

# **Contribution of SRC to long term ragweed eradication in the City of Osijek**

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**Task 43 NTL Croatia**

**IEA Bioenergy Task 43 workshop**

**„Attractive Systems for Bioenergy Feedstock Production in Sustainably Managed Landscapes”**

**November 20, 2017 at Sydney, Australia**

# Energy Institute Hrvoje Požar – EIHP

## Zagreb, Croatia

- ❑ Est. 1991, 86 employees 😊 😊 😊
- ❑ Research institute with market orientation
- ❑ 70% of income generated at external markets
- ❑ (some of) Clients: EBRD, EC, Energy Community; EuropAid; FAO; GEF; GGF; IAEA; IEA Bioenergy, UNDP, UNIDO; USAid; WB...

### **Mission:**

developing modern, resilient, secure, sustainable energy systems including both (non)conventional energy sources by energy planning, balancing, integration by developing new energy and business models, innovative approach to each topic

- ❑ Participation in >70 EU projects with different sources of funding (IEE, Horizon 2020, IPA, Interreg, IPA-Med, FP7; LIFE...)
- ❑ Among top national beneficiaries from H2020 so far...



## Dept for Renewable Energy Sources, Energy Efficiency and Environmental Protection (1/6) steps out to bioeconomy

### o Why?

To find options for bioenergy projects in a competitive environment (post-feed in period) & improve bankability of bioenergy projects.

### o How?

- Creating new business models for bioenergy projects
- Discovering innovative value chains from bioenergy by-products
- integrating biomass supply into existing landscape management and design to reduce biomass supply costs by triggering ecosystem services

### o Our team = 25 experts 😊😊😊: energy, civil engineering, urban planning, environmental protection, agroecology, architecture, chemical engineering

- Currently involved in 10 H2020 research projects: biogas, biomass, energy efficiency, transport...
- Holding IPR and establishing of a spin-off underway...

# Outline

The problem: common ragweed



The location: Croatia, the City of Osijek



The solution:  
short rotation coppice  
(SRC)?



Conclusions



# The problem: common ragweed (*Ambrosia artemisiifolia* L.)

## o Pollen allergy causes allergic rhinitis („hay fever“)

Allergic rhinitis symptoms are caused by the body's immune response to inhaled pollen, resulting in chronic inflammation of the eyes and nasal passages.

– Allergic rhinitis symptoms include:

- Runny, itchy, congested nose
- Irritable, itchy, watery and red eyes
- Itchy ears, throat and palate.

## o Pollen can also trigger asthma

Small particles of allergens can penetrate deep into the airways of the lung.

Thunderstorms can also contribute to this: When pollen granules come into contact with water, starch granules are released that are small enough to be breathed into the airways, causing allergic rhinitis and asthma in some people.

**Pollen is easily spread by wind**

**1 billion pollen grains per plant**

# Asteraceae or Compositae = „daisy family”





Home » News & Media » News

Submitted by on Fri, 23/06/2017 - 12:17

Scientists at the Centre for Ecology & Hydrology (CEH) predict that climate change may well lead to a widespread invasion of harmful ragweed across Northern Europe in the next 60 years unless its path is halted by policy-makers.

Researchers at CEH have produced a scientific model – which is able to take account of the effects of changes in temperature and length of exposure to daylight – to see how in future ragweed could spread as far as central UK and Ireland, Denmark, southern Sweden and most of the southern Baltic coast.

Ragweed (*Ambrosia artemisiifolia*) is a serious concern because of its harmful effects on agriculture as a crop weed but also on public health as a major allergen. A single plant may produce a billion grains of pollen per season – pollen which may remain airborne for days, affecting people hundreds of miles away.

Those sensitive to ragweed pollen can suffer itching, burning, and swelling of the mouth and throat, runny eyes and nose, hives, and, less commonly vomiting, diarrhoea, asthma and anaphylaxis. It also affects crop production as a weed



Photo by Harry Sosa (CC BY 2.0)

