

Monitoring the occurrence of invasive plants in different types of natural habitats

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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)

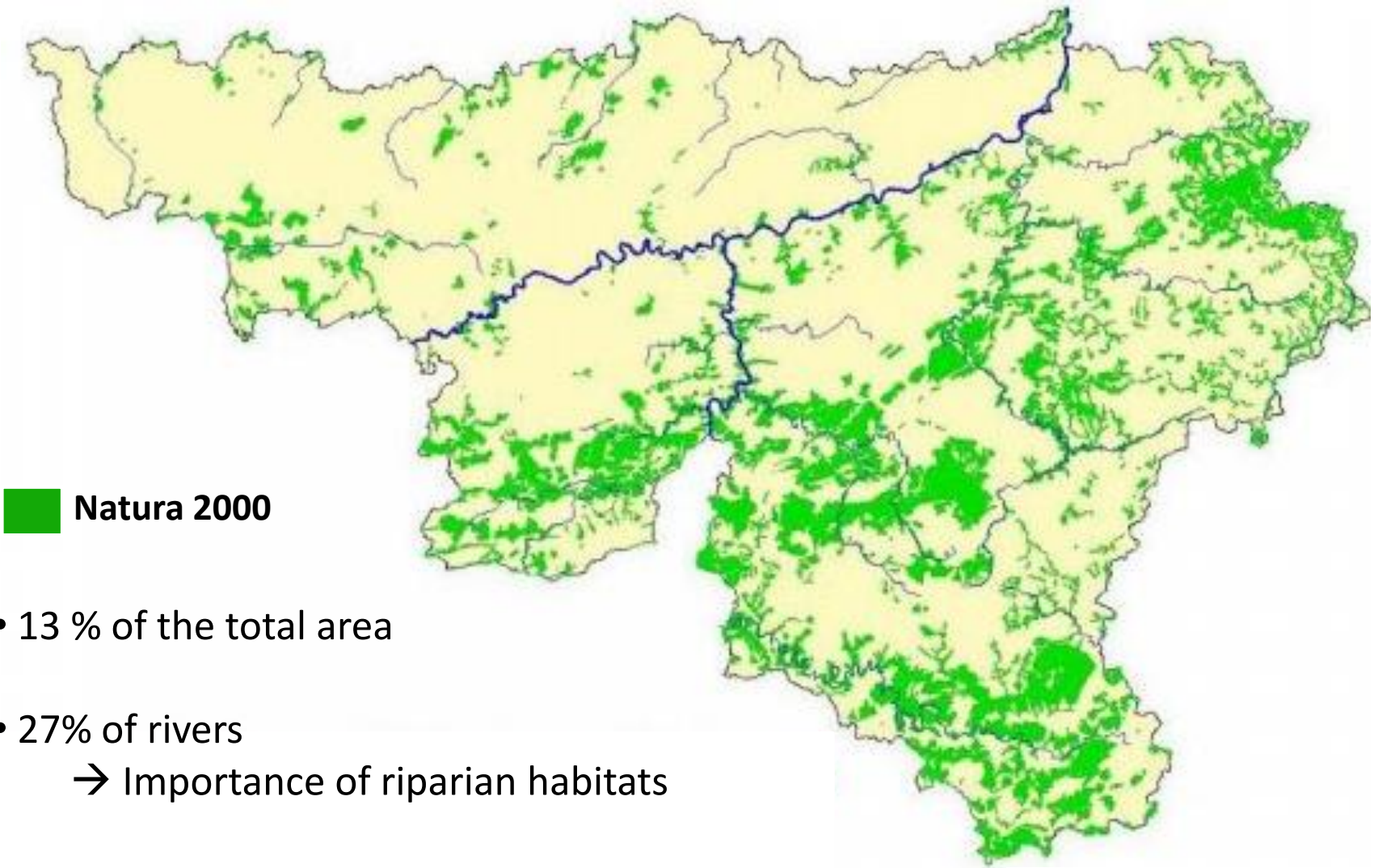


Natura 2000 in Wallonia



0 15 30 60 Kilometers

Natura 2000 in Wallonia



