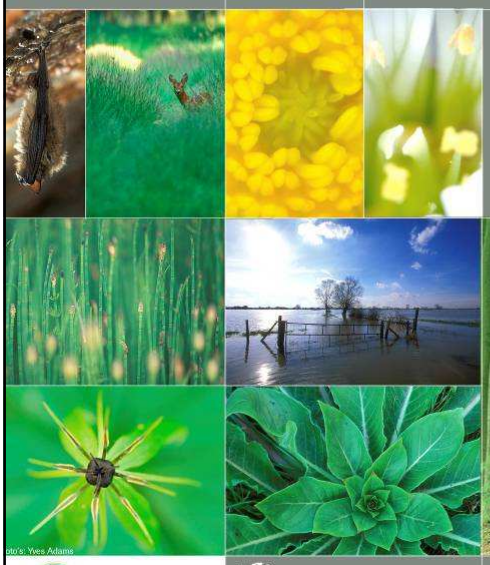
Climate Change



effects on forest biodiversity

Luc De Bruyn

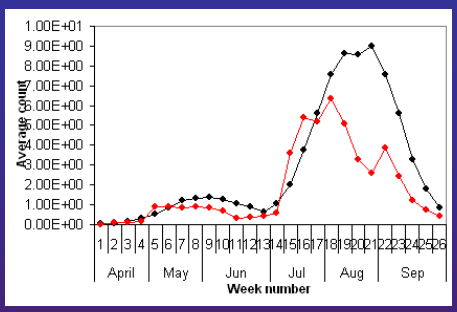
Species diversity group

luc.debruyn@inbo.be

Research Institute for Nature and Forest
Kliniekstraat 25 • 1070 Brussel

www.inbo.be

Phenology

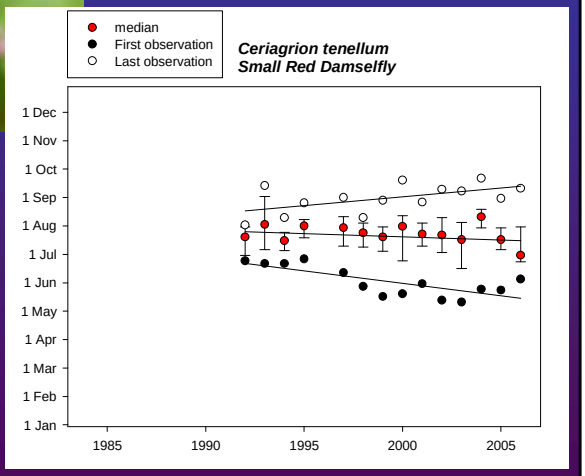


Research Institute for Nature and Forest
Kliniekstraat 25 • 1070 Brussel

www.inbo.be
luc.debruyn@inbo.be

