Montpellier Weeds and Invasive Plants 2014

4th International Symposium on Weeds and Invasive Plants

Alien plant species along watercourses in the Natura 2000 network

Arnaud Monty, Hélène Aimont, Gregory Mahy

biodiversité paysage

gembloux agro bio tech

Université de Liège

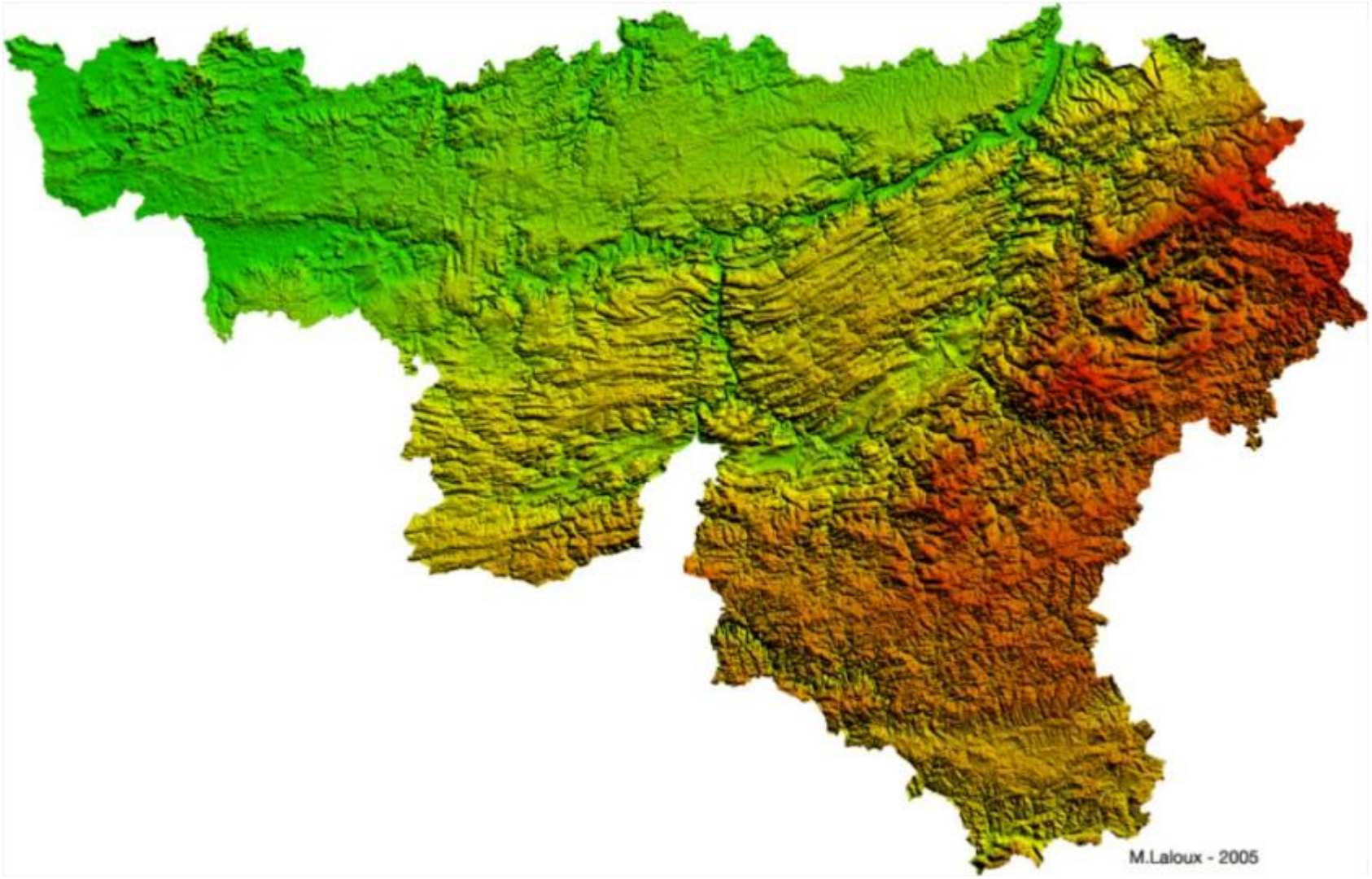
Rivers: the core of Natura 2000 in Wallonia