 Natura 2000

- 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



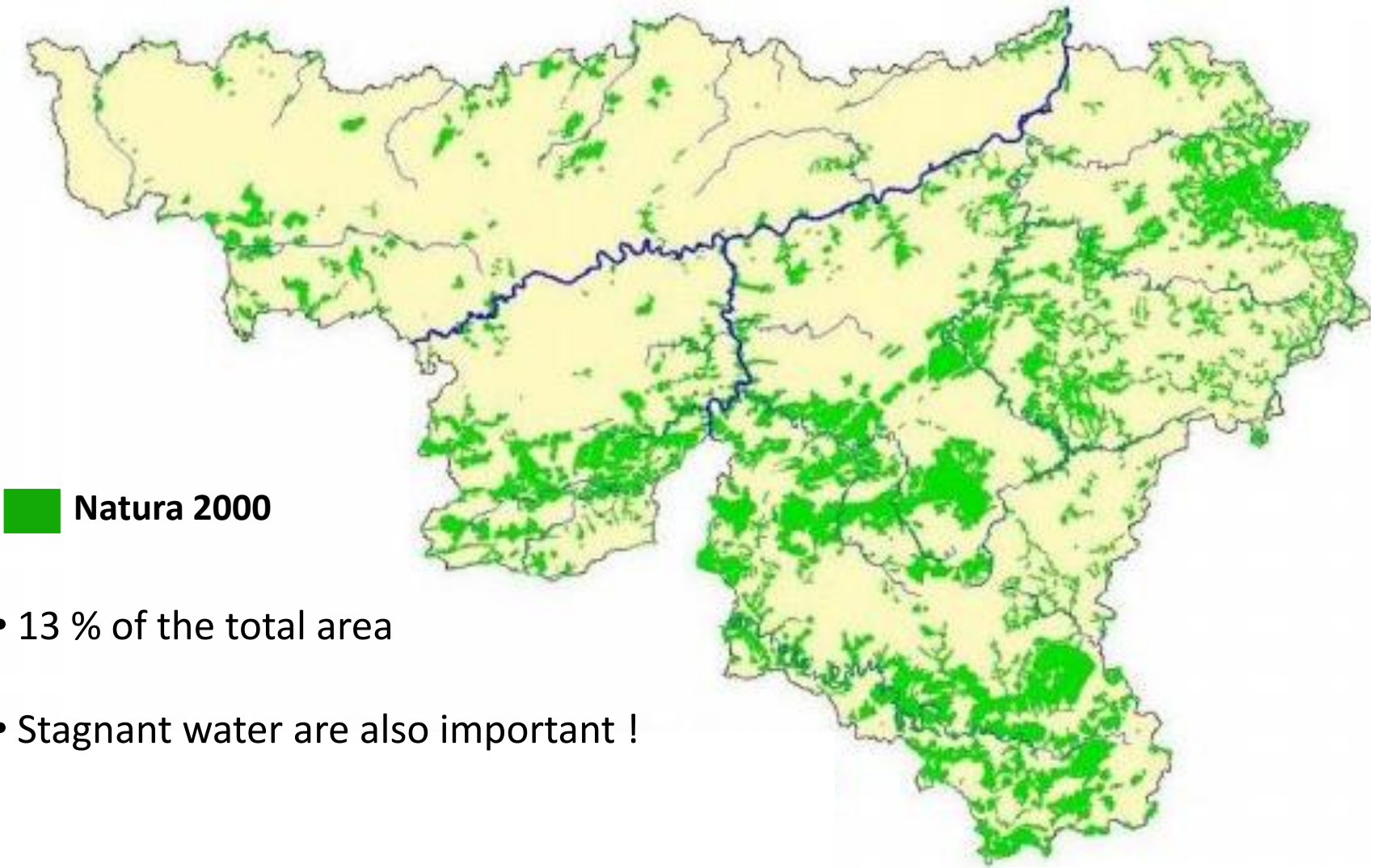
Rivers: the core of Natura 2000 in Wallonia

- 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



Natura 2000 in Wallonia



Natura 2000

- 13 % of the total area
- Stagnant water are also important !

