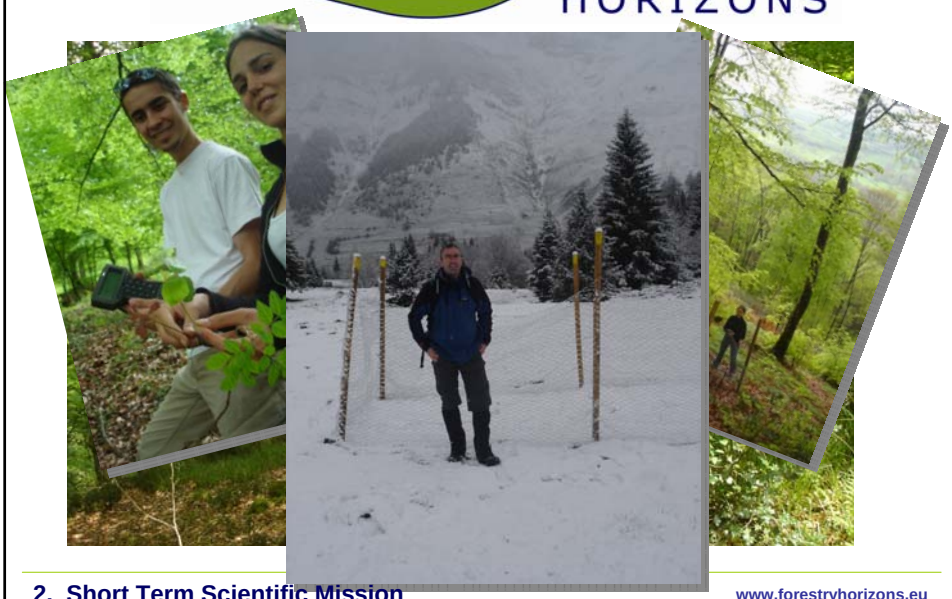
Growing scattered broadleaved tree species in a changing climate – risks and opportunities.

Hemery, G., Clark, J., Aldinger, E., Claessens, H, Malvolti, M., O'connor, E., Raftoynnis, Y., Savill, P. and Brus, R.

A presentation at the COST Action E42 conference
Growing Valuable Broadleaved Tree Species
October 6th – 9th, 2008. Freiburg, Germany.

FORESTRY HORIZONS



FORESTRY HORIZONS

- STSM hosted by Forest Research UK, Dr Gary Kerr.
- Visit to France, to University of Bordeaux and INRA Pierroton.
- Meetings and observation of field research.
- Interviews and meetings with scientists.
- Extensive literature review.
- 73 page / 196 refs report: available on ValBro website and at www.ForestryHorizons.eu

Arising publications:

HEMERY, G. (accepted). Forest management and silvicultural responses to projected climate change impacts on European broadleaved trees and forests. *International Forestry Review.*

HEMERY, G., CLARK, J., ALDINGER, E., CLAESSENS, H, MALVOLTI, M., O'CONNOR, E., RAFTOYNNIS, Y., SAVILL, P. and BRUS, R. (submitted). Growing scattered broadleaved tree species in a changing climate – risks and opportunities. *Forestry.*

- European forests are single largest natural ecosystem supporting biodiversity (UNECE-FAO 2006)
- Climate change impacts will increase importance of ecosystem services provided by forests
- Long-term trends in world timber trade indicate a continuing decrease in hardwood roundwood exports from tropical forests and increasing demand from industrialising countries
- Domestic timber supply likely to become more important, providing national, regional and local benefits.

FORESTRY HORIZONS

What changes are detectable now, and predicted for the future?

- IPCC Fourth Assessment Report published 2007: *"very high confidence that human activities since 1750 have caused warming"*
- whole-scale biome shift in mountains of NE Spain (Penuelas & Marti 2003)
- changes in tree greenery across circumboreal region (Lapenis et al 2005)
- altitudinal shift in Swedish Boreal forests (Troung et al 2007)
- spread of *Juglans regia* Alpine valleys (Loacker et al 2007)

A suit of large scale analyses generates 'very high confidence' (as defined by the IPCC 2007) that climate change is already impacting living systems .
(Parmesan and Yohe, 2003)

