Control of Acer negundo insights from experimental and physiological studies


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Target species: Boxelder maple (*Acer negundo*)

- Light green foliage
- Fast-growing
- Dioecious species
- Seed dispersal by wind and water
- Resprouts from the stump
- Source: urban plantations
Distribution areas

Native range

Introduced in Europe in 1689 (GB) around 1749 in France

Invasive range

Lamarque LJ, PhD (2013)
Invaded habitats

Riparian forests and wetlands

Local distribution

- **Fraxinus sp, Quercus sp**
  - = LATE-SUCCESSIONAL SPECIES

- **Acer negundo**
  - = INTERMEDIATE POSITION + RIVERBANKS

- **Salix sp, Populus sp, Alnus sp**
  - = PIONEER SPECIES
Negundo negatively impacts native tree species

Density

Lamarque et al. 2012 Ecography
Negundo dominates native tree species

**Frequency**

- Acer negundo
- Native tree species

![Graph showing frequency of Acer negundo and native tree species across stages of development (seedlings, saplings, adults)].

**Methods** in Lamarque et al. 2012 Ecography.
Local context: ecological and economic impacts

• River bank collapse

• Lower nesting

• Production and conservation concerns:
  ▪ Replacement of *Populus* (paper pulp), *Alnus* (energy)
  ▪ Protected areas
Questions?

Can we control *Acer negundo* establishment?

In which way?
Main methods to control invasive trees

Mortality rate (%) of resprouting invasive species

Review 50 articles
Main methods to control invasive trees

Mortality rate (%) of resprouting invasive species

Prohibited in natural areas (wetlands, forests ...)

Review 50 articles
Experimental sites

- Experiment setting up
- 1st year of measurements
- 2nd year of measurements

Legend:
- ★ Management locations
- ● Major cities
- Rivers

Map showing locations: Bruges, Salies, Marestaing, Bayonne, Toulouse.
Experimental sites

### Salles
- Acer negundo: 91%
- Populus sp: 1%
- Alnus glutinosa: 1%
- Ulmus minor: 0%
- Carpinus betulus: 0%
- Quercus robur: 7%

### Bruges
- Acer negundo: 69%
- Fraxinus excelsior: 16%
- Ulmus minor: 3%
- Quercus robur: 1%
- Alnus glutinosa: 0%
- Platanus sp: 11%

### Marestaing
- Acer negundo: 22%
- Ulmus minor: 1%
- Fraxinus excelsior: 1%
- Alnus glutinosa: 0%
- Populus alba: 72%
- Salix alba: 4%
Experimental treatments

- **Cutting**
- **Cutting** + **Juglone**
- **Large girdling**
- **High cutting**
- **Girdling**
- **Cutting + Juglone**
Experimental treatments

**High cutting**

- **C**: Cutting (0.20 m)
- **H**: High cutting (1.30 m)
- **G**: Girdling (1.30 m)
- **J**: Cutting + Juglone (0.20 m + Juglone)

**Large girdling**
Experimental treatments

Girdling

- 0.20 m Cutting
- 1.30 m High cutting
- 1.30 m Girdling
- 0.20 m Cutting + Juglone

Juglone

Large girdling

C
H
G
J
Experimental treatments

Juglone = allelopathic substance with herbicide properties
Experimental treatments

Measurements:

- **Mortality**: mortality rate (%)
- **Vitality**: diameter of the five largest resprouts

Juglone = allelopathic substance with herbicide properties
Mortality rate (%)

- **Cutting**
- **Girdling**
- **High cutting**
- **Juglone**

**Treatments**

- **N+1**
- **N+2**

Mortality rate by **girdling** best method.
Diameter of resprouts

Girdling limits diameter of resprouts
Control method of *A. negundo* in natural areas

- **Adults: girdling**
  - Control rather than eradication
  - 2-3 year long
  - Stand level method

- **Seedlings: removal**
  - No germination
  - No seed rain
  - Long distance dispersal?

Scars reconstructing the phloem tissues
High level of plasticity to nutrients and Light

• Growth (Relative Growth Rate)

Beware of an opening in forest cover

Adapted from Porté et al. 2011 BMC Ecology
Take Home Message

- No eradication but local elimination and control

- **Girdling** and *seedling removal*: best methods
  - Beware of timing
  - Beware of light and nutrients availability
The Negundo Team

And all the people from the Gers river management center, Bruges National Reserve, Natural Park of Landes de Gascogne, Pierroton Hermitage Experimental Unit

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