Fraxinus dieback in Europe

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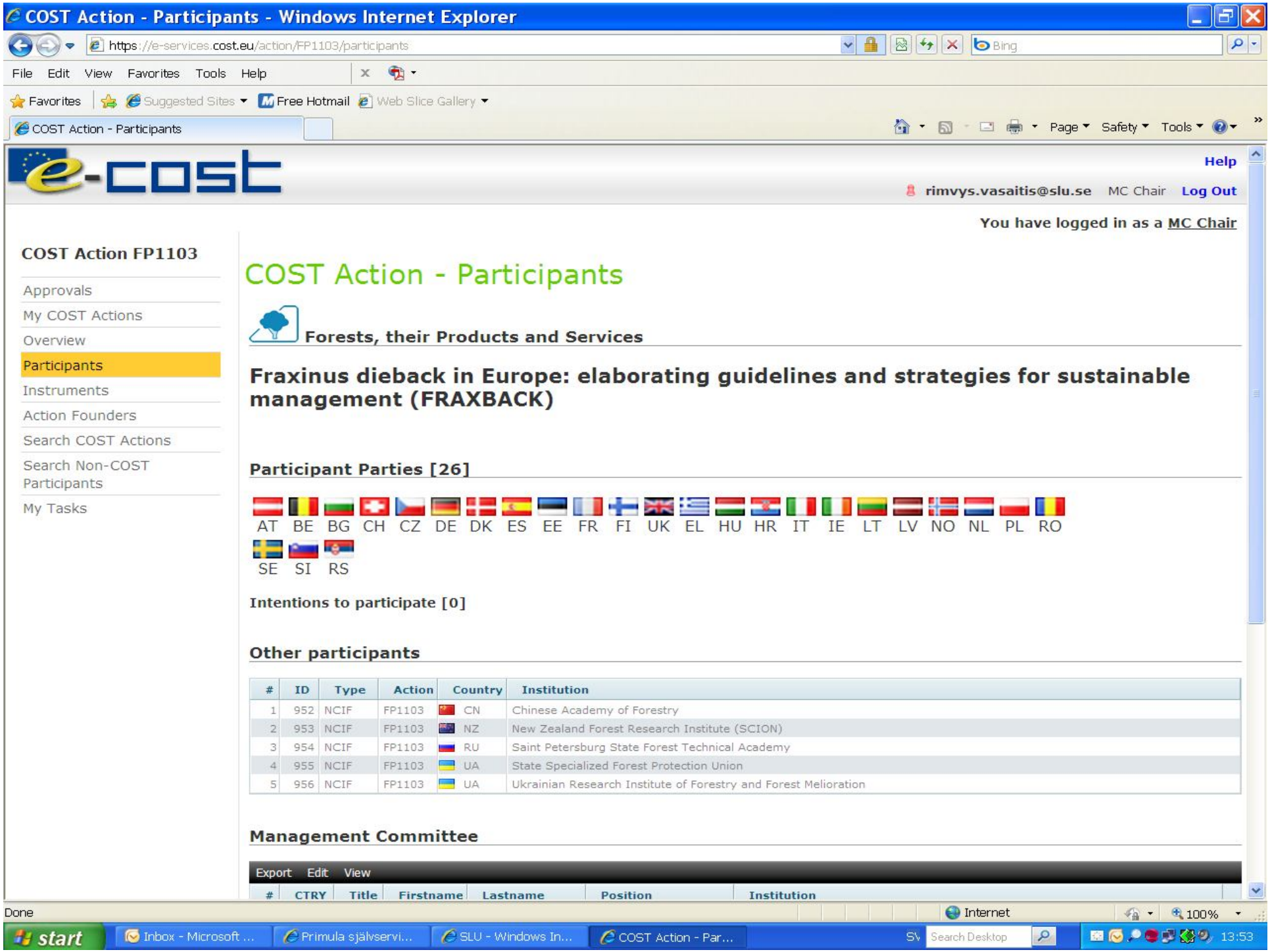
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AT BE BG CH CZ DE DK ES EE FR FI UK EL HU HR IT IE LT LV NO NL PL RO
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Intentions to participate [0]
Other participants
ID Type Action Country Institution
1 952 NCIF FP1103 CN Chinese Academy of Forestry
2 953 NCIF FP1103 NZ New Zealand Forest Research Institute (SCION)
3 954 NCIF FP1103 RU Saint Petersburg State Forest Technical Academy
4 955 NCIF FP1103 UA State Specialized Forest Protection Union
5 956 NCIF FP1103 UA Ukrainian Research Institute of Forestry and Forest Melioration
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Dieback of Ash
... about 20 years ago in eastern EU

History & current situation

- Lethal disease of *Fraxinus* spp.
- No correlation with tree age, soil (moisture & fertility), environment (forest, urban, nursery, roadside …)
- Massive tree death
- Stepwise geographic spread
- Currently, over larger part of Europe
- Threat for species existence (in Sweden, since 2010 *Fraxinus excelsior* is Red-listed)