- Natura 2000 is an ecological network of protected areas in the European Union
- Complementary to natural reserves: lower protection, but larger scale (18% area)
- Set up differently in different member states and/or regions

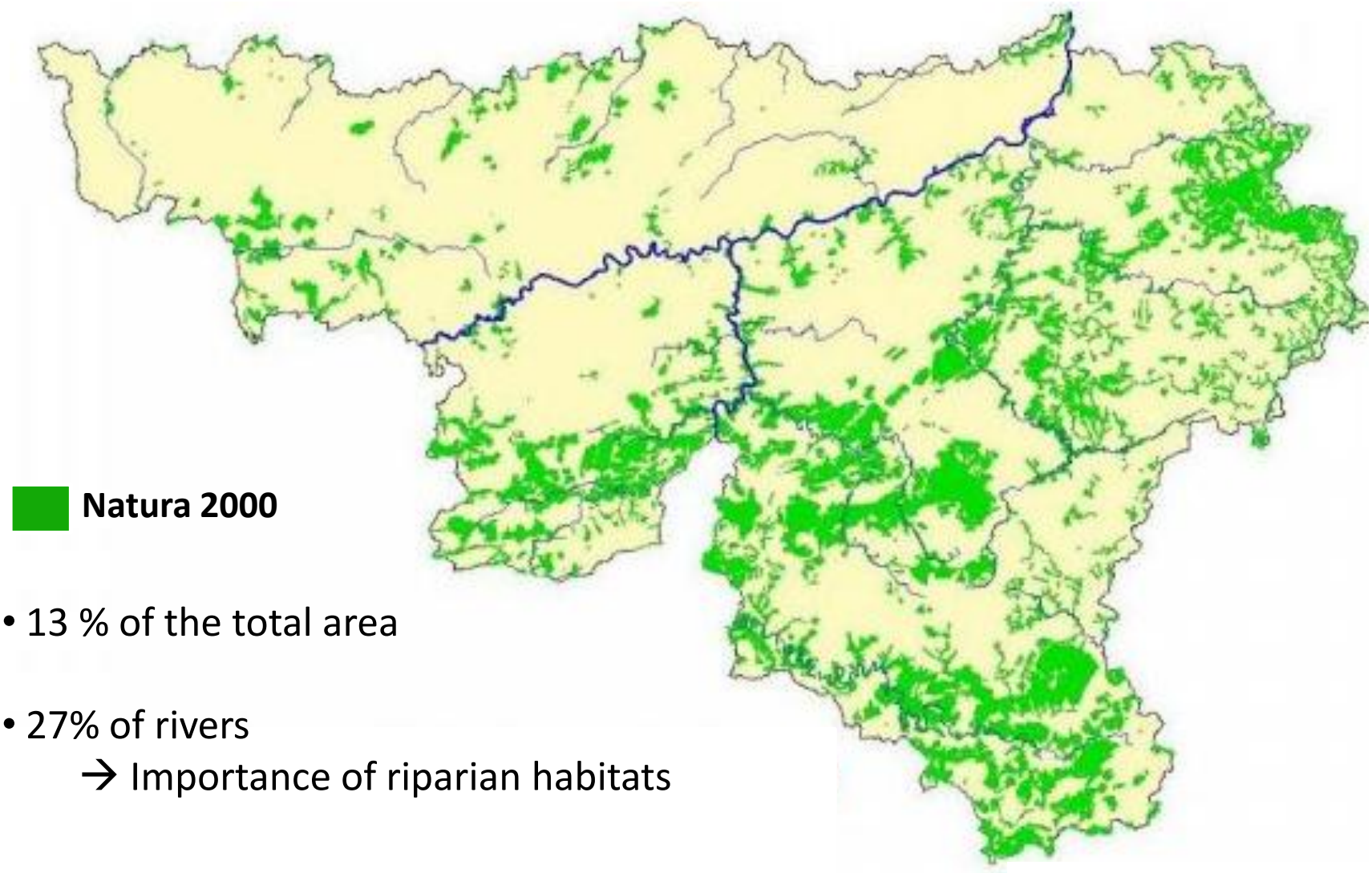
Wallonia
(Southern region of Belgium)