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## Recent Publications

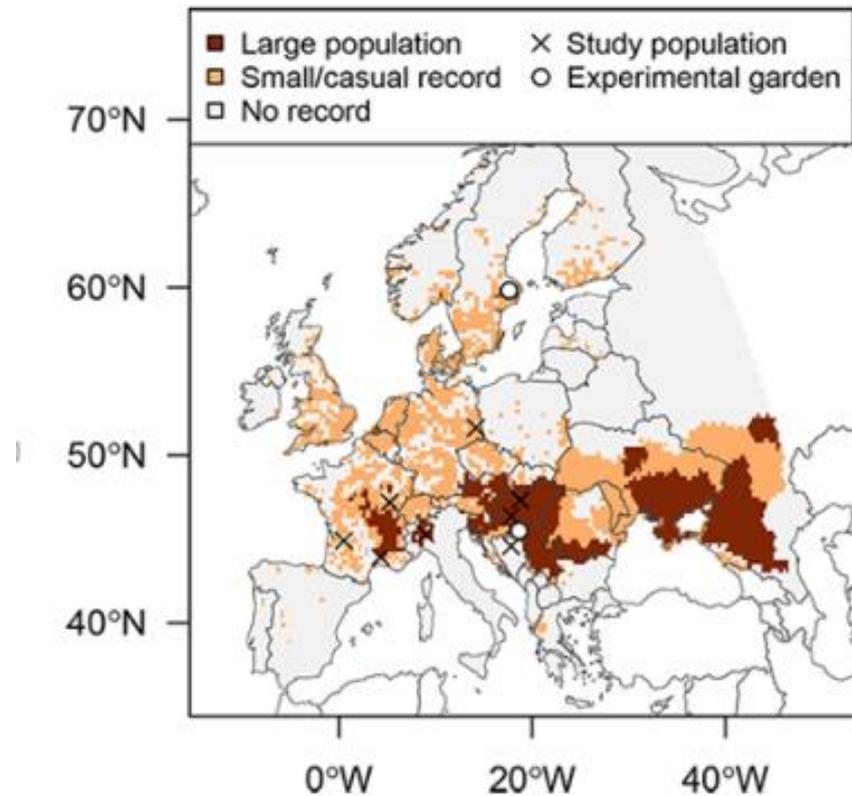
**Metal speciation from stream to open ocean: modelling v. measurement**

**Wheat yield responses to stomatal uptake of ozone: peak rising background ozone conditions**

**Influence of tree species and forest land use on soil hydraulic conductivity and implications for surface runoff generation**

**Source:** Chapman, D S, Scalone, R, Stefanic, E & Bullock, J M. (2017) **Mechanistic species distribution modelling reveals a niche shift during invasion.** *Ecology*, 98, 1671-1680. DOI: [10.1002/ecy.1835](https://doi.org/10.1002/ecy.1835)  
<https://www.ceh.ac.uk/news-and-media/news/scientists-predict-widespread-invasion-harmful-ragweed-across-northern-europe>

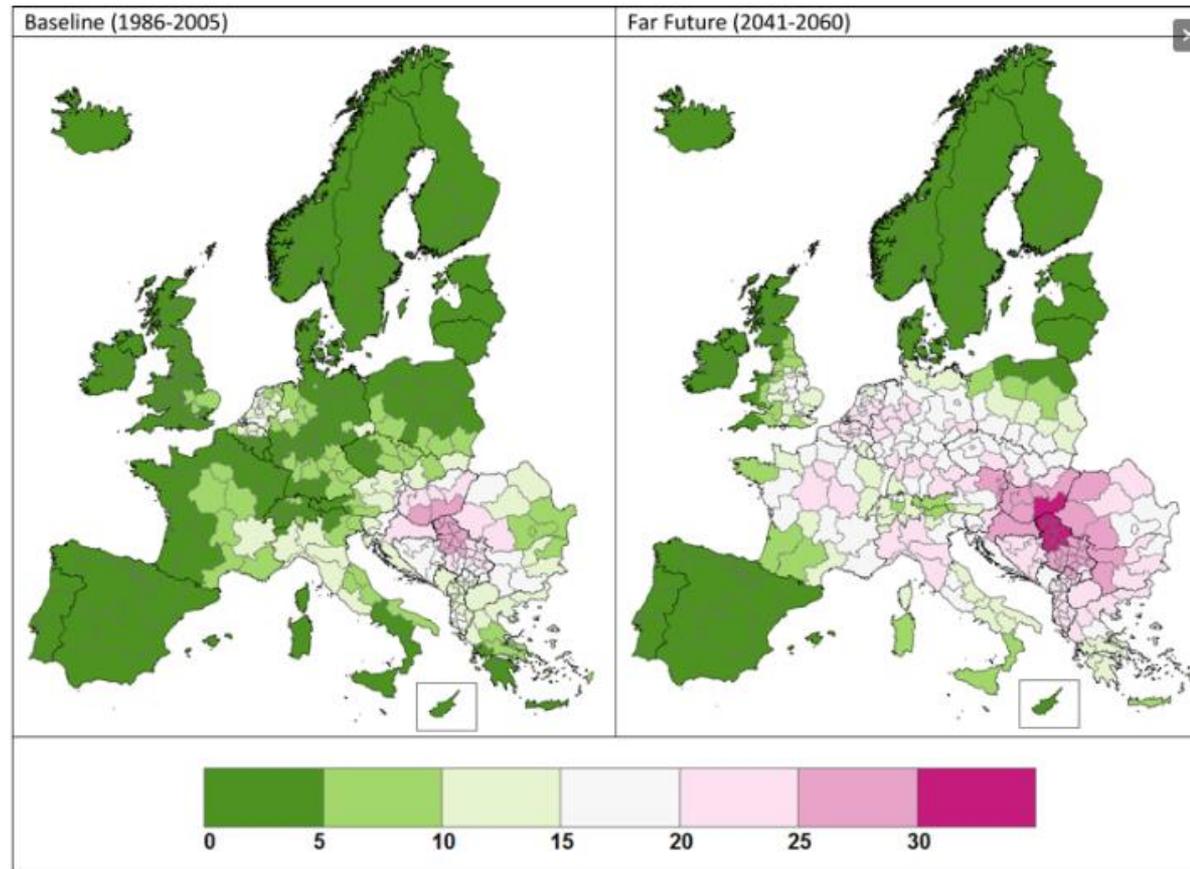
# Non-native distribution of common ragweed in the modelled region of Europe (records 1991-2010 on a 0.25° grid)