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Arkhangel'sk
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Oulu
Umeå
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Lake Onega
Trondheim
Tórshavn
Faroe Islands (DENMARK)
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Gulf of Bothnia
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Lake Ladoga
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Turku
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Gulf of Finland
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North Atlantic Ocean
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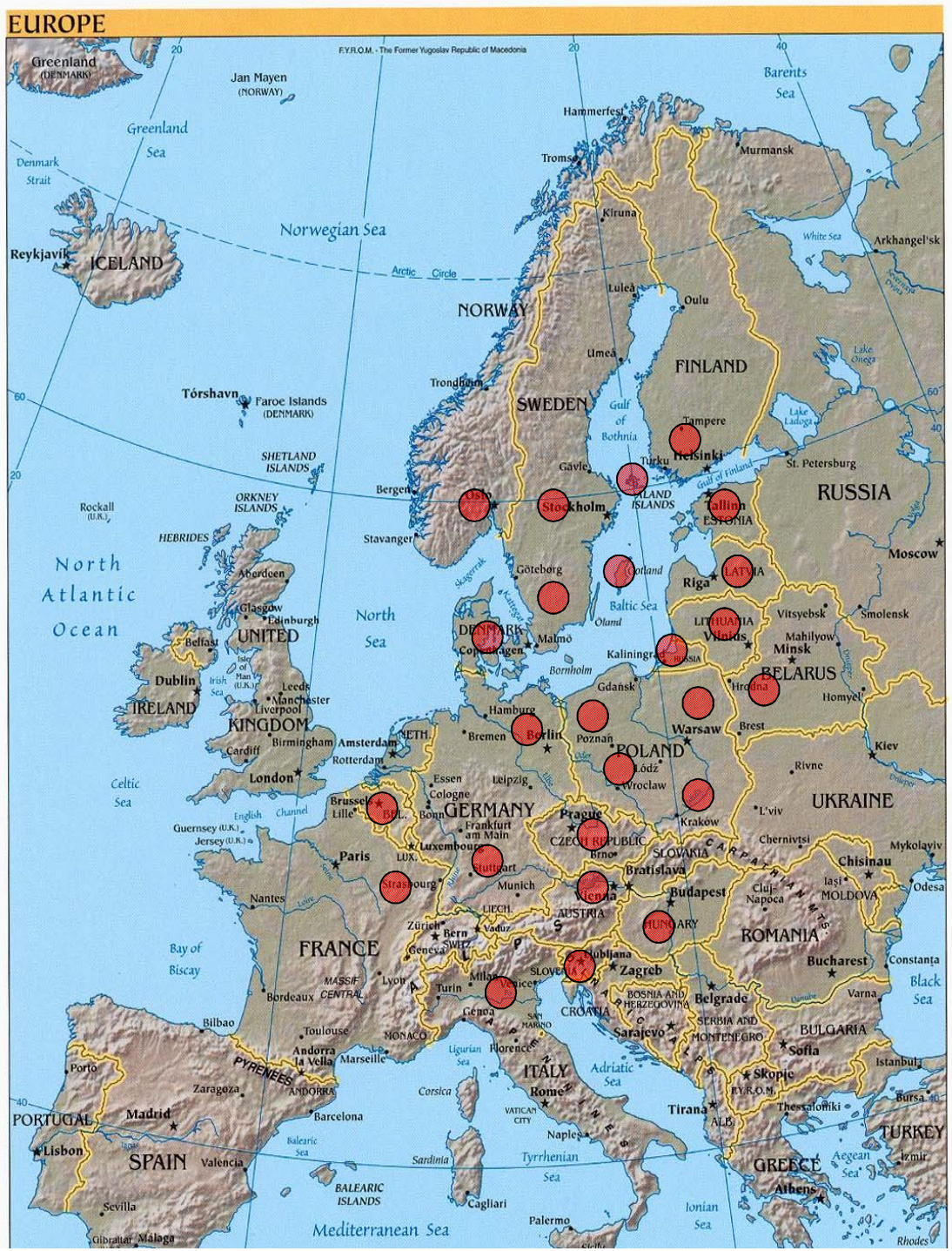
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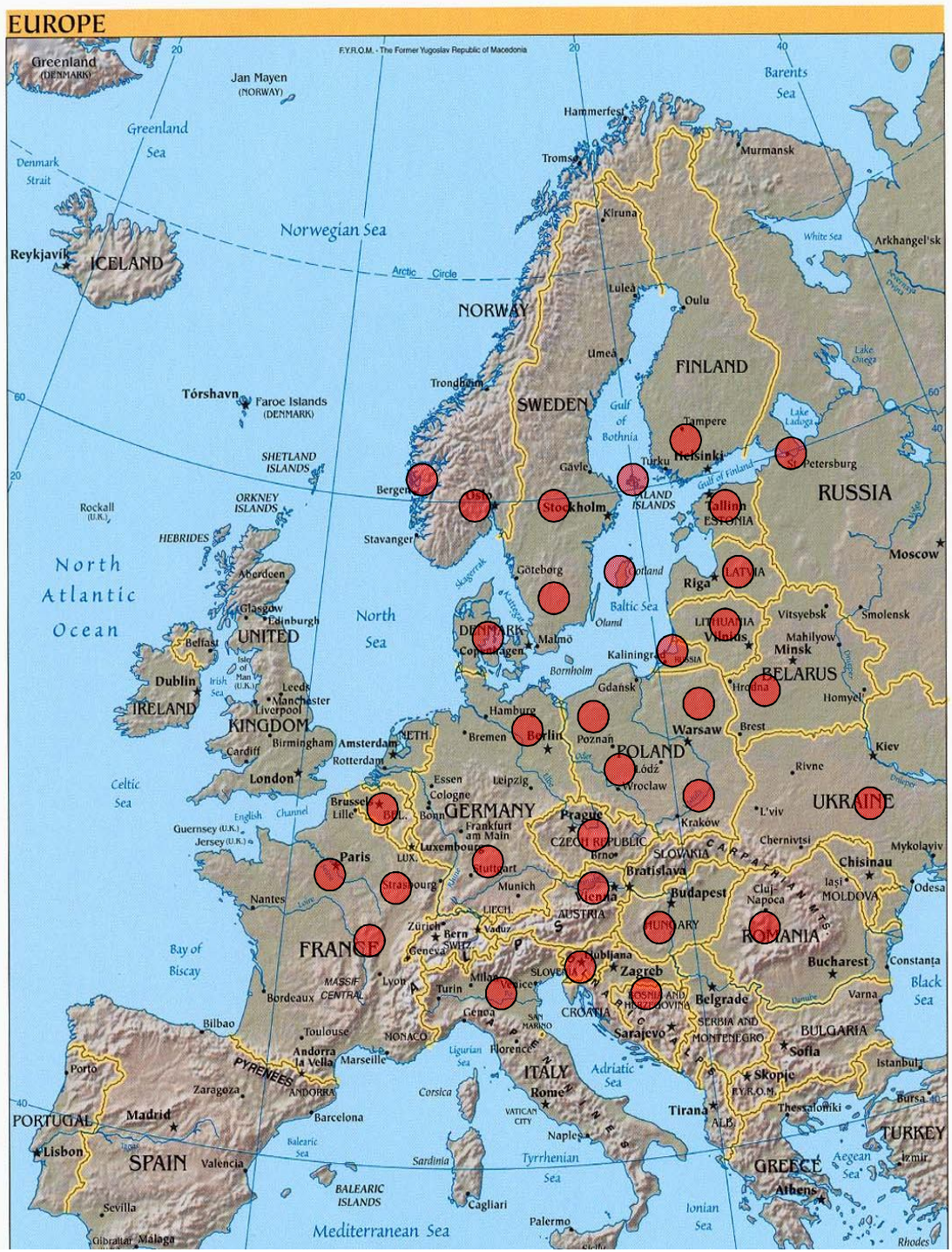
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Lake Onega
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Gulf of Bothnia
