</sup>. 2256 lakes are larger than 1 ha. 16 lakes are larger than 10 km<sup>2</sup> and account for 45% of the total surface of lakes in Latvia. The reed is one of the most widespread aquatic plants, it occupies larger or smaller areas in all water bodies of Latvia.

Studies show that in Kurzeme region there are 17 lakes with mirror surface larger than 100 ha. Their total mirror surface is 16310.4 ha.

In all the studied lakes the level of overgrowth is higher than 3% with the exception of Usmas Lake where the reed growth covers 2.1% of mirror surface

of the lake and it was not taken into account during the calculations of total reed resources. Reed growths of Usmas Lake cover 72 ha and they are dispersed over all the aquatorium along the bank.

The total amount of important reed resources in Kurzeme region (in lakes that correspond with the criteria of study) grow on a territory of 7464 ha and its potential is 53 716 tons of biomass per year. (Table 1).

The most important reed resources are located in the littoral lakes with small average depth. The level of their overgrowth is high. The largest reed-covered areas (95.8%) are concentrated in four lakes of this region: Engures, Papes, Liepājas and Tosmares. These four lakes are considered to be the most important and the most suitable for reed extraction in Kurzeme region. Papes, Liepājas and Tosmares Lakes are located relatively close to each other, therefore the reeds extracted in these lakes could be processed in one place. (Figure 2).

The largest reed-covered areas were observed in Engures Lake – 3194 ha. The total potential amount of biomass is approximately 23 000 tons per year. The reeds in Engures Lake cover 77.3% of its total surface. The largest part of reed-covered areas consists of big monodominant growths in the Northern, Northwestern



Figure 2. Location of reed growths in Kurzeme region

and Southern parts. Some reeds grow in relatively small reed blocs with the surface of 0.3-10 ha, and they are dispersed over all the aquatorium.

The second largest reed-covered area of Kurzeme region is observed in Papes Lake. The biggest reed-covered areas are located in the Northern, Northwestern and Southern parts of the lake. The reed growths are found not only on the territory of lake, but also in the wetlands located nearby. The total reed-covered territory and the lake constitute 2919 ha, the total reed area – 2087 ha. The potential amount of biomass is approximately 15 000 tons per year, the level of overgrowth – 71.5%.

The biggest reed-covered areas of Liepājas Lake are located in its Southern and Northern part. Moreover, these areas are situated along the Eastern and Western banks constituting a relatively wide zone (50-500 m). The reed-covered area – 1554 ha, the potential amount of biomass – approximately 11189 tons per year. The level of overgrowth in Liepājas Lake is 41.8% and this index is the lowest of all the four richest lakes.

Tosmāres Lake, which is situated close to Liepājas Lake, is relatively small. Its mirror surface is 405 ha, reeds grow on a surface of - 314 ha. The total annual potential is approximately 2261 tons of biomass per year.

Another 12 lakes of Kurzeme region (Durbes Lake, Puzes Lake, Būšnieku Lake, Rimzātu ponds, Cieceres Lake, Sasmakas Lake, Vilgāles Lake, Spāres Lake, Liekna Lake, Laidzes Lake, Lubezers, Gulbju Lake) that were considered to be important based on the criteria of studies, constitute only 4.2% of the total reed resources – 313.5 ha, i.e., 2257 tons of biomass. These lakes are characterized by relatively big average depth and low level of overgrowth. Principally, the reeds grow along the lake banks constituting zones of 10-50m.

Papes Lake, Liepājas Lake, Tosmares Lake, Engures Lake and Liekna Lake, as well as the Northern part of Durbes Lake are the territories of Natura 2000. This fact might impose restrictions on the reed extracting. (Natura-2000, 2011)

### Conclusions

In Kurzeme region there are 17 lakes with the mirror surface larger than 100 ha. Their total mirror surfaces constitute 16310.4 ha.

In all the studied lakes the level of overgrowth is higher than 3%, with the exception of Usmas Lake where reed growths are observed in 2.1% of the total mirror surface of this lake.

The total important reed resources (in lakes that correspond with the criteria of studies) grow in 16 lakes of Kurzeme region, they cover 7464 ha and their potential is 53 716 tons of biomass per year.

The most important reed resources are located in littoral lakes with small average depth. The level of their overgrowth is high. The largest reed-covered areas (95.8%) are concentrated in 4 lakes of this region: Engures Lake, Papes Lake, Liepājas Lake and Tosmares Lake. These four lakes are the most important and the most suitable for reed extraction in Kurzeme region.

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Papes, Liepājas and Tosmares Lakes are located relatively close to each other, therefore the reeds extracted in these lakes could be processed in one place.

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