**Source:** Chapman, D S, Scalone, R, Stefanic, E & Bullock, J M. (2017) **Mechanistic species distribution modelling reveals a niche shift during invasion.** *Ecology*, 98, 1671-1680. DOI: [10.1002/ecy.1835](https://doi.org/10.1002/ecy.1835)

# Percentage of population sensitized to ragweed pollen at baseline and in the far future

averaged results for WRF/RegCM and CHIMERE, RCP4.5, and reference invasion scenario. © EuroGeographics for the administrative boundaries.



EHP173.g002

**Source:** Lake I.R, Jones N.R, Agnew M, Goodess C.M, Giorgi F, Hamaoui-Laguel L, Semenov M.A, Solomon F, Storkey J, Vautard R, Epstein M.M. **Climate Change and Future Pollen Allergy in Europe;** Environ Health Perspect; DOI:10.1289/EHP173; Vol. 125/2017

SCIENCE SELECTION VOLUME 125 | 2017



*Environ Health Perspect*; DOI:10.1289/ehp.125-A60

## Your Grandchildren’s Pollen? Modeling the Future of Ragweed Sensitization in Europe

Charles W. Schmidt, MS, an award-winning science writer from Portland, ME, writes for *Scientific American*, *Science*, various *Nature* publications, and many other magazines, research journals, and websites.

About This Article [open](#)

[PDF Version](#) (796 KB)

Many plants are growing faster, flowering earlier, and producing more pollen with rising atmospheric levels of carbon dioxide (CO<sub>2</sub>) and increasing surface temperatures.<sup>1</sup> In this issue of *EHP*, scientists estimate how changing growth

**Related EHP Article**

[Climate Change and Future Pollen Allergy in Europe](#)

INFORMATION FOR OUR READERS

**A Note about Our Table of Contents**

*EHP* operates under a continuous publication model in which new content is published every day, instead of just one day a month. As a result, each monthly table of contents starts with one article, and grows each day throughout the month. Sign up for our [e-mail alerts](#) to be notified when new content is available!

ANNOUNCEMENTS

[EHP Paper Named CEHN October 2017 Article of the Month](#)

*EHP* is pleased to announce that “[The Prevalence of Antibiotic-Resistant \*Staphylococcus aureus\* Nasal Carriage among Industrial Hog Operation Workers, Community Residents, and Children](#)”

„Our primary estimates indicated that sensitization to ragweed will more than double in Europe, from 33 to 77 million people, by 2041–2060. According to our projections, sensitization will increase in countries with an existing ragweed problem (e.g., Hungary, the Balkans), but the greatest proportional increases will occur where sensitization is uncommon (e.g., Germany, Poland, France).

**Higher pollen concentrations and a longer pollen season may also increase the severity of symptoms.** Our model projections were driven predominantly by changes in climate (66%) but were also influenced by current trends in the spread of this invasive plant species. Assumptions about the rate at which ragweed spreads throughout Europe had a large influence upon the results.”

# Ragweed features:

- Populates idle agricultural land or abandoned areas as well as gardens and siderows
- Seed germination period up to 30 years
- Produces an average 3000 seeds per year
- Seeds distributed easily by car tires and bird food
- Control/erradication methods: mechanical, chemical, biological
  - The most efficient control method: mechanical plucking before blossoming
  - Herbicide resistant or develops resistance
  - Biological methods controversy
- Strong competitor to open row crops (sunflower, maize, potatoes, pumpkins and legumes) - leads to significantly lower yields
- Doesn't stand competition

# Ragweed in Australia

- o **Management and Control:** Cultivation, mowing and grazing are generally not effective control techniques because of the high levels of dormant seed. Herbicides provide good short term control for crops. Establishment of perennial pasture provides good long term control of the weed. It is not common as a contaminant of agricultural seed or produce.

- o **Thresholds:**

It is an aggressive coloniser of waste ground.

It is a serious competitor in crops overseas.

1-5 plants/m<sup>2</sup> reduce yields in row crops.