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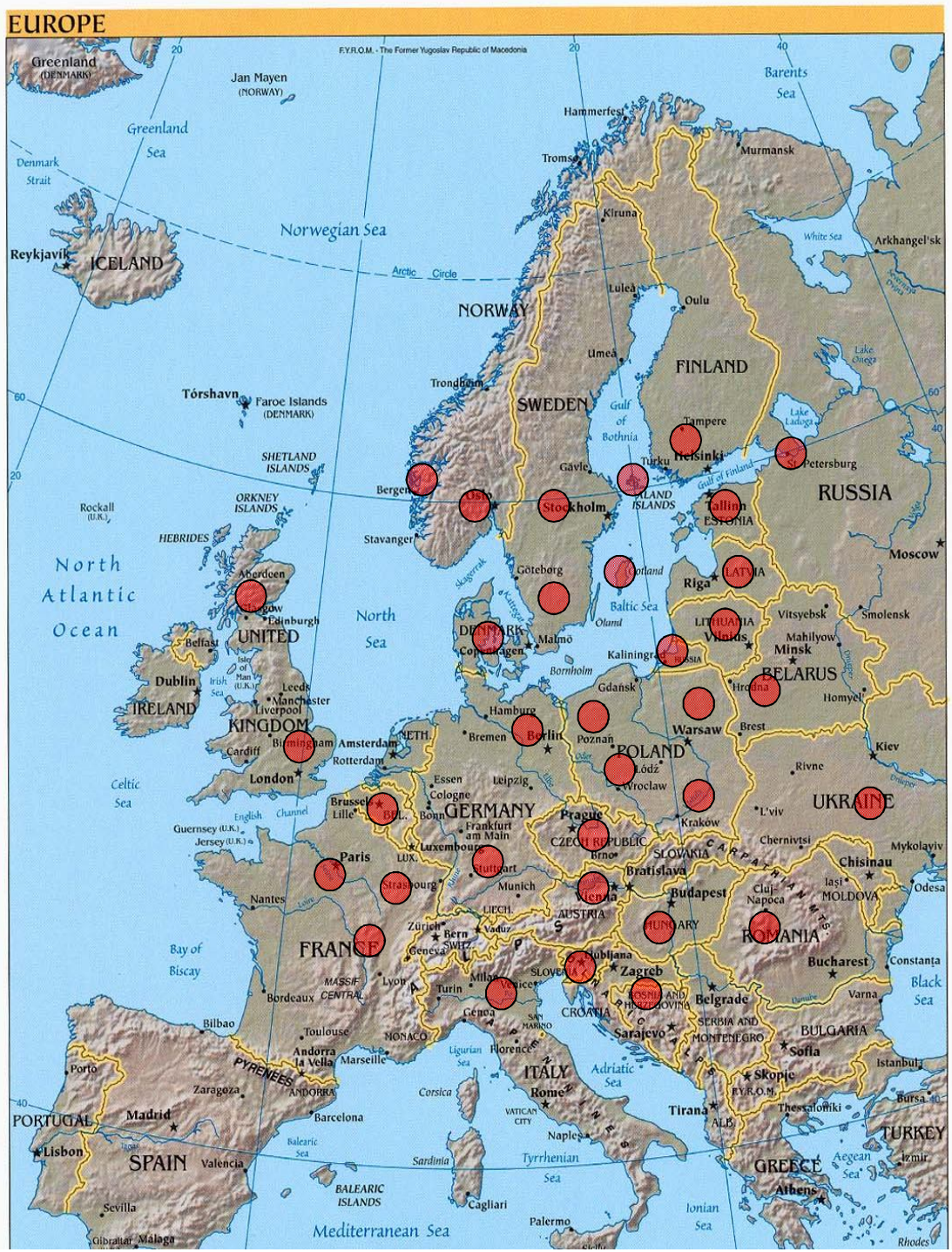
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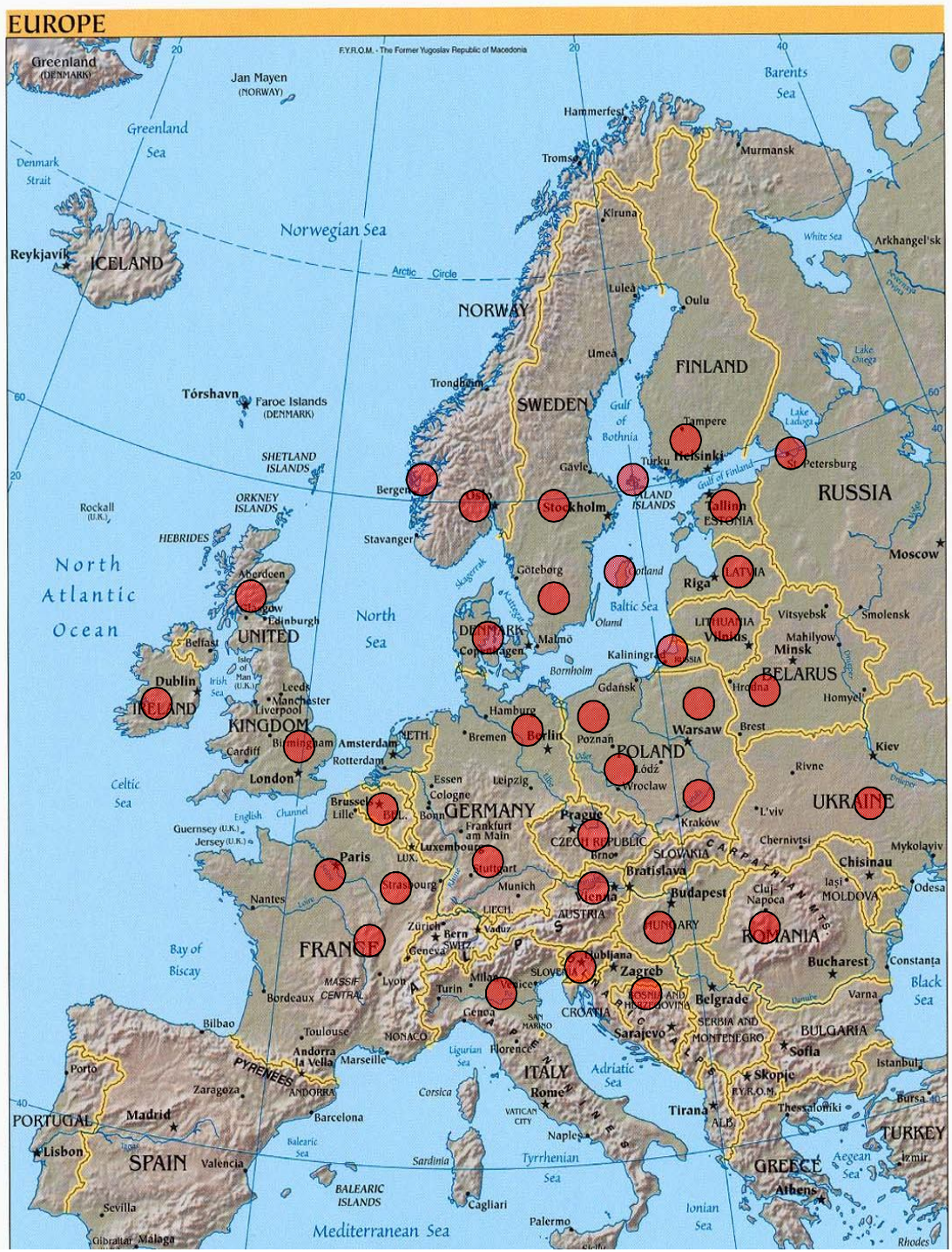
2012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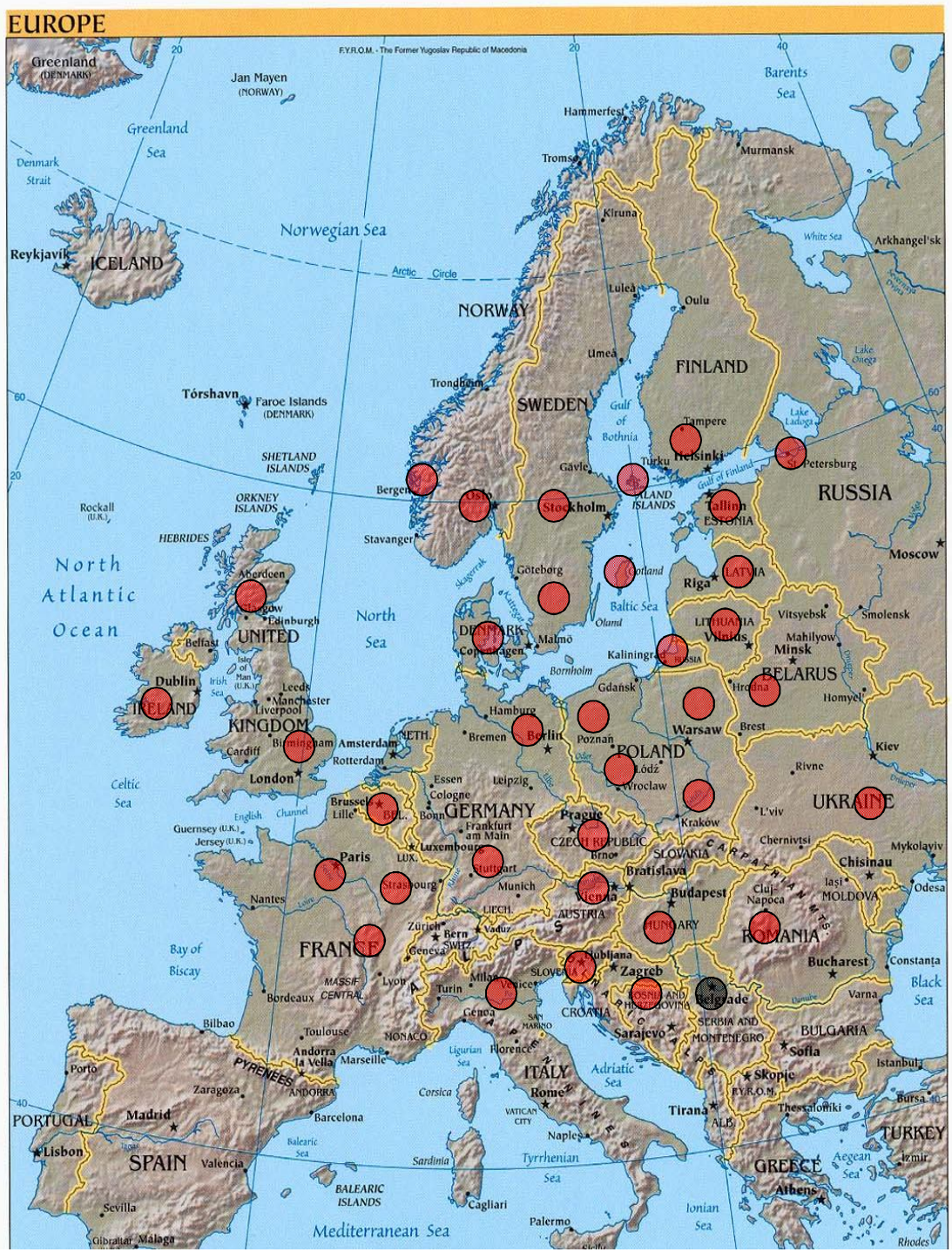
2013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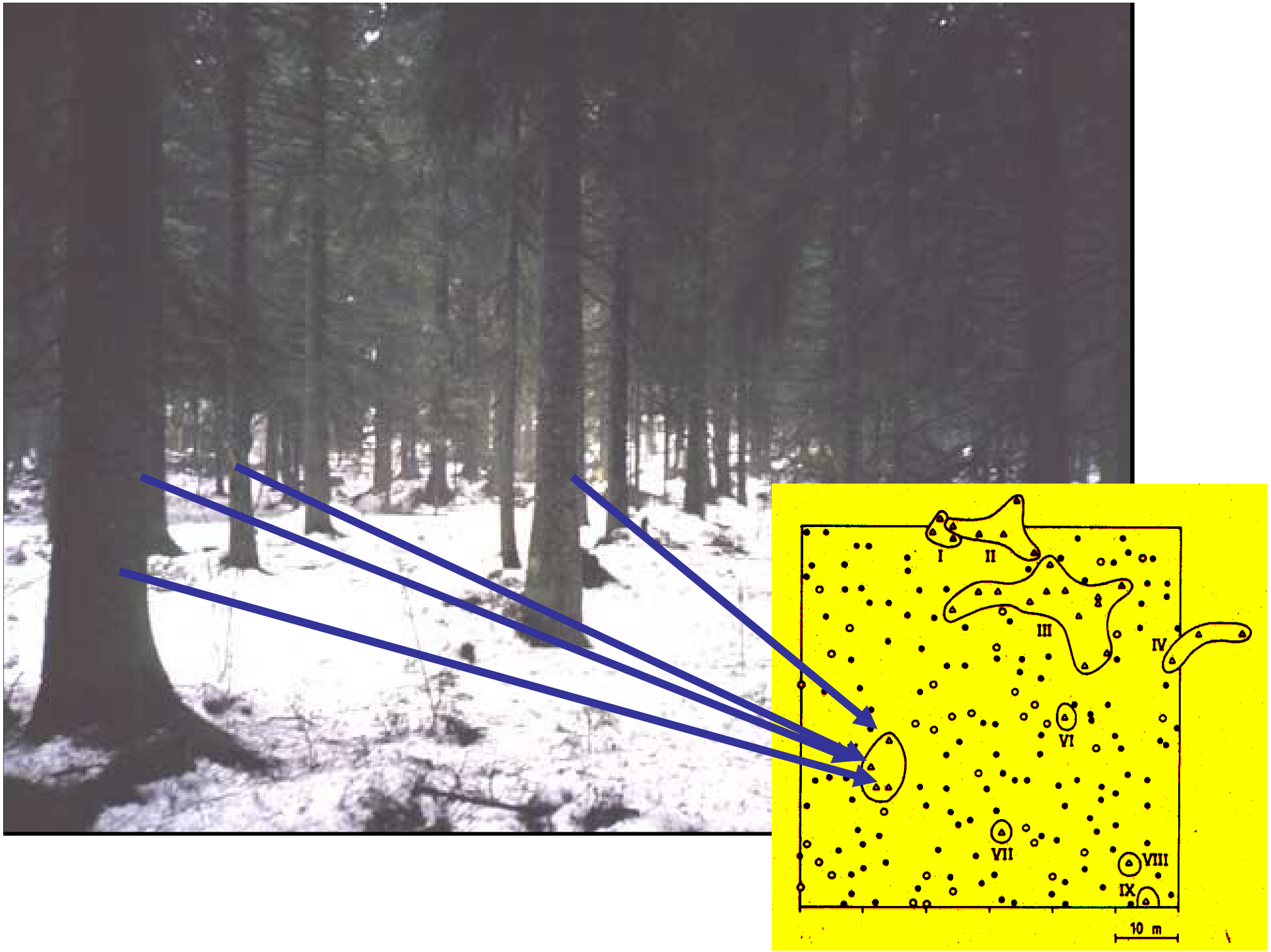
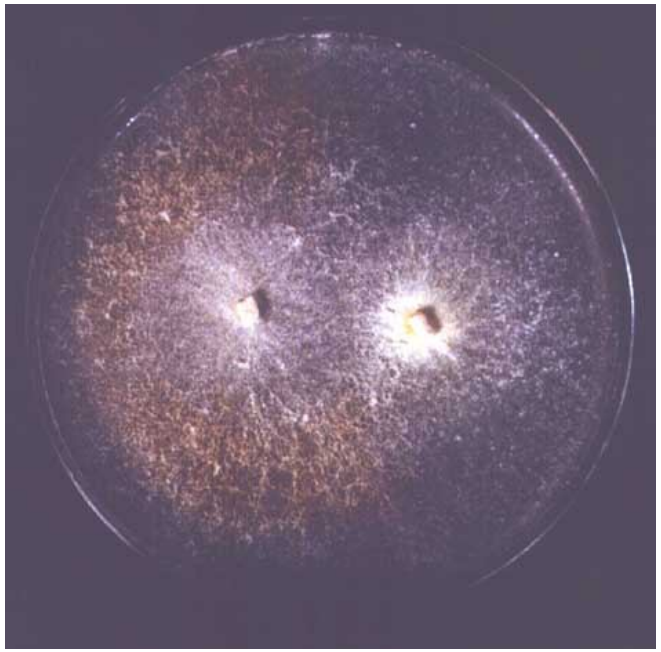
2016