NATURA 2000

Rivers: the core of Natura 2000 in Wallonia



Rivers: the core of Natura 2000 in Wallonia



- 13 % of the total area
- 27% of rivers
  → Importance of riparian habitats

Rivers: the core of Natura 2000 in Wallonia

- Riparian habitats:
  - ➢ have high conservation values
  - ➢ are rather preserved
  - ➢ act as natural corridors for species




Rivers: the core of Natura 2000 in Wallonia

- Riparian habitats:
  - ➢ have high conservation values
  - ➢ are rather preserved
  - ➢ act as natural corridors for species
  - ➢ **are sensitive to plant invasion….**

✗ *Disturbances* ✗ *Downstream dispersal* ✗ *Gardens and ponds* ✗ *Important human use*




Research questions

- Represent a large proportion of riparian habitats
- Habitats should be in favourable conservation statuses

… and an improvement is expected!

- Are exposed to potentially high propagule pressures

➔Well-known invaders

➔ Emerging invaders (lag phase?)

✓**List all alien species occuring on river banks in the N2000 network**

✓**Identify the most common species**

✓**Identify the most problematical species**

✓**Assess the importance of downstream dispersal and disturances**

Method

Method: stratified sampling

Sampling method

- Stratefied sampling of 187 units in the N2000 network

  ➢ *Strata: 5 natural regions AND 2 watersheds size (> and < 100 km²)*

- Sampling unit: 150 x 10m of river bank

  ➢ *28 km of linear river bank in total*
  (~0.4% of the 6800 km of river in Natura 2000)

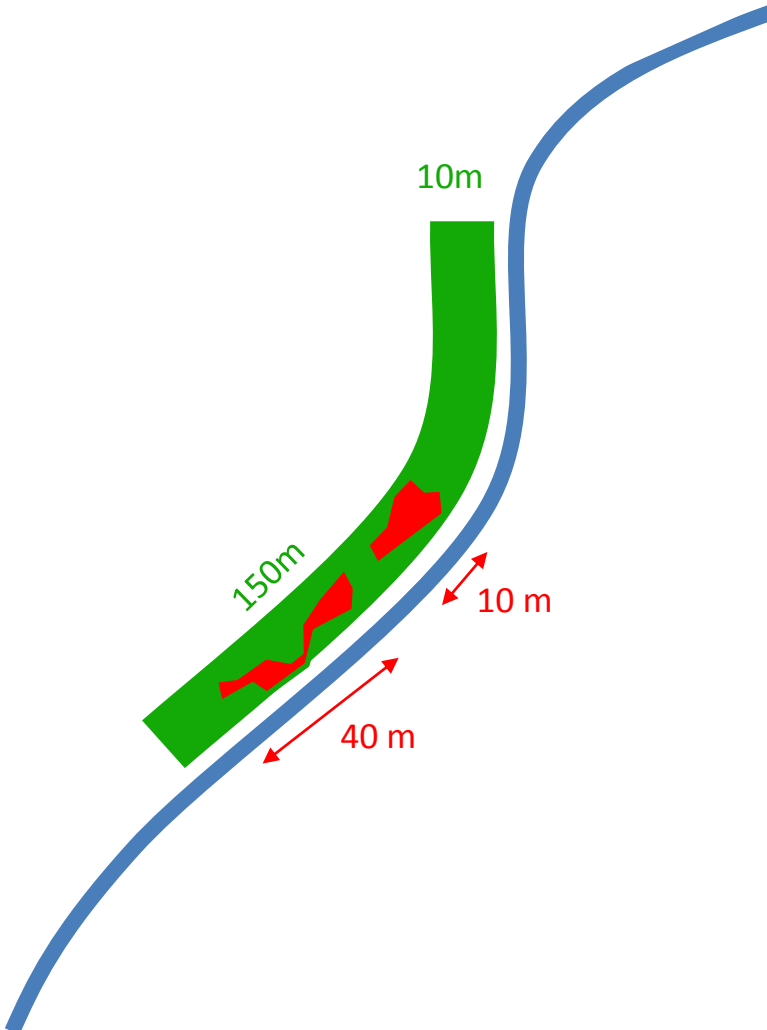
Method: stratified sampling

Measurements:

- Vegetation relevés from May to September 2013

- For all alien species:
  - ✓ Occurrence
  - ✓Linear proportion of river bank invaded

    Example: (40m + 10m) / 150m



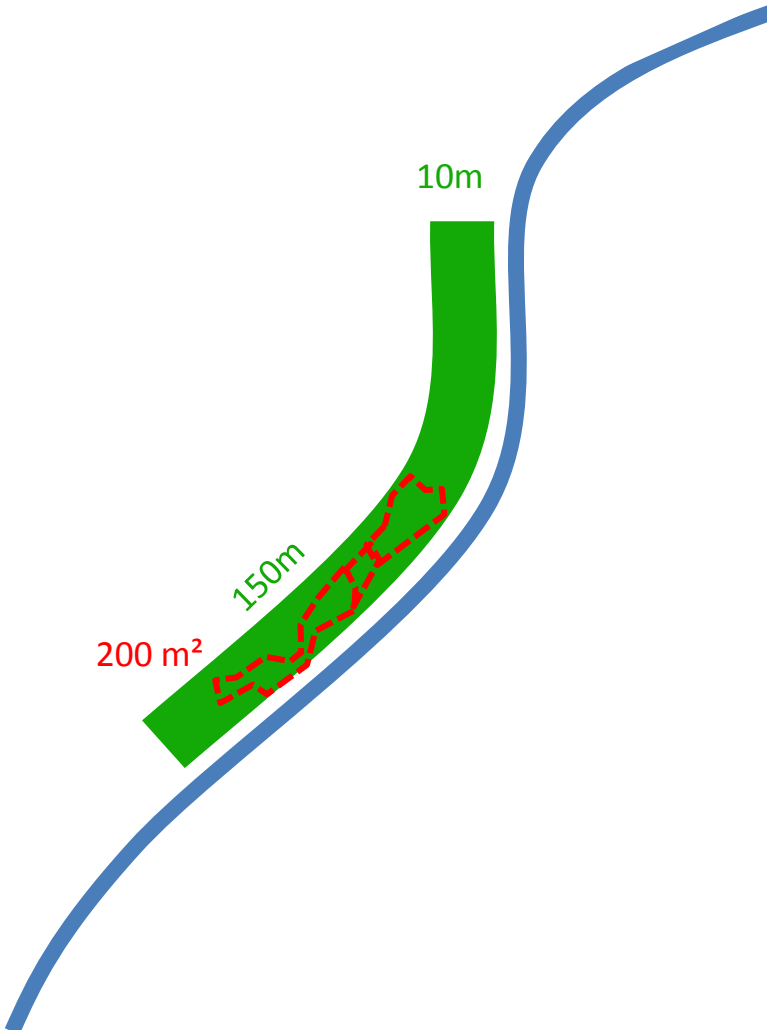
Method: stratified sampling

Measurements:

- Vegetation relevés from May to September 2013

- For all alien species:
  - ✓ Occurrence
  - ✓Linear proportion of river bank invaded

    Example: (40m + 10m) / 150m
  - ✓Area invaded



Method: stratified sampling

Measurements:

- Vegetation relevés from May to September 2013

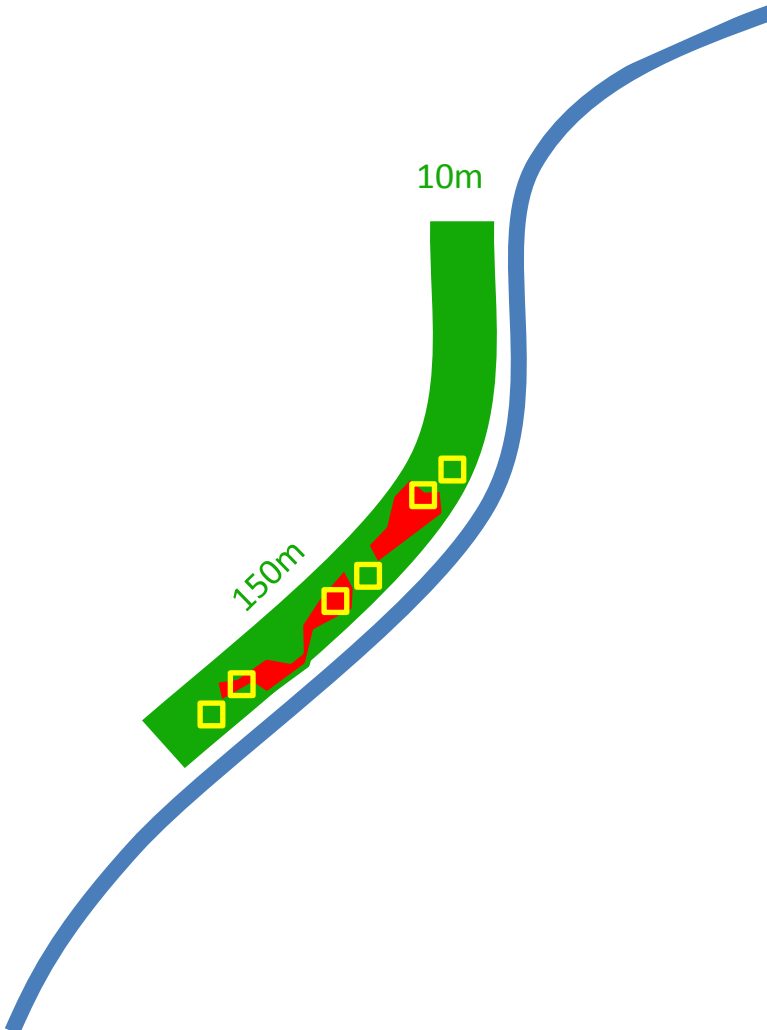
- For all alien species:
  - ✓ Occurrence
  - ✓Linear proportion of river bank invaded

    Example: (40m + 10m) / 150m
  - ✓Area invaded

- In 3 pairs of quadrats (invaded / non-invaded):
  - ✓ Invasive plant cover
  - ✓ Number of native species

- Presence of disturbance

(construction, enbankment, presence of green waste…)



Results

Results

- 51 exotic species recorded
- 75 % of the sites were invaded by at least one exotic species
- One site with 13 exotic species

Results

- 51 exotic species recorded
- 75 % of the sites were invaded by at least one exotic species
- One site with 13 exotic species

➔ **What are the most common species?**

Results: most common species

Exotic species	Number of sites	Linear proportion of river bank (%)
Picea abies	76/187	17.1
Impatiens glandulifera	45/187	16.6
Epilobium ciliatum	33/187	4.1
Fallopia spp.	10/187	1.6
Alnus incana	10/187	1.1
Impatiens parviflora	3/187	0.9
Populus x canadensis	13/187	0.7
Prunus serotina	11/187	0.7
Larix kaempferi	5/187	0.4
Solidago gigantea	5/187	0.4
Quercus rubra	3/187	0.3
Hesperis matronalis	4/187	0.2
Bidens frondosa	3/187	0.2
Heracleum mantegazzianum	3/187	0.2
Pseudotsuga menziesii	5/187	0.1

Norway spruce

New plantations forbidden

Only 7.2 % of river bank invaded when excluding plantations

Results: most common species

Exotic species	Number of sites	Linear proportion of river bank (%)
Picea abies	76/187	17.1
Impatiens glandulifera	45/187	16.6
Epilobium ciliatum	33/187	4.1
Fallopia spp.	10/187	1.6
Alnus incana	10/187	1.1
Impatiens parviflora	3/187	0.9
Populus x canadensis	13/187	0.7
Prunus serotina	11/187	0.7
Larix kaempferi	5/187	0.4
Solidago gigantea	5/187	0.4
Quercus rubra	3/187	0.3
Hesperis matronalis	4/187	0.2
Bidens frondosa	3/187	0.2
Heracleum mantegazzianum	3/187	0.2
Pseudotsuga menziesii	5/187	0.1