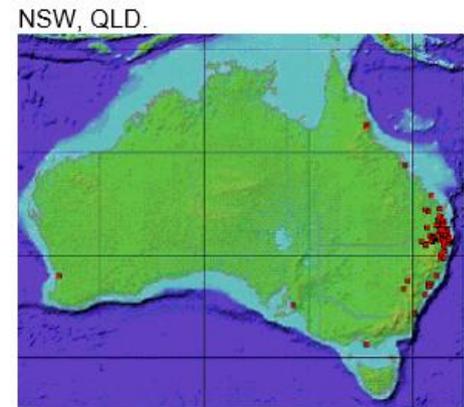
**Eradication strategies:**

It is susceptible to many common herbicides, but the seed dormancy and longevity make eradication difficult.

**Herbicide resistance:** Resistant forms of ragweed have developed where triazine herbicides have been regularly used.

**Biological Control:** A number of bio control agents have been selected and two have been released in Qld and NSW.

Source: [http://www.herbiguide.com.au/Descriptions/hg\\_Annual\\_Ragweed.htm](http://www.herbiguide.com.au/Descriptions/hg_Annual_Ragweed.htm)



Courtesy Australia's Virtual Herbarium.

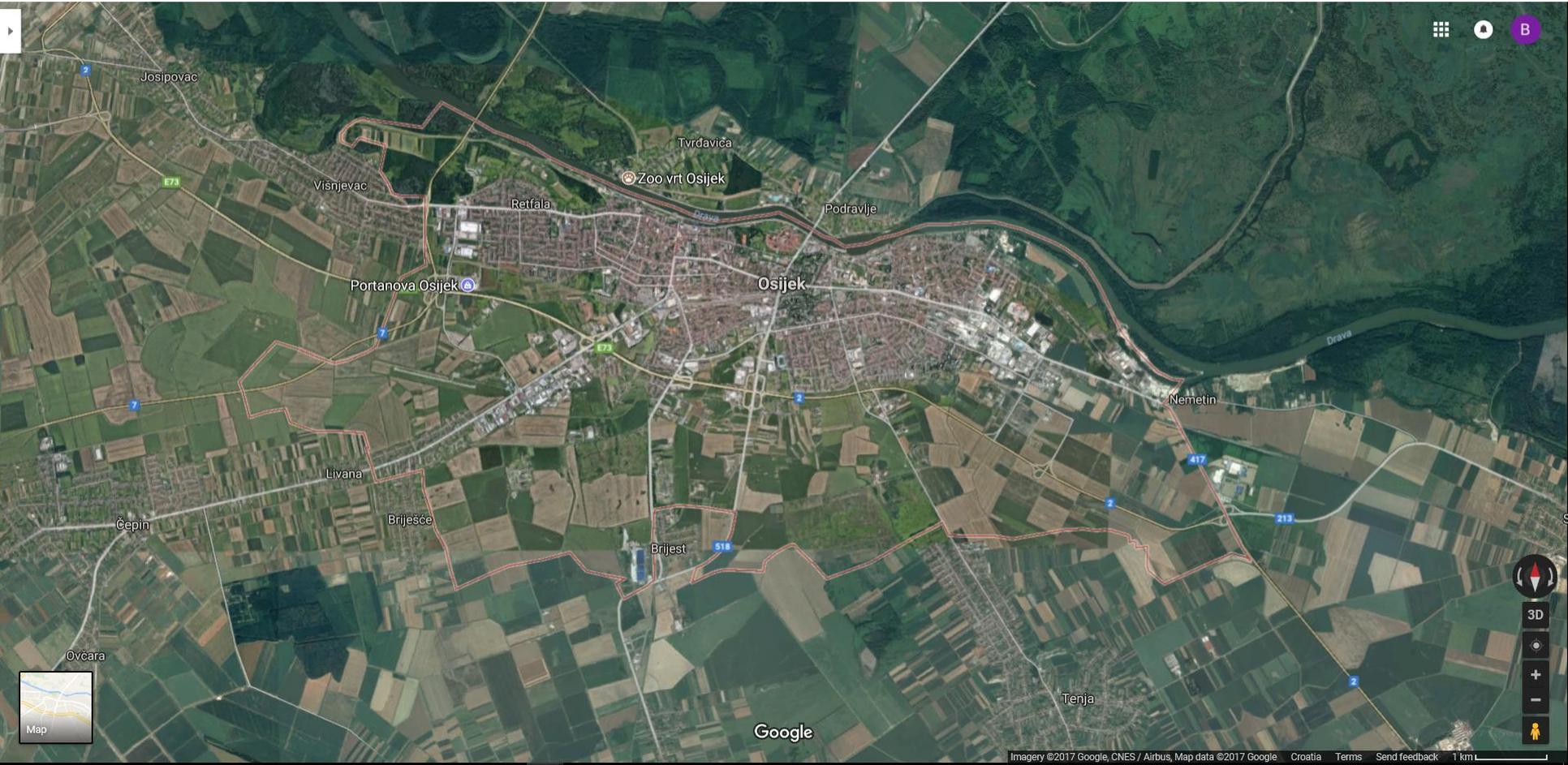
# The location: Croatia, the City of Osijek