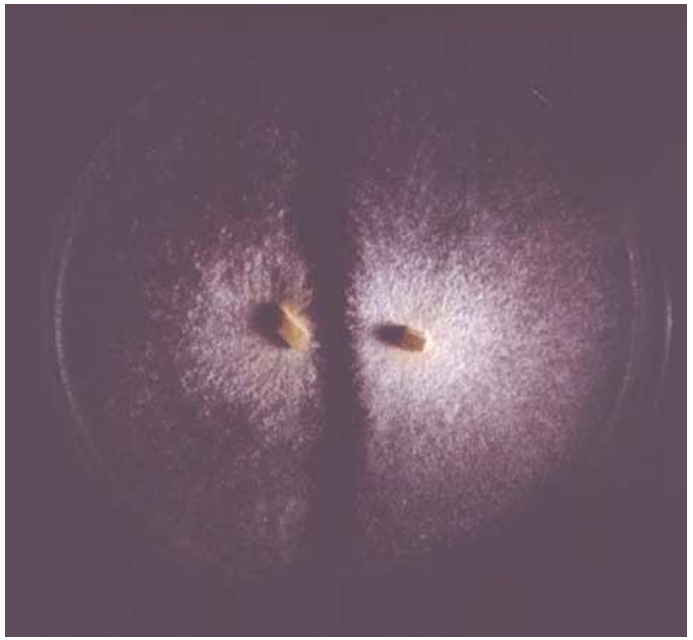
History: Armillaria?