Norway spruce

New plantations forbidden

Only 7.2 % of river bank invaded when excluding plantations

Results: most common species

Exotic species	Number of sites	Linear proportion of river bank (%)
Picea abies	76/187	17.1
Impatiens glandulifera	45/187	16.6
Epilobium ciliatum	33/187	4.1
Fallopia spp.	10/187	1.6
Alnus incana	10/187	1.1
Impatiens parviflora	3/187	0.9
Populus x canadensis	13/187	0.7
Prunus serotina	11/187	0.7
Larix kaempferi	5/187	0.4
Solidago gigantea	5/187	0.4
Quercus rubra	3/187	0.3
Hesperis matronalis	4/187	0.2
Bidens frondosa	3/187	0.2
Heracleum mantegazzianum	3/187	0.2
Pseudotsuga menziesii	5/187	0.1

Giant balsam

Results: most common species

Exotic species	Number of sites	Linear proportion of river bank (%)
Picea abies	76/187	17.1
Impatiens glandulifera	45/187	16.6
Epilobium ciliatum	33/187	4.1
Fallopia spp.	10/187	1.6
Alnus incana	10/187	1.1
Impatiens parviflora	3/187	0.9
Populus x canadensis	13/187	0.7
Prunus serotina	11/187	0.7
Larix kaempferi	5/187	0.4
Solidago gigantea	5/187	0.4
Quercus rubra	3/187	0.3
Hesperis matronalis	4/187	0.2
Bidens frondosa	3/187	0.2
Heracleum mantegazzianum	3/187	0.2
Pseudotsuga menziesii	5/187	0.1

Northern willowherb

Weedy species rapidly increasing in abundance

Identification difficult (possible underestimation)

Hybridization with native willowherbs

Results: most common species

Exotic species	Number of sites	Linear proportion of river bank (%)
Picea abies	76/187	17.1
Impatiens glandulifera	45/187	16.6
Epilobium ciliatum	33/187	4.1
Fallopia spp.	10/187	1.6
Alnus incana	10/187	1.1
Impatiens parviflora	3/187	0.9
Populus x canadensis	13/187	0.7
Prunus serotina	11/187	0.7
Larix kaempferi	5/187	0.4
Solidago gigantea	5/187	0.4
Quercus rubra	3/187	0.3
Hesperis matronalis	4/187	0.2
Bidens frondosa	3/187	0.2
Heracleum mantegazzianum	3/187	0.2
Pseudotsuga menziesii	5/187	0.1

Asian knotweed

Three species altogether

F. japonica/F. sachalinensis/F. x bohemica

Mostly in open habitats

Results: most common species

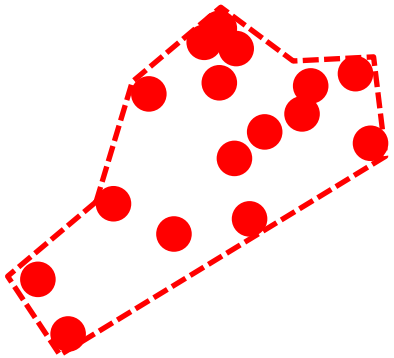
Exotic species	Number of sites	Linear proportion of river bank (%)
Picea abies	76/187	17.1
Impatiens glandulifera	45/187	16.6
Epilobium ciliatum	33/187	4.1
Fallopia spp.	10/187	1.6
Alnus incana	10/187	1.1
Impatiens parviflora	3/187	0.9
Populus x canadensis	13/187	0.7
Prunus serotina	11/187	0.7
Larix kaempferi	5/187	0.4
Solidago gigantea	5/187	0.4
Quercus rubra	3/187	0.3
Hesperis matronalis	4/187	0.2
Bidens frondosa	3/187	0.2
Heracleum mantegazzianum	3/187	0.2
Pseudotsuga menziesii	5/187	0.1

➔ **What are the most problematical species?**

Results: most problematical species

Quantification of the competitive impact:

Impact = Area invaded x *Invasive cover* x *Delta species*



X % x

Sp. richness in **non-invaded**
– Sp. richness in **invaded** quadrats

Area covered by the species

Intrinsic competitive impact

Results: most problematical species

Exotic species	Area of « pure » invasive population (m^2)	ΔSp (Nb Sp)	Impact (Nb $sp.m^2$)
Fallopia spp.	181,9 ± 107,7	1,1 ± 0,5	554,0 ± 364,6
Picea abies (plantations excluded)	186,1 ± 51,1	1,7 ± 0,3	352,4 ± 112,8
Phyllostachys spp.	158,4	2,0	316,8
Impatiens glandulifera	241,1 ± 49,8	0,8 ± 0,2	280,3 ± 133,3
Alnus incana	139,8 ± 88,3	1,2 ± 0,4	252,5 ± 179,2
Prunus laurocerasus	146,4 ± 106,8	1,5 ± 0,2	237,3 ± 184,5
Quercus rubra	112,5 ± 87,6	2,6 ± 1,2	153,0 ± 115,8
Pseudotsuga menziesii	32,4 ± 27,0	1,9 ± 1,0	140,8 ± 128,4
Spiraea chamaedryfolia	39,0	2,7	103,9
Solidago gigantea	61,9 ± 41,2	0,2 ± 0,8	82,0 ± 93,0

- Well-known blacklisted invasive
- Eradication hardly feasible

Results: most problematical species

Exotic species	Area of « pure » invasive population (m^2)	ΔSp (Nb Sp)	Impact (Nb $sp.m^2$)
Fallopia spp.	181,9 ± 107,7	1,1 ± 0,5	554,0 ± 364,6
Picea abies (plantations excluded)	186,1 ± 51,1	1,7 ± 0,3	352,4 ± 112,8
Phyllostachys spp.	158,4	2,0	316,8
Impatiens glandulifera	241,1 ± 49,8	0,8 ± 0,2	280,3 ± 133,3
Alnus incana	139,8 ± 88,3	1,2 ± 0,4	252,5 ± 179,2
Prunus laurocerasus	146,4 ± 106,8	1,5 ± 0,2	237,3 ± 184,5
Quercus rubra	112,5 ± 87,6	2,6 ± 1,2	153,0 ± 115,8
Pseudotsuga menziesii	32,4 ± 27,0	1,9 ± 1,0	140,8 ± 128,4
Spiraea chamaedryfolia	39,0	2,7	103,9
Solidago gigantea	61,9 ± 41,2	0,2 ± 0,8	82,0 ± 93,0

- High impact even when excluding plantations
- Other impacts documented: soil acidification, etc.

Results: most problematical species

Exotic species	Area of « pure » invasive population (m^2)	ΔSp (Nb Sp)	Impact (Nb $sp.m^2$)
Fallopia spp.	181,9 ± 107,7	1,1 ± 0,5	554,0 ± 364,6
Picea abies (plantations excluded)	186,1 ± 51,1	1,7 ± 0,3	352,4 ± 112,8
Phyllostachys spp.	158,4	2,0	316,8
Impatiens glandulifera	241,1 ± 49,8	0,8 ± 0,2	280,3 ± 133,3
Alnus incana	139,8 ± 88,3	1,2 ± 0,4	252,5 ± 179,2
Prunus laurocerasus	146,4 ± 106,8	1,5 ± 0,2	237,3 ± 184,5
Quercus rubra	112,5 ± 87,6	2,6 ± 1,2	153,0 ± 115,8
Pseudotsuga menziesii	32,4 ± 27,0	1,9 ± 1,0	140,8 ± 128,4
Spiraea chamaedryfolia	39,0	2,7	103,9
Solidago gigantea	61,9 ± 41,2	0,2 ± 0,8	82,0 ± 93,0

- Bamboo escaped from garden

!! Only one site but extremely abundant and competitive !!