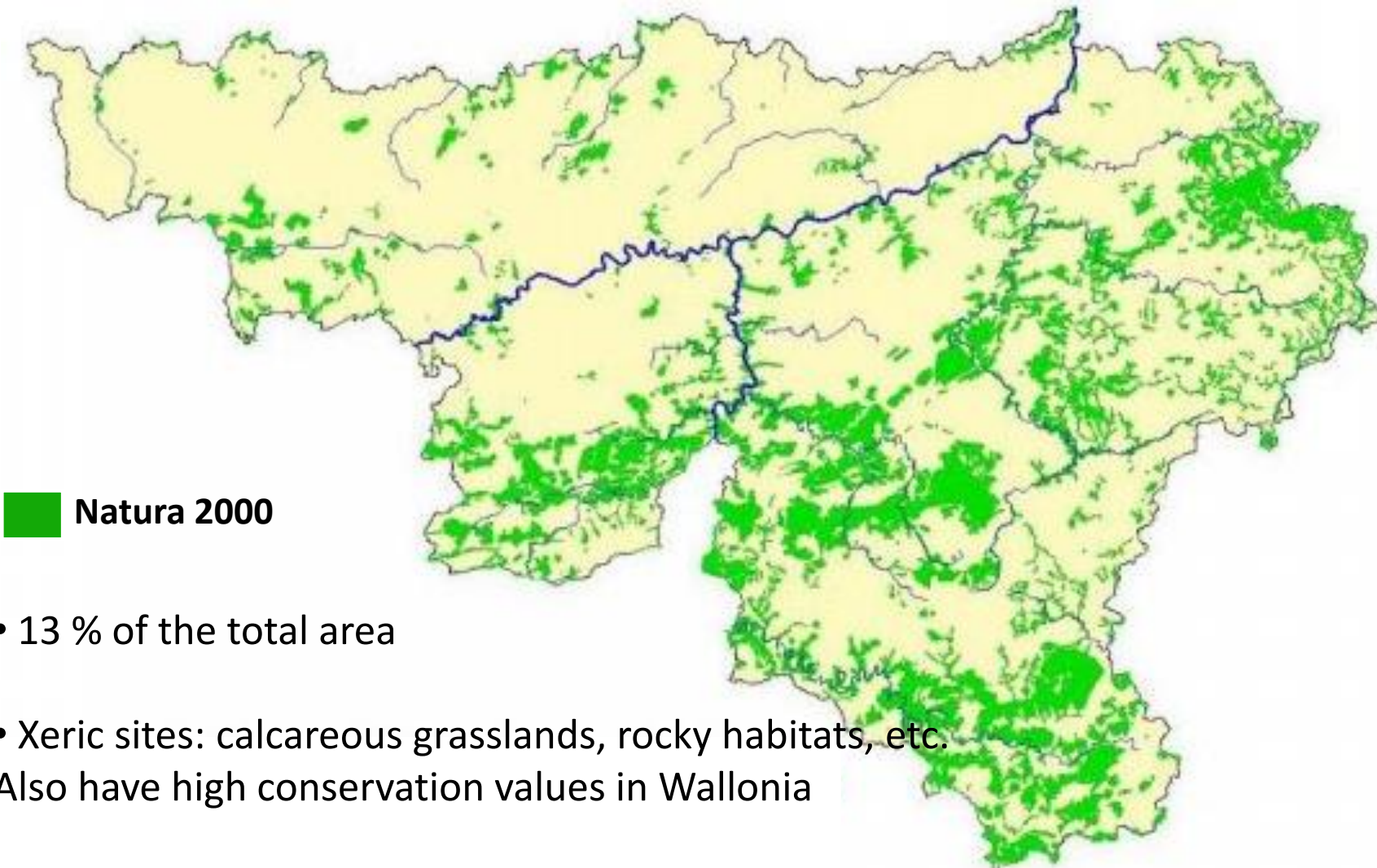


Stagnant waters: particularly sensitive to aquatic aliens

- Stagnant waters:
 - have relatively high conservation and recreational values
 - **are extremely sensitive to plant invasion....**
 - **... and control is extremely difficult !**



Natura 2000 in Wallonia



 **Natura 2000**

- 13 % of the total area
- Xeric sites: calcareous grasslands, rocky habitats, etc.
Also have high conservation values in Wallonia



Xeric habitats

- Xeric habitats:
 - have high conservation and patrimonial values
 - **are supposed to be less sensitive to plant invasion...**
 - **...even though cases are recorded!**



Research questions

Is it a big problem? What priority?