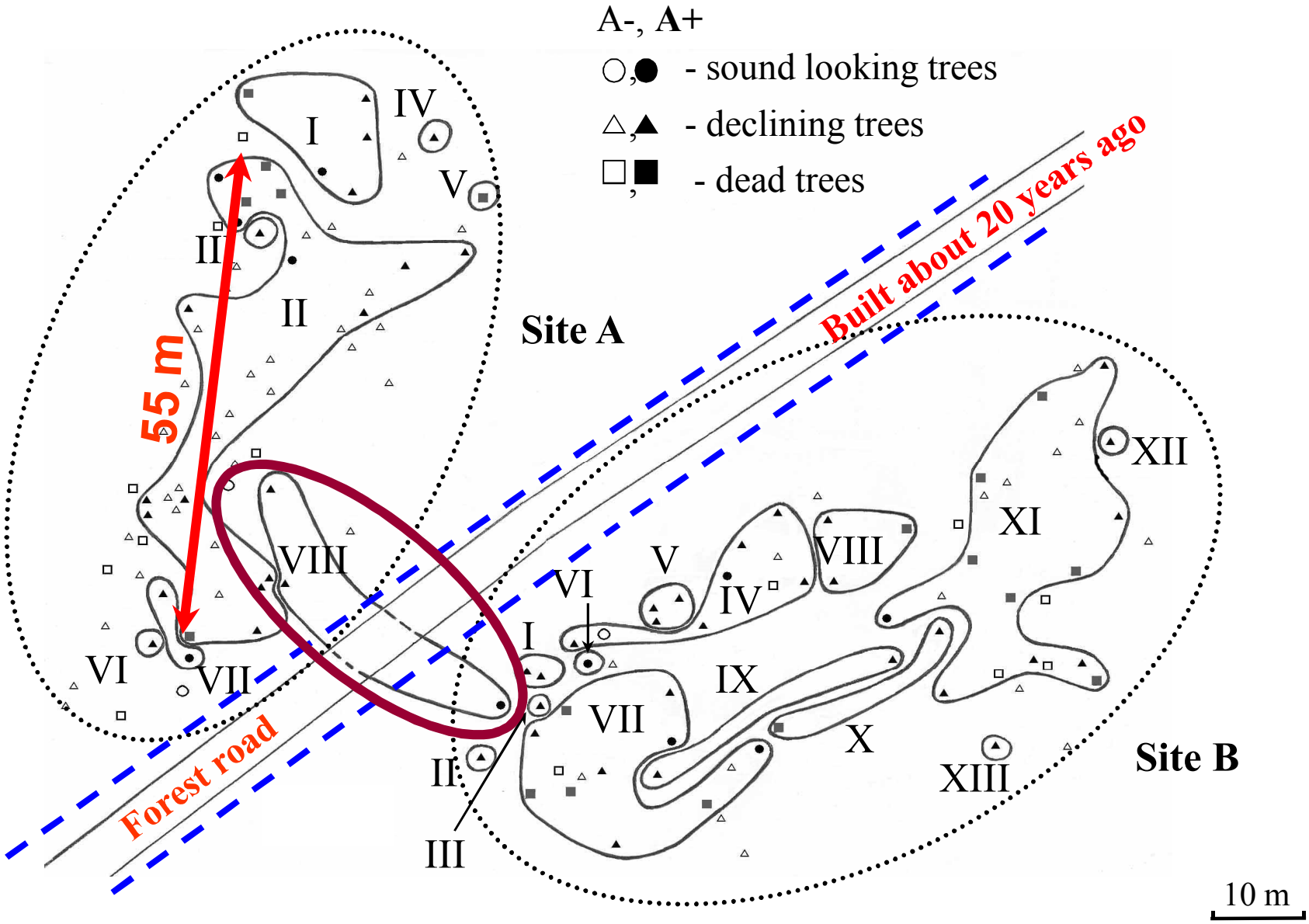

I
II
III
IV
VI
VII
VIII
IX
10 m

Compatible



Incompatible




A-, A+
○,● - sound looking trees
△,▲ - declining trees
□,■ - dead trees
Site A
Site B
Built about 20 years ago
Forest road
55 m
10 m
I
II
II
III
IV
V
VI
VII
VIII
I
II
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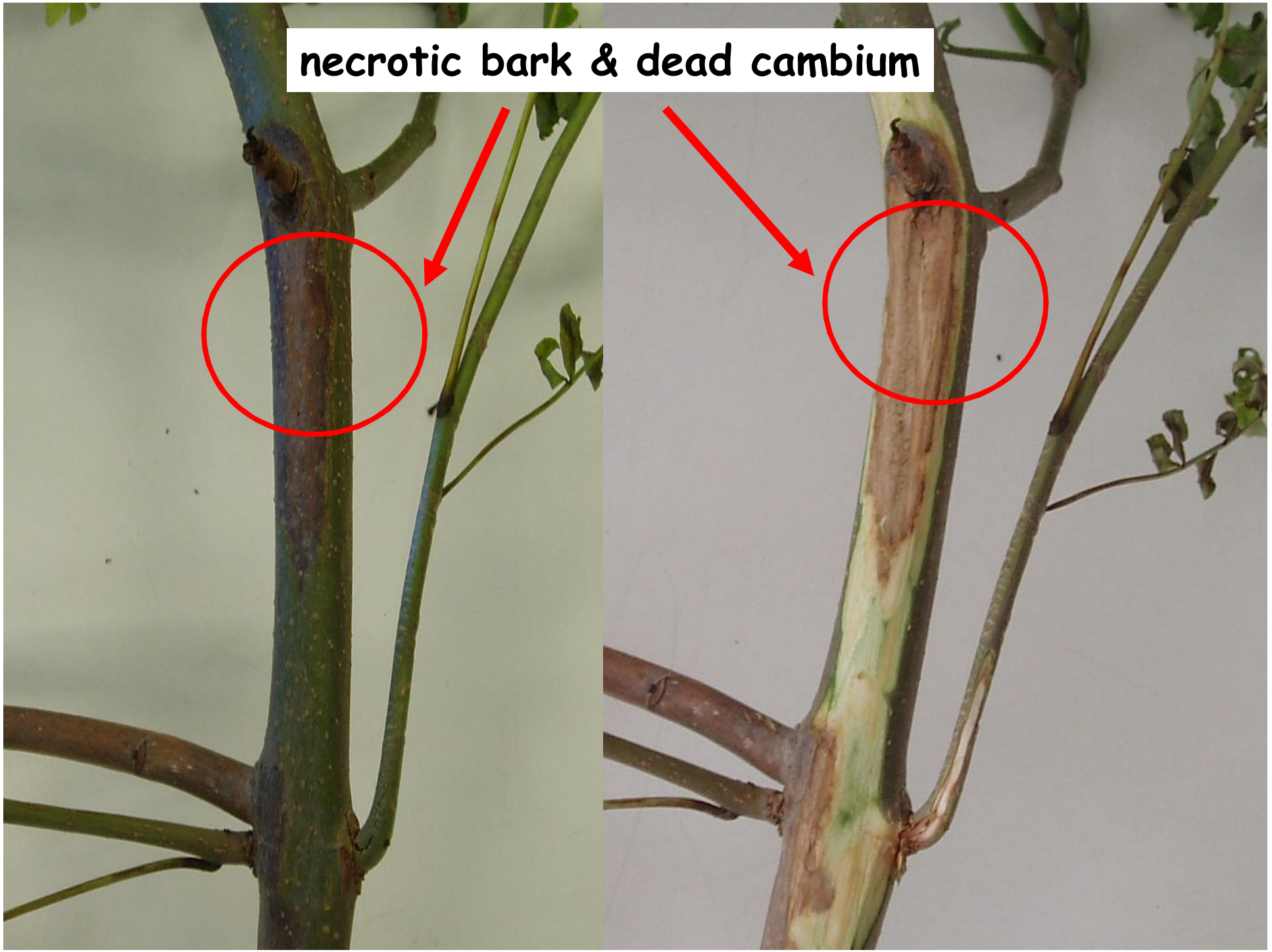
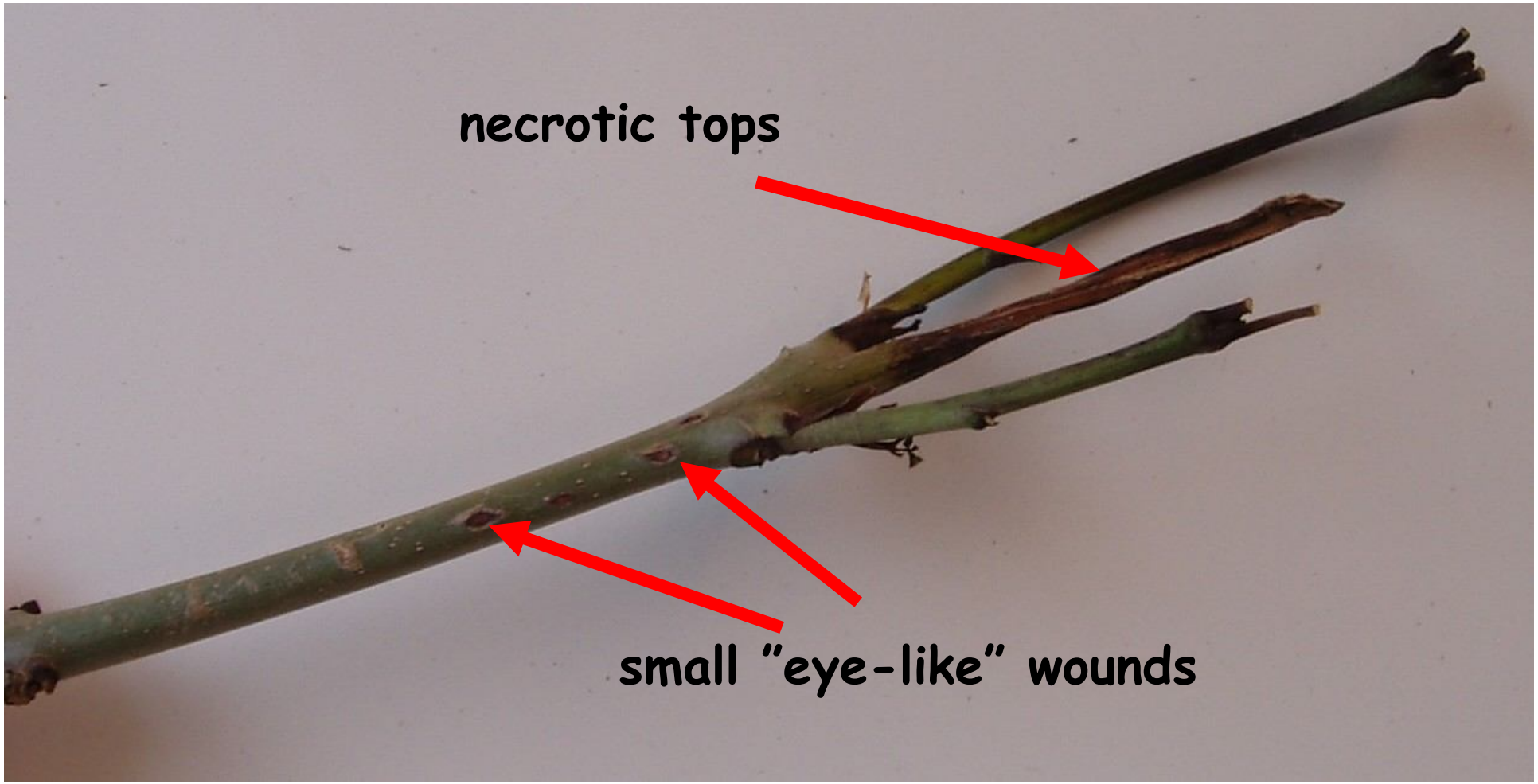
XII
XIII