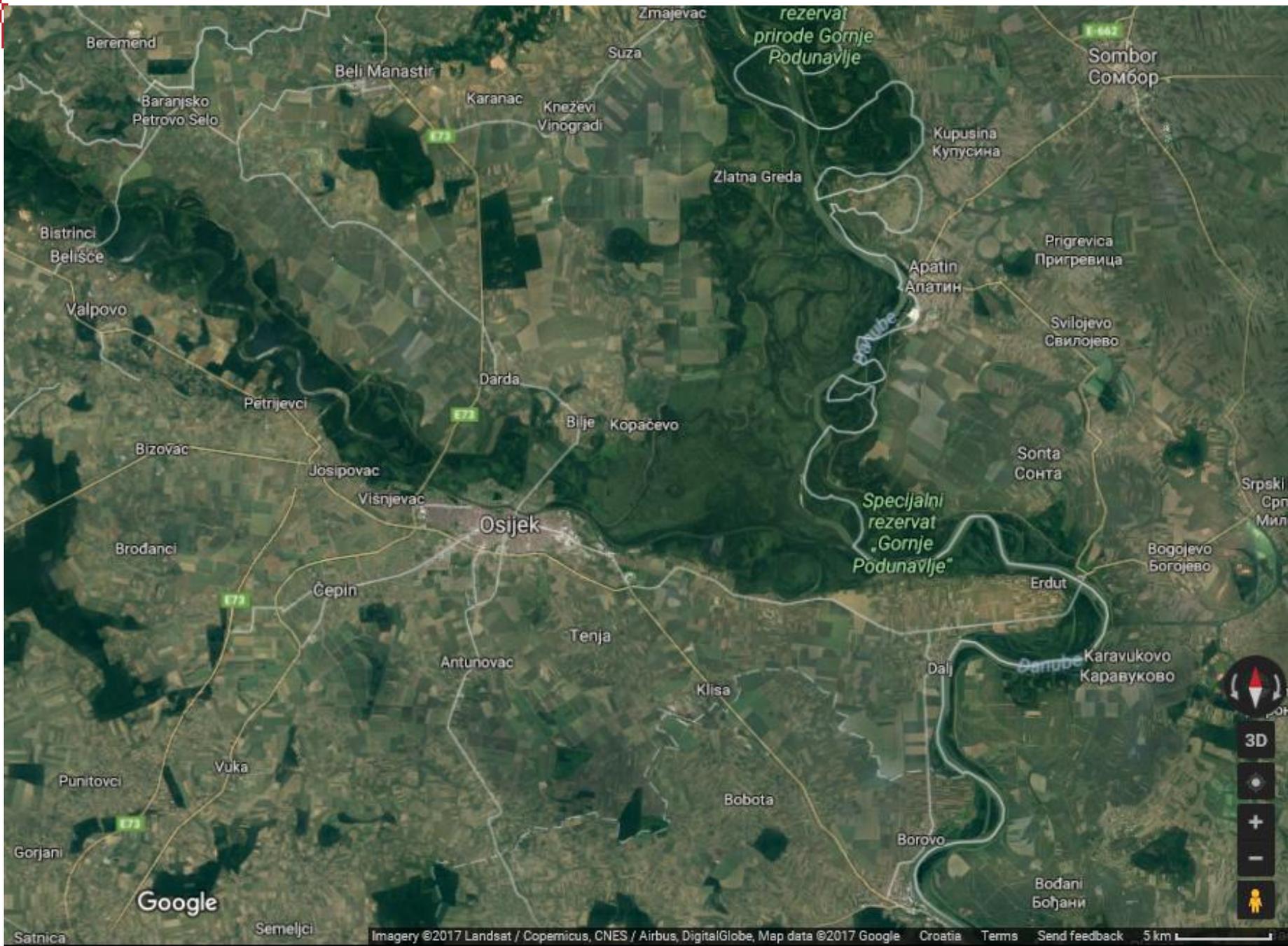
- o Population: 108,048 in 2011 (4th in Croatia)
- o Area: 169 km<sup>2</sup>
- o Moderate continental climate with 4 seasons and sudden & intensive changes
- o Elevation: 88 m
- o Average temperature Jun-Aug: 19.7-21.3 °C  
67.5-70.3 °F



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NO THANKS YES





# Recorded ragweed pollen quantities in air 2005-2009

At all measurement stations, from July till September, there is increased pollen concentrations.