- ✓ List all alien species occurring in these habitats
- ✓ Identify the most common species
- ✓ Identify the most problematical species

Case study on rivers : method



Case study on rivers : method - sampling

Sampling method

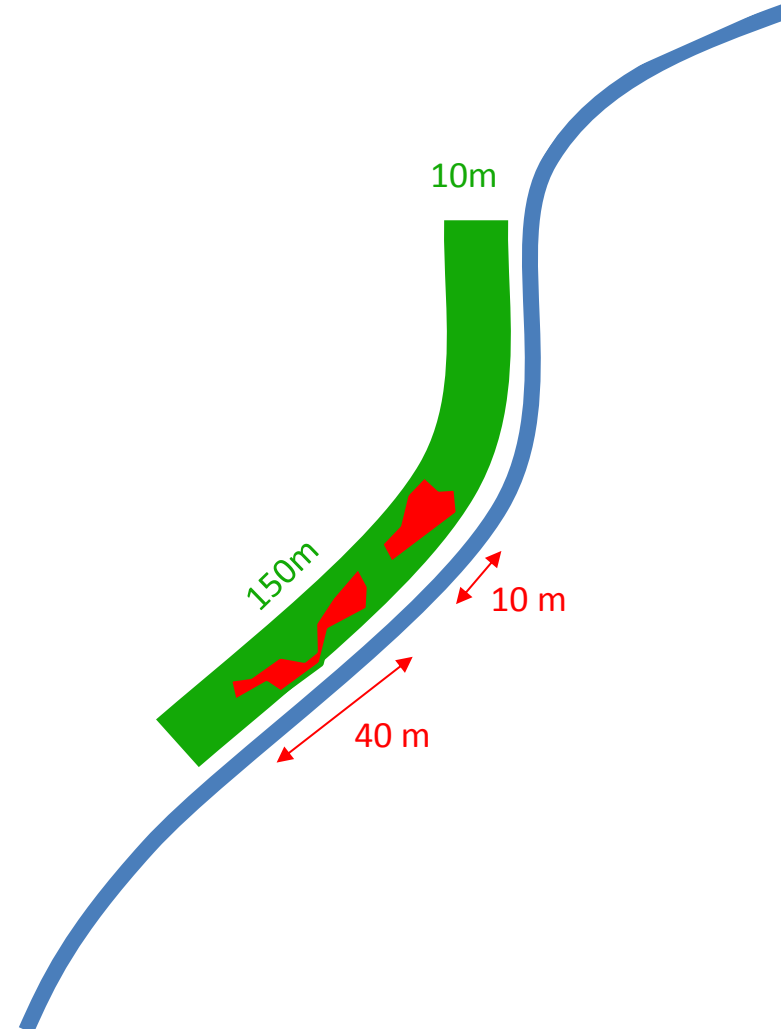
- Stratified sampling of 187 units in the N2000 network
- Sampling unit: 150 x 10m of river bank
 - *28 km of linear river bank in total*
(~0.4% of the 6800 km of river in Natura 2000)

Case study on rivers : method - sampling

Measurements:

- Vegetation relevés from May to September 2013
- For all alien species:
 - ✓ Occurrence
 - ✓ Linear proportion of river bank invaded

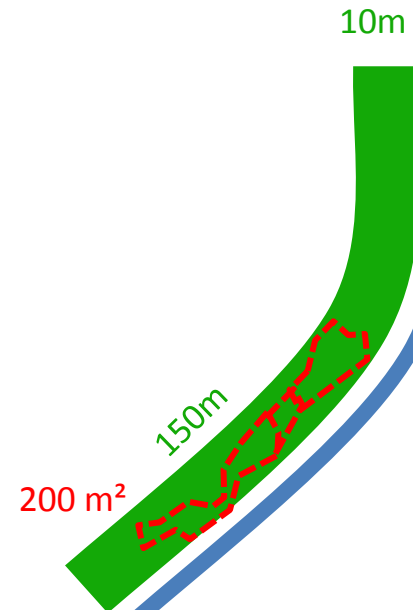
Example: $(40\text{m} + 10\text{m}) / 150\text{m}$