But a closer look …

The symptoms:

1) shoots


necrotic bark & dead cambium


necrotic tops
small "eye-like" wounds


bigger bark wounds


canker wounds

The symptoms:

2) leaves

wilt

necrotic leaves & petioles

Pathogenicity tests

- 45 fungal species from crowns, stems and roots of declining trees (isolated during part 1)

- 700 one-year-old *Fraxinus excelsior* seedlings

- bare root nursery and greenhouse

Pieces of pre-colonized wood (1x1x5 mm) …

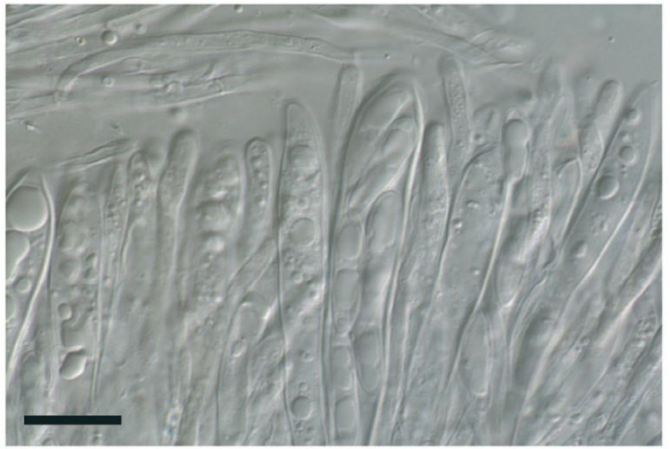
… taped to a 1x5 mm wound.

The test with Hymenoscyphus sp.970

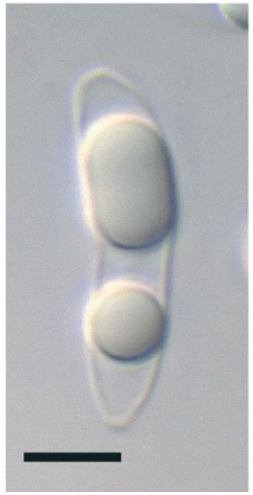
- Origin: Far East Asia
- Ecology: in native environment, (harmless) decomposer of shed ash leaves
- Identity: *Chalara fraxinea* / *Hymenoscyphus fraxineus* (to date called 4 names)
- Entrance to EU: imported plants for planting
- Spread: plant material & airborne spores (flying far)
- Genetic diversity in EU: low, indicating few entries

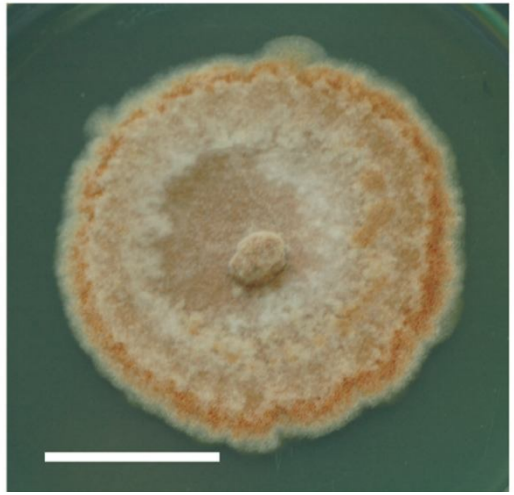
Kowalski & Holdenrieder (2009)

Forest Pathology



Ascospores: sexual spores implying genetic diversity





Dramatic situation: perspectives?

- Ash Dieback is impossible to eradicate
- Tree disease one must learn to live with
- Breeding for resistance?