Results: most problematical species

Exotic species	Area of « pure » invasive population (m^2)	ΔSp (Nb Sp)	Impact (Nb $sp.m^2$)
Fallopia spp.	181,9 ± 107,7	1,1 ± 0,5	554,0 ± 364,6
Picea abies (plantations excluded)	186,1 ± 51,1	1,7 ± 0,3	352,4 ± 112,8
Phyllostachys spp.	158,4	2,0	316,8
Impatiens glandulifera	241,1 ± 49,8	0,8 ± 0,2	280,3 ± 133,3
Alnus incana	139,8 ± 88,3	1,2 ± 0,4	252,5 ± 179,2
Prunus laurocerasus	146,4 ± 106,8	1,5 ± 0,2	237,3 ± 184,5
Quercus rubra	112,5 ± 87,6	2,6 ± 1,2	153,0 ± 115,8
Pseudotsuga menziesii	32,4 ± 27,0	1,9 ± 1,0	140,8 ± 128,4
Spiraea chamaedryfolia	39,0	2,7	103,9
Solidago gigantea	61,9 ± 41,2	0,2 ± 0,8	82,0 ± 93,0

- Lower intrinsic impact …but very frequent!
- Impact on pollination networks ?

Results: most problematical species

Exotic species	Area of « pure » invasive population (m^2)	ΔSp (Nb Sp)	Impact (Nb $sp.m^2$)
Fallopia spp.	181,9 ± 107,7	1,1 ± 0,5	554,0 ± 364,6
Picea abies (plantations excluded)	186,1 ± 51,1	1,7 ± 0,3	352,4 ± 112,8
Phyllostachys spp.	158,4	2,0	316,8
Impatiens glandulifera	241,1 ± 49,8	0,8 ± 0,2	280,3 ± 133,3
Alnus incana	139,8 ± 88,3	1,2 ± 0,4	252,5 ± 179,2
Prunus laurocerasus	146,4 ± 106,8	1,5 ± 0,2	237,3 ± 184,5
Quercus rubra	112,5 ± 87,6	2,6 ± 1,2	153,0 ± 115,8
Pseudotsuga menziesii	32,4 ± 27,0	1,9 ± 1,0	140,8 ± 128,4
Spiraea chamaedryfolia	39,0	2,7	103,9
Solidago gigantea	61,9 ± 41,2	0,2 ± 0,8	82,0 ± 93,0

Many ornamentals escaped from gardens

Cherry laurel

Phyllostachys

Results: most problematical species

Exotic species	Area of « pure » invasive population (m^2)	ΔSp (Nb Sp)	Impact (Nb $sp.m^2$)
Fallopia spp.	181,9 ± 107,7	1,1 ± 0,5	554,0 ± 364,6
Picea abies (plantations excluded)	186,1 ± 51,1	1,7 ± 0,3	352,4 ± 112,8
Phyllostachys spp.	158,4	2,0	316,8
Impatiens glandulifera	241,1 ± 49,8	0,8 ± 0,2	280,3 ± 133,3
Alnus incana	139,8 ± 88,3	1,2 ± 0,4	252,5 ± 179,2
Prunus laurocerasus	146,4 ± 106,8	1,5 ± 0,2	237,3 ± 184,5
Quercus rubra	112,5 ± 87,6	2,6 ± 1,2	153,0 ± 115,8
Pseudotsuga menziesii	32,4 ± 27,0	1,9 ± 1,0	140,8 ± 128,4
Spiraea chamaedryfolia	39,0	2,7	103,9
Solidago gigantea	61,9 ± 41,2	0,2 ± 0,8	82,0 ± 93,0

… but also several timber production species !


Norway spruce


Grey alder


Red oak


Douglas fir

Other results

- Important downstream accumulation for *Impatiens glandulifera*

  ➔*6 times more frequent in large watersheds (>100 km²)*

- No significant effet of disturbance on exotic species occurence



Conclusions

- **Globally high invasion level :**

  By well-known invaders:
  → *Giant balsam and Asian knotweeds*

  By potentially emerging invaders:
  → *Northern willowherb? Cherry laurel? Bamboos ? Etc.*

- **Importance of timber production species**
  →N2000 reglementation makes new coniferous plantation forbidden

  But:
  → Natural regeneration !
  →Deciduous species

- **In the future:**

➔ Set up a monitoring system for emerging species
➔ Compare with the situation outside N2000

Thank you for your attention !

This research project was funded by the Public Service of Wallonia
Under the supervision of Dr. J-P. Bizoux

Wallonie