An allergic reaction threshold: >30 grains per m<sup>3</sup> per day.

| Br. postaje | Measurement location         | Year  | Total annual quantity (# of grains) | Max daily concentration (# of grains) | #of days with max daily concentration >30 grains/m <sup>3</sup> d | # of pollination days |
|-------------|------------------------------|-------|-------------------------------------|---------------------------------------|---|-----------------------|
| 1.          | Osijek<br>Franje Krežme 1    | 2005. | 4.367                               | 364                                   | 32  | 118                   |
|             |                              | 2006. | 7.368                               | 987                                   | 30  | 99                    |
|             |                              | 2007. | 5.776                               | 414                                   | 36  | 120                   |
|             |                              | 2008. | 5.550                               | 345                                   | 39  | 113                   |
|             |                              | 2009. | 6.079                               | 669                                   | 31  | 151                   |
| 2.          | Našice<br>Bana Jelačića 6    | 2008. | 4.630                               | 362                                   | 28  | 123                   |
|             | Našice<br>Vinogradska 4      | 2009. | 14.244                              | 1.883                                 | 42  | 145                   |
| 3.          | Đakovo<br>B. J. Jelačića 6/5 | 2009. | 13.097                              | 1.012                                 | 42  | 158                   |
| 4.          | Beli Manastir<br>Republike 1 | 2009. | 7.048                               | 585                                   | 36  | 165                   |

# Current measures taken (PPP,2016)

- o 500.000 AUS\$ to landscape management company
- o Spot recording, elaborated pollen measurement and alert system



# Contribution of SRC to long term ragweed eradication in the City of Osijek

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<sup>4</sup> City of Osijek, Department for EU programmes and projects & economy, Section for preparation and implementation of programmes and projects, Osijek, Croatia

<sup>5</sup> Croatian Extension Service, Zagreb, Croatia

*With the support of prof. E. Stefanic, JJ Strossmayer University of Osijek, Agronomic Faculty Osijek, Croatia*

# Research builds upon :

- o As a follow up activity of an IEE project SRCplus (2014-2017) focused on SRC for local heat supply chains [www.srcplus.eu](http://www.srcplus.eu)
  - o Osijek-healthy City “Osijek-zdravi grad”
  - o Eco-business zone Nemetin: prioritizes businesses that are environmentally friendly or use renewable energy
  - o 3 MWe/10 MWth biomass CHP BE-TO Osijek
  - o City of Osijek efforts to eradicate ragweed
- 
- o Extensive research from prof. Štefanić and her team on common ragweed in respect of allergy, measurement and prevention
- + literature review

# Could SRC ecosystem services...

- prevent pollen grains reaching the breathing zone in the City?  
= SRC as wind/pollen barriers
- prevent ragweed to develop as a dominant crop?  
= SRC plantation as a biological control measure
- prevent existing ragweed seed germination?  
= SRC plantation as a long-term biological control measure
- financially offset ragweed eradication measures?  
= SRC for bioenergy
- engage the idle/abandoned areas until „true” purpose emerges?  
= SRC for bioenergy as a biological control measure

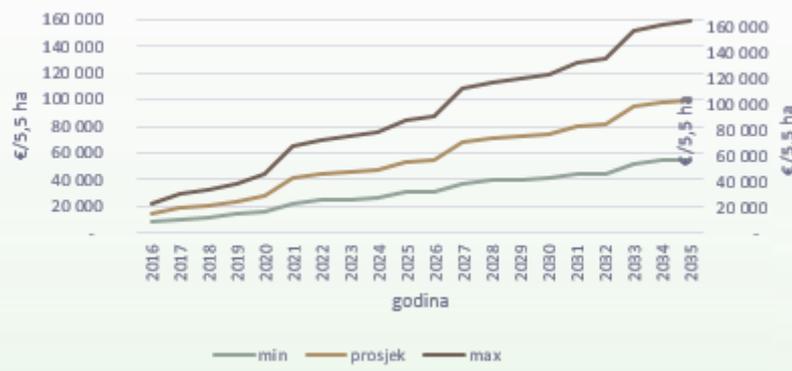
# Being pragmatic:

- o Can biomass from SRC meet the market price?
- o How much of SRC can be supplied?
- o How much it would cost?
- o What are the side effects?
- o Who benefits?
- o FINAL QUESTION: is there enough motivation to pursue further with triggering SRC ecosystem services?

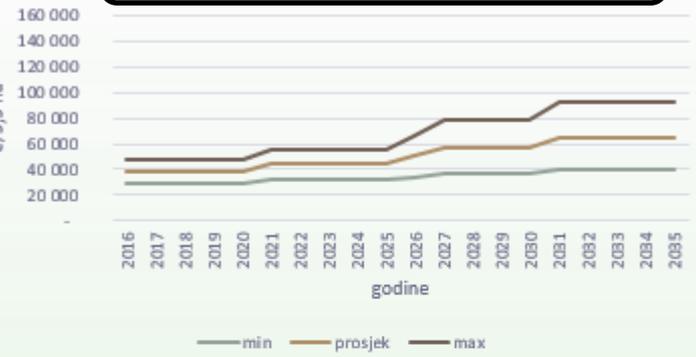
# Can biomass from SRC meet the market price?