Case study on rivers : method - sampling

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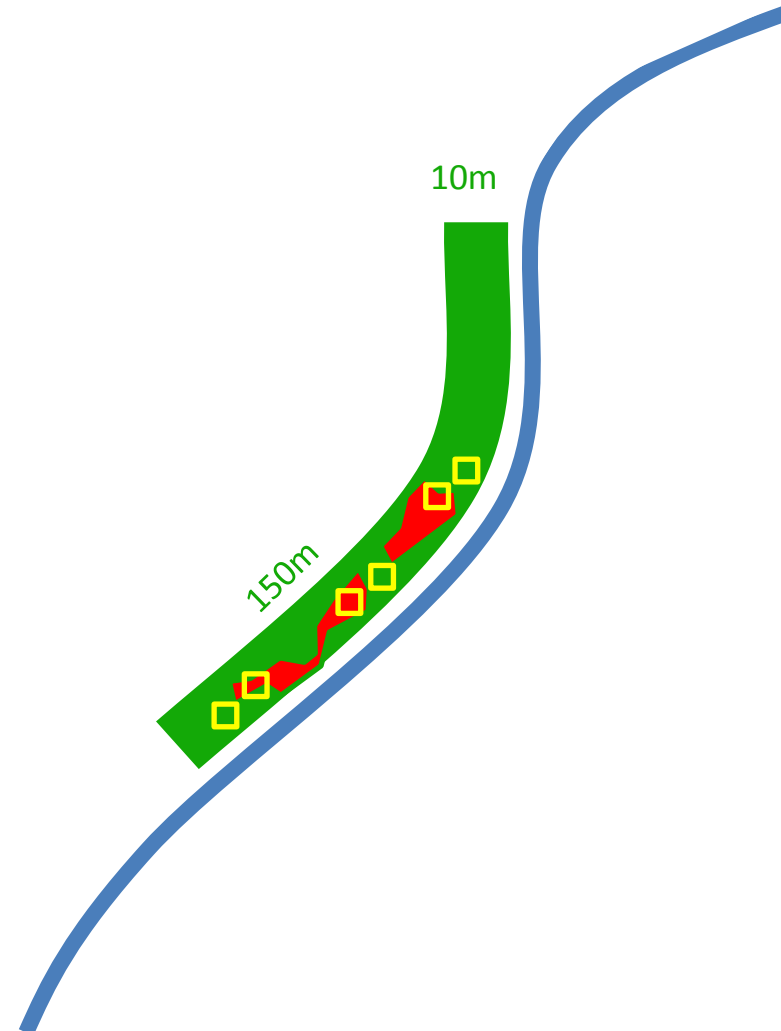
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Case study on rivers : method - sampling

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- For all alien species:
 - ✓ Occurrence
 - ✓ Linear proportion of river bank invaded
Example: $(40\text{m} + 10\text{m}) / 150\text{m}$
 - ✓ Area invaded
- In 3 pairs of quadrats (invaded / non-invaded):
 - ✓ Invasive plant cover
 - ✓ Number of native species



Case study on rivers : results



Case study on rivers : results

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

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➔ What are the most common species?

Case study on rivers : results - most common species

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

New plantations forbidden

Only 7.2 % of river bank invaded when excluding plantations

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Giant balsam

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Northern willowherb

Weedy species rapidly increasing in abundance

Identification difficult (possible underestimation)

Hybridization with native willowherbs

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Asian knotweed

Three species altogether

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

Mostly in open habitats

Case study on rivers : results - most common species

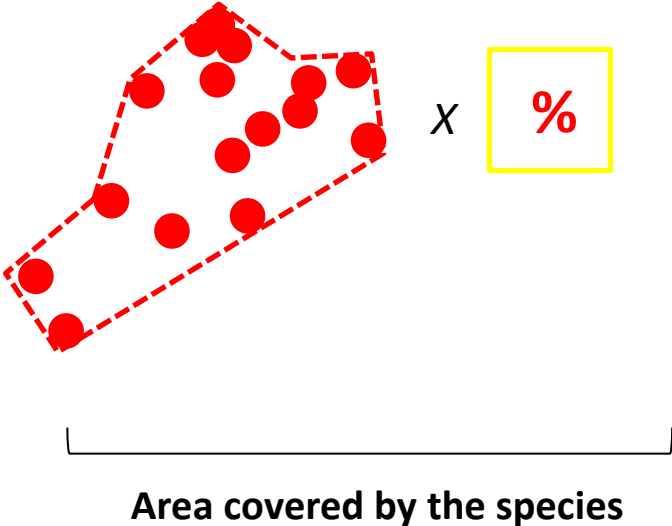
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➔ What are the most problematical species?