Breeding Ash

- In Europe, trials initiated about 5 yrs ago
- Inventory & mapping of healthy looking trees
- Following "durability" of resistance over time
- Progeny trials & propagation
- Establishment of seed orchards / banks of dieback-resistant ash

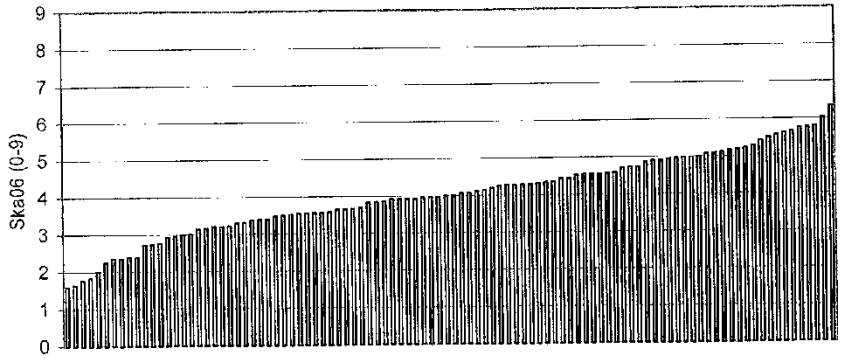
Different susceptibility of *F. excelsior* genotypes

Stener (2007):

- 15 yr-old clonal seed orchard

- 100 clones

- 6-29 (aver. 17) ramets per clone



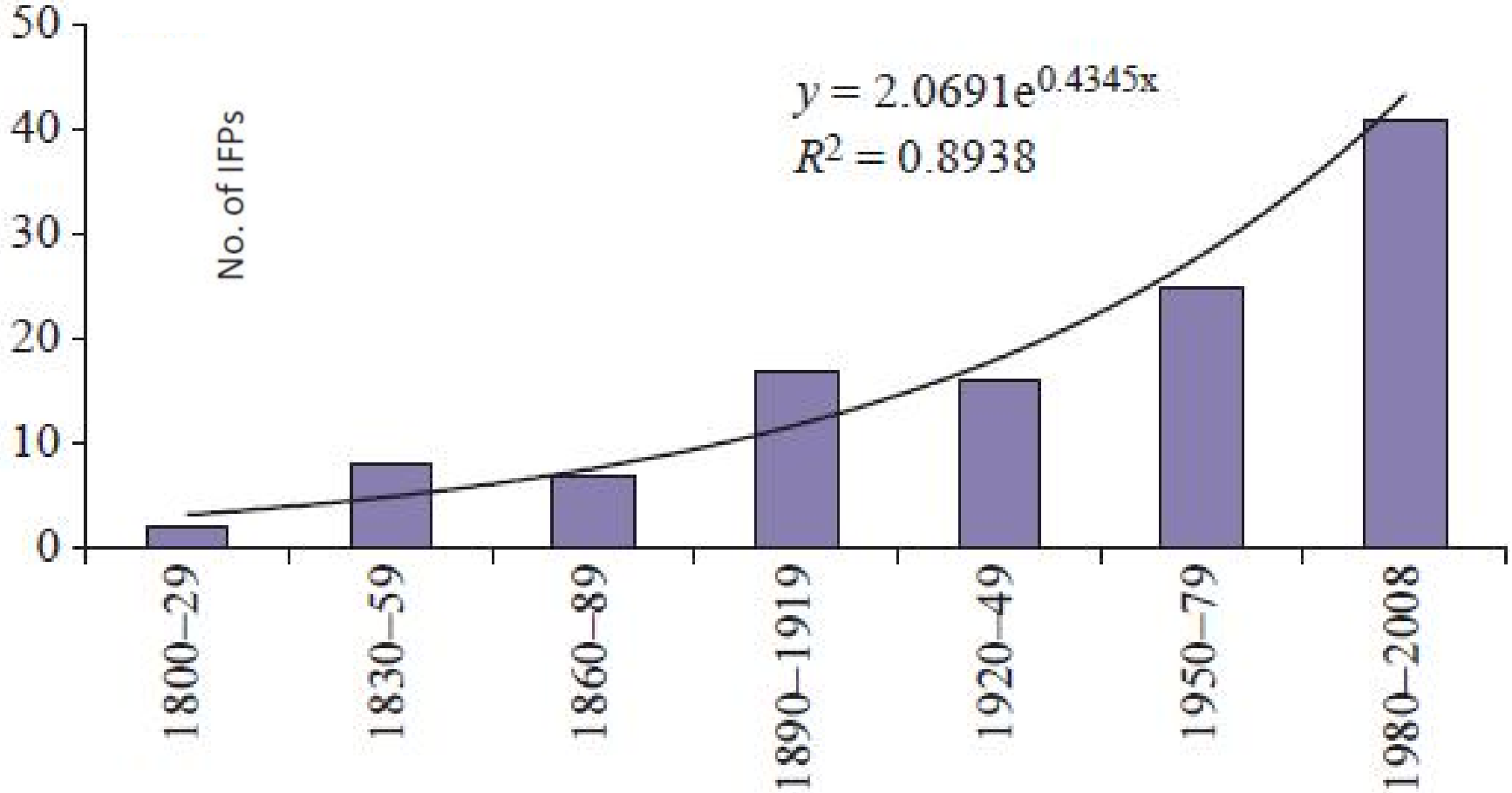
Figur 1.
Genotypvärden för Ska06 sorterad i stigande ordning (ju högre värde desto större skada). Varje stapel representerar en plusträdsklon.

Preliminary hints

- strong evidence for genetic variation in resistance against Ash Dieback
- potential available for breeding for resistance
- yet, the proportion of genotypes initially deemed as ADB-resistant decrease with time
- the pathogen genetically recombines on yearly basis, while trees are to remain for 100s of yrs
- Emerald Ash Borer is closing from Russia
- should hybrids of European Ash with Asian be considered?

Identification of dieback-resistant genotypes (screened by nature)

... but invasive diseases & pests represent a major threat for the forest sector



Exponential increase of invasive forest pest and pathogens in EU (Santini et al. 2013)

More potential invasive alien pathogens to come?

YES, and a lot

To avoid similar situations in the future:

- Boycot plants-for-planting imported from outside EU
- Plant trees grown in local nurseries
- Propagate ADB- resistant ash

Acknowledgements

- Swedish Forestry Agency
- EU LIFE+ NATURE
- COST Action FP1103 FRAXBACK
- Stiftelsen Oscar och Lili Lamms Minne
- Carl Tryggers Stiftelse för Vetenskaplig Forskning
- Audrius Menkis, Inga-Lena Östbrant, Karin Wågström, Kateryna Davydenko