- o Current CHP biomass supply price: 3.67 €/GJ
- o At that price, BEP is achieved at ~ 6 year (2nd rotation)
- o Farmer finds SRC planting
  - less lucrative than competitive conventional cropping but
  - more lucrative than passive agriculture, land sale and land lease
- o Low intensity SRC plantation are not justifying the land use: BEP at ~15 year; more lucrative to sell the land

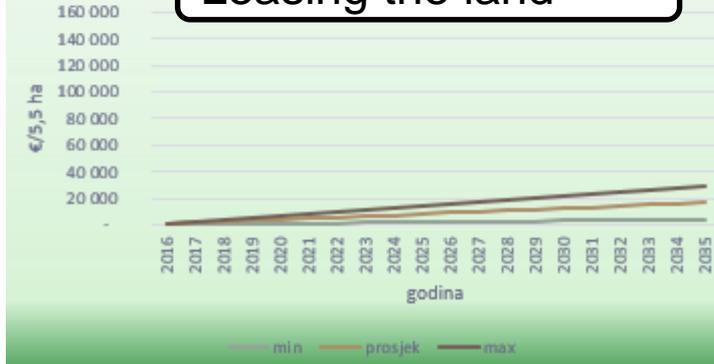
### Commercial cropping



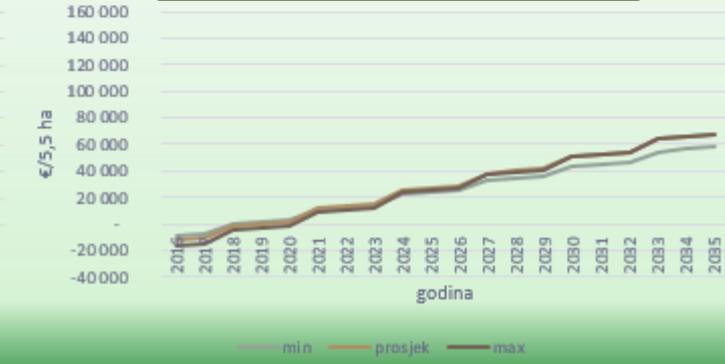
### Selling the land



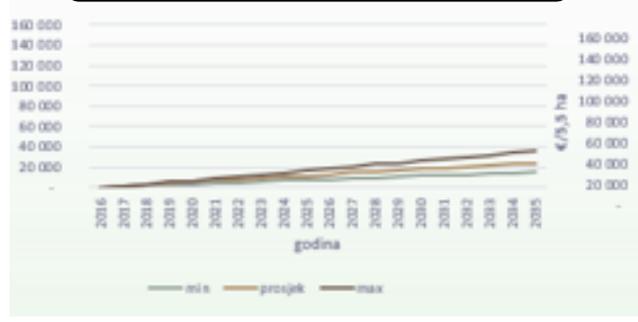
### Leasing the land



### Willows low intensity



### Passive cropping



### Willows high intensity



# How much SRC could be supplied?

- o CHP biomass demand (local demand):
  - 21.000 t/yr dm = 1,750 ha of SRC
- o Financial offset of ragweed eradication measures:
  - Efforts of the City+ Social costs of sick days+ prescription medicine
  - = 38 ha/yr or 460 t/yr dm or 2.5% of local demand needed for SRC
- o Land limitation (broader area):
  - 200,690 ha of arable land = < 1% of land needed for SRC
- o Land limitation (City area):
  - Total area: 17,100 ha = 10% of land needed for SRC
  - Agricultural land: 12.121 ha = 14% of land needed for SRC
    - » 11.000 ha planned for urban gardens

# How much it would cost?

- o Planting 1,750 ha with SRC: 4.3 M€ (82.6 AUS\$ ppp)
  - Not feasible if SRC planted for bioenergy purposes only
  - By lowering the price 20%, 6 ha could be planted – price is not the target
- o Looking at ecosystem services: 0.09 M€/year (1.8 M AUS\$ ppp/year)
  - Simple BP: 45 years
  - Not feasible
- o Taking it slow:  
38 ha/yr or 460 t/yr dm or 2.5% of local demand to offset the social costs

# Are there any side-effects?

- o Decreasing the heat island effect
- o Improve air quality in general (agriculture protection agents decrease air quality)
- o Sudden shower water regulation
- o Mosquito reduction effect
- o Visual effects
- ...
- o **How much do they value to the City of Osijek?**