Case study on rivers : results - most problematical species

Quantification of the competitive impact:


$$\text{Impact} = \text{Area invaded} \times \text{Invasive cover} \times \text{Delta species}$$



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



Case study on rivers : results - most problematical species

| Exotic species | Area of « pure » invasive population (m ²) | ΔSp (Nb Sp) | Impact (Nb sp.m ²) |
|---|--|-------------|-----------------------------------|
|  <i>Fallopia spp.</i> | 181,9 ± 107,7 | 1,1 ± 0,5 | 554,0 ± 364,6 |
| <i>Picea abies</i> (plantations excluded) | 186,1 ± 51,1 | 1,7 ± 0,3 | 352,4 ± 112,8 |
| <i>Phyllostachys spp.</i> | 158,4 | 2,0 | 316,8 |
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| <i>Alnus incana</i> | 139,8 ± 88,3 | 1,2 ± 0,4 | 252,5 ± 179,2 |
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| <i>Pseudotsuga menziesii</i> | 32,4 ± 27,0 | 1,9 ± 1,0 | 140,8 ± 128,4 |
| <i>Spiraea chamaedryfolia</i> | 39,0 | 2,7 | 103,9 |
| <i>Solidago gigantea</i> | 61,9 ± 41,2 | 0,2 ± 0,8 | 82,0 ± 93,0 |



- Well-known blacklisted invasive
- Eradication hardly feasible

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

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- Bamboo escaped from garden

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

Case study on rivers : results - most problematical species

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- Lower intrinsic impact ...but very frequent!

Case study on rivers : results - most problematical species

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Many ornamentals escaped from gardens



Cherry laurel

Phyllostachys

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... but also several timber production species !



Norway spruce

Grey alder

Red oak

Douglas fir



Stagnant waters

- 400 water bodies sampled (ponds and lakes)
- In and out of the N2000 network
- Extensive search for exotic plants along the bank and in the water
- Focus on aquatic and amphibian plants



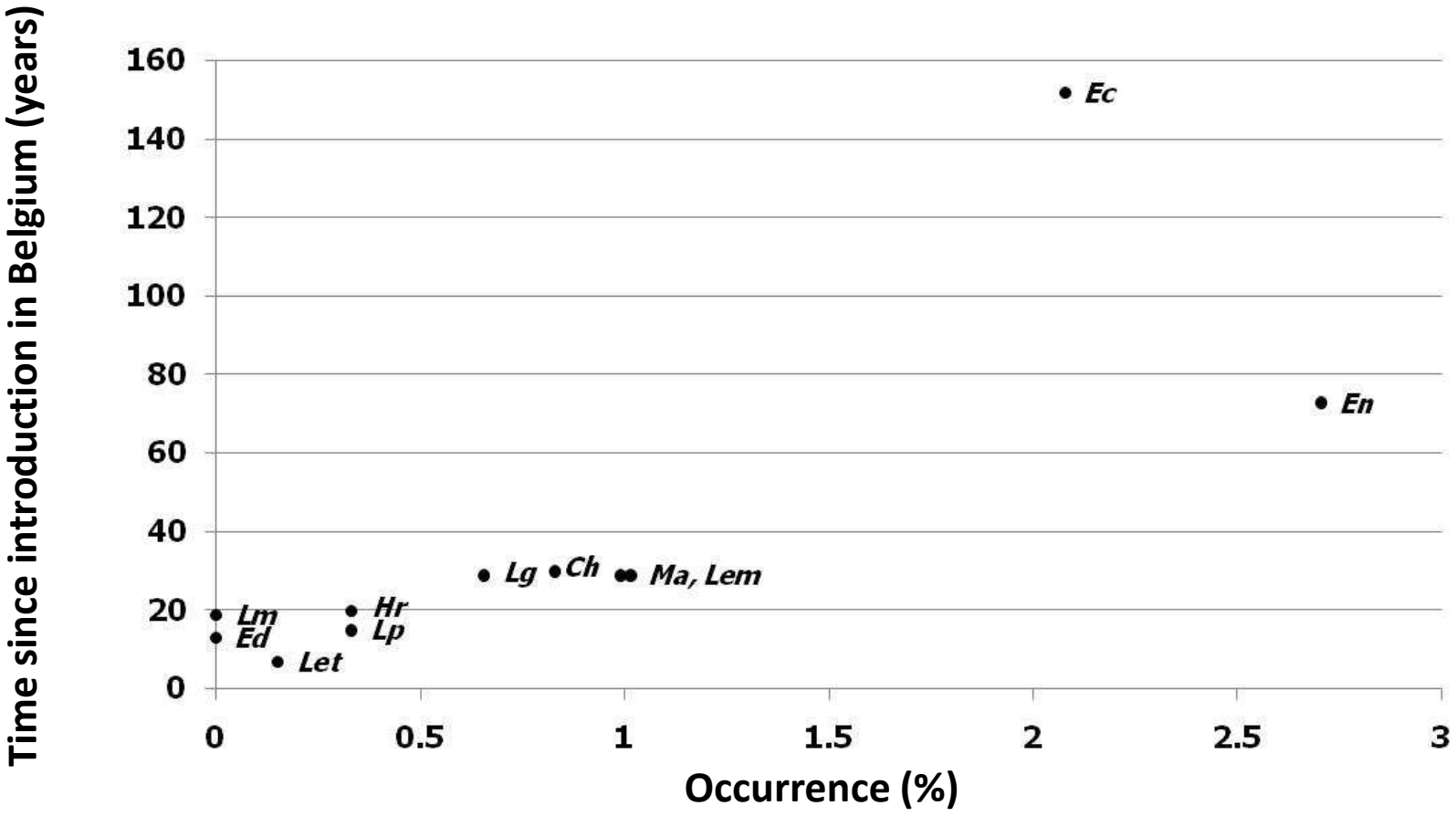
Stagnant waters – main results

- 30/400 invaded by one (26), two (2) or three (2) species
- 6/72 in N2000 (roughly same proportion ~ 7%- 8%)

| | Nb sites | % occurrence |
|---|----------|--------------|
|  <i>Elodea nuttallii</i> | 12 | 3 |
|  <i>Elodea canadensis</i> | 7 | 1.75 |
| <i>Myriophyllum aquaticum</i> | 4 | 1 |
| <i>Lemna minuta</i> | 3 | 0.75 |
| <i>Crassula helmsii</i> | 3 | 0.75 |
| <i>Ludwigia grandiflora</i> | 3 | 0.75 |
| <i>Lemna turionifera</i> | 2 | 0.5 |
| <i>Ludwigia peploides</i> | 1 | 0.25 |
| <i>Hydrocotyle ranunculoides</i> | 1 | 0.25 |



Stagnant waters – main results



Xeric habitats

- 86 N2000 sites visited – sandy, rocky and dry habitats
- Extensive search for alien plants



Xeric habitats– main results

- 25 alien plant species observed
- 60 % of the sites with at least one alien plant species
- Different patterns according to the habitats

Xeric habitats– main results

| | Nb sites | % occurrence |
|-----------------------------------|----------|--------------|
| → <i>Juglans regia</i> | 13 | 15.1 |
| → <i>Cotoneaster horizontalis</i> | 12 | 14 |
| <i>Prunus serotina</i> | 9 | 10.5 |
| <i>Robinia pseudoacacia</i> | 7 | 8.1 |
| → <i>Buddleja davidii</i> | 6 | 7 |
| <i>Hieracium bauhinii</i> | 6 | 7 |
| <i>Quercus rubra</i> | 5 | 5.8 |
| <i>Senecio inaequidens</i> | 5 | 5.8 |
| <i>Oenothera deflexa</i> | 4 | 4.7 |
| <i>Cerastium tomentosum</i> | 3 | 3.5 |
| <i>Epilobium ciliatum</i> | 3 | 3.5 |
| <i>Syringa vulgaris</i> | 3 | 3.5 |
| <i>Campylopus introflexus</i> | 2 | 2.3 |
| <i>Erigeron annuus</i> | 2 | 2.3 |
| <i>Juncus tenuis</i> | 2 | 2.3 |
| <i>Laburnum anagyroides</i> | 2 | 2.3 |
| <i>Sedum spurium</i> | 2 | 2.3 |
| <i>Amelanchier lamarckii</i> | 1 | 1.2 |
| <i>Fallopia japonica</i> | 1 | 1.2 |
| <i>Ficus carica</i> | 1 | 1.2 |
| <i>Oenothera glazioviana</i> | 1 | 1.2 |
| <i>Rhododendron ponticum</i> | 1 | 1.2 |
| <i>Rhus typhina</i> | 1 | 1.2 |
| <i>Solidago gigantea</i> | 1 | 1.2 |
| <i>Spiraea douglasii</i> | 1 | 1.2 |