FORESTRY HORIZONS


Range change


Pests and pathogens


Drought


Reproductive biology and genetics

Other factors

FORESTRY HORIZONS

Acer spp. ~ Maples

Northwards
Higher elevations

Grey squirrel – expanding range
Cryptostroma corticale incidence may increase

Sensitive to drought … dieback/premature death
Increased stress = increased susceptibility

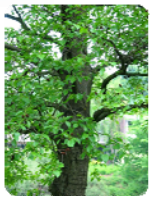
Insect pollinated – become more strongly differentiated than wind pollinated species

Other factors

Sycamore - already widely naturalised and spreading

FORESTRY HORIZONS

Alnus glutinosa ~ black alder



+ north
- south
- east

Increased threat from *Phytophthora alni*

Less suitable for drier soils

Resistant to genetic erosion

Other factors

Increased productivity predicted

FORESTRY HORIZONS

Betula spp. ~ birches

+ north
+ colonise rapidly with increase storm damage

Increased geometrid moth outbreaks

Less suitable for drier soils

High capacity to adapt

Storm damage and flooding may decrease tree quality

FORESTRY HORIZONS

Fraxinus spp. ~ ashes

+ north
Hybridisation with *F. angustifolia* in south

Prays fraxinella, Agrilus planipennis and ash canker

Tolerates some drought conditions if soils optimal
Tolerates seasonal flooding

High regeneration potential

Highly sensitive to frost

FORESTRY HORIZONS

Juglans spp. ~ walnuts

+ north
Close correlation with mild winters and frost incidence.

Armellia mellea and *Xanthomonas campetris* incidence may increase with warmer summers and increased rainfall

Deeply rooted so resistant to drought
Valleys and plains preferred for the future

Genetic erosion threat
Genetic pollution from cultivars

Fast rotation
Health benefits from nuts

FORESTRY HORIZONS

Prunus avium ~ wild cherry

+ north
+ east
Competition from beech and other vegetation

Insects
Bacterial canker and cherry leaf spot may increase in north

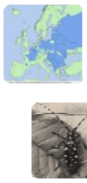
Intolerant of frequent or severe drought

Threat from habitat fragmentation, particularly at southern limits of range

Flowering prone to frost damage, this could negatively affect biodiversity
Fast rotation

FORESTRY HORIZONS

Sorbus spp. ~ service trees



+ north
+ east
May persist at high elevations in south

Browsing mammals and leaf miner impact.
Fireblight in Mediterranean region

Very drought tolerant

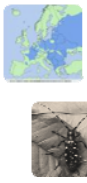
Threats from habitat fragmentation and lack of site availability

Other factors

Seed dispersal may be negatively impacted

FORESTRY HORIZONS

Tilia spp. ~ limes



+ north
+ abundance with increased temperatures

Phyllonorycter issikii leaf miner potential serious pest in Western Europe
Phytophthera infection may increase

Drought resistant

High genetic erosion a threat across Europe

Other factors

Highly tolerant of timing of frost

FORESTRY HORIZONS

Ulmus spp. ~ elms

+ north

DED vector range may extend northwards
Tree stress will increase susceptibility

Drought may increase mortality in combination with DED

Genetic pollution from ornamentals
Habitat erosion

Restricted to suckers and saplings for the indefinite future

FORESTRY HORIZONS

- European forests are relics of glacial and post-glacial history, subsequently influenced by human activity.
- Our forests are relatively species-poor compared to American and Asian forests.
- Projected impacts of climate change on forests are wide ranging:
  - rising temperature
  - increasing CO_2 (positive for tree growth in short to medium terms)
  - large scale stochastic events such as increased incidences of fire, drought (frequency and severity), and increase (distribution and impact) of pests and pathogens.
- Growing scientific evidence that climate change is already influencing plant range and abundance.

- Valuable broadleaves have a particular niche in the forest ecosystem.
- Responses vary greatly between different species.
- Key factors explored:
  - range change
  - pests & pathogens
  - drought
  - genetics and reproduction biology
  - other factors

- STSM undertaken and 73 pp. report available online
- Two peer-review publications submitted
- One paper considers forest management and silviculture options for broadleaves in Europe
- The other paper, presented here, provides a review of risks and opportunities for valuable broadleaves, species by species.

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FORESTRY HORIZONS

Acknowledgements

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