# Who benefits?

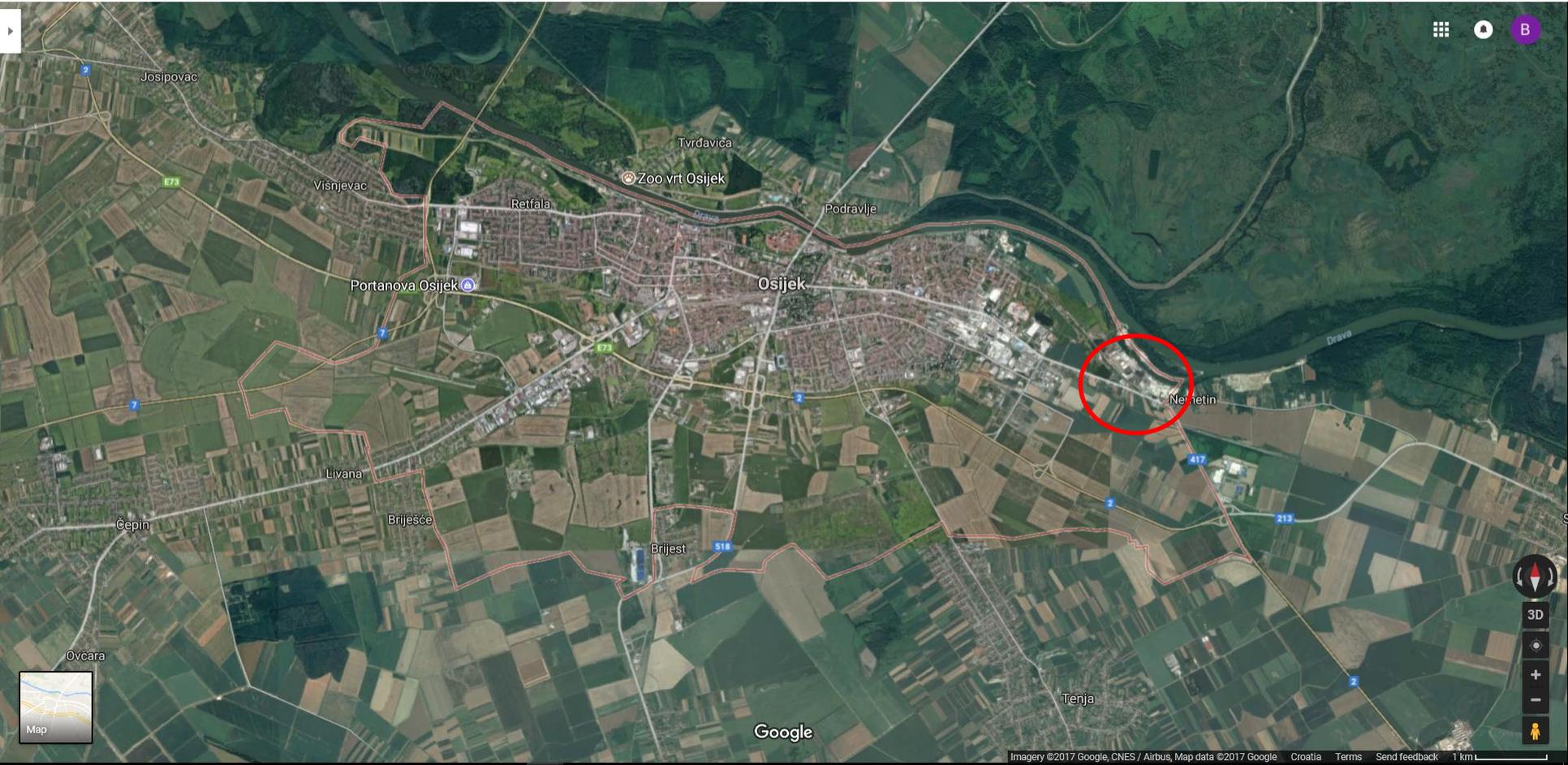
- o The City of Osijek from ecosystem services and branding
- o CHP bioenergy plant boosts local employment
- o Citizens have improved life standard
- o Emigration has a reason to return
- o ...

## Further steps:

- o Prevent pollen grains reaching the breathing zone in the City: SRC as wind/pollen barriers = **MAP pollen migration with wind charts and elevation**
- o Prevent ragweed to develop: SRC plantation as a biological control measure = **plant SRC trial plantations at Nemetin Zone (<101 ha)**
- o Prevent ragweed seed germination: SRC plantation as a long-term biological control measure = **modelling**
- o Financially offset ragweed eradication measures: SRC for bioenergy = **contrast against wood chips prices**
- o Utilise the idle/abandoned areas: SRC for bioenergy as a biological control measure = **GIS mapping of SRC slots**

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NO THANKS YES



*More results are coming up*

Discussion, comments or suggestions are welcomed and to be addressed towards:

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Thank you!