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| <i>Juglans regia</i> | 13 | 15.1 |
| <i>Cotoneaster horizontalis</i> | 12 | 14 |
| → <i>Prunus serotina</i> | 9 | 10.5 |
| → <i>Robinia pseudoacacia</i> | 7 | 8.1 |
| <i>Buddleja davidii</i> | 6 | 7 |
| <i>Hieracium bauhinii</i> | 6 | 7 |
| → <i>Quercus rubra</i> | 5 | 5.8 |
| <i>Senecio inaequidens</i> | 5 | 5.8 |
| <i>Oenothera deflexa</i> | 4 | 4.7 |
| <i>Cerastium tomentosum</i> | 3 | 3.5 |
| <i>Epilobium ciliatum</i> | 3 | 3.5 |
| <i>Syringa vulgaris</i> | 3 | 3.5 |
| <i>Campylopus introflexus</i> | 2 | 2.3 |
| <i>Erigeron annuus</i> | 2 | 2.3 |
| <i>Juncus tenuis</i> | 2 | 2.3 |
| <i>Laburnum anagyroides</i> | 2 | 2.3 |
| <i>Sedum spurium</i> | 2 | 2.3 |
| <i>Amelanchier lamarckii</i> | 1 | 1.2 |
| <i>Fallopia japonica</i> | 1 | 1.2 |
| <i>Ficus carica</i> | 1 | 1.2 |
| <i>Oenothera glazioviana</i> | 1 | 1.2 |
| <i>Rhododendron ponticum</i> | 1 | 1.2 |
| <i>Rhus typhina</i> | 1 | 1.2 |
| <i>Solidago gigantea</i> | 1 | 1.2 |
| <i>Spiraea douglasii</i> | 1 | 1.2 |



Xeric habitats– main results

| | Nb sites | % occurrence |
|---------------------------------|----------|--------------|
| <i>Juglans regia</i> | 13 | 15.1 |
| <i>Cotoneaster horizontalis</i> | 12 | 14 |
| <i>Prunus serotina</i> | 9 | 10.5 |
| <i>Robinia pseudoacacia</i> | 7 | 8.1 |
| <i>Buddleja davidii</i> | 6 | 7 |
| <i>Hieracium bauhinii</i> | 6 | 7 |
| <i>Quercus rubra</i> | 5 | 5.8 |
| <i>Senecio inaequidens</i> | 5 | 5.8 |
| <i>Oenothera deflexa</i> | 4 | 4.7 |
| <i>Cerastium tomentosum</i> | 3 | 3.5 |
| <i>Epilobium ciliatum</i> | 3 | 3.5 |
| <i>Syringa vulgaris</i> | 3 | 3.5 |
| <i>Campylopus introflexus</i> | 2 | 2.3 |
| <i>Erigeron annuus</i> | 2 | 2.3 |
| <i>Juncus tenuis</i> | 2 | 2.3 |
| <i>Laburnum anagyroides</i> | 2 | 2.3 |
| <i>Sedum spurium</i> | 2 | 2.3 |
| <i>Amelanchier lamarckii</i> | 1 | 1.2 |
| <i>Fallopia japonica</i> | 1 | 1.2 |
| <i>Ficus carica</i> | 1 | 1.2 |
| <i>Oenothera glazioviana</i> | 1 | 1.2 |
| <i>Rhododendron ponticum</i> | 1 | 1.2 |
| <i>Rhus typhina</i> | 1 | 1.2 |
| <i>Solidago gigantea</i> | 1 | 1.2 |
| <i>Spiraea douglasii</i> | 1 | 1.2 |

Relatively low abundance
within the sites

Take-home message

Rivers → particularly invaded (many species, high abundance)

Water bodies → invasions are less frequent... but problematical!

Dry habitats → alien plants are frequent... but low invasion dynamics

Quantitative field surveys are complementary to the information found in databases and the literature

- **Major well-known invasive plants: low interest**
- **BUT major interest for:**
 - **emerging species**
 - **overlooked invasions !**
 - **Check the invasive behavior of exotic trees**

Thank you for your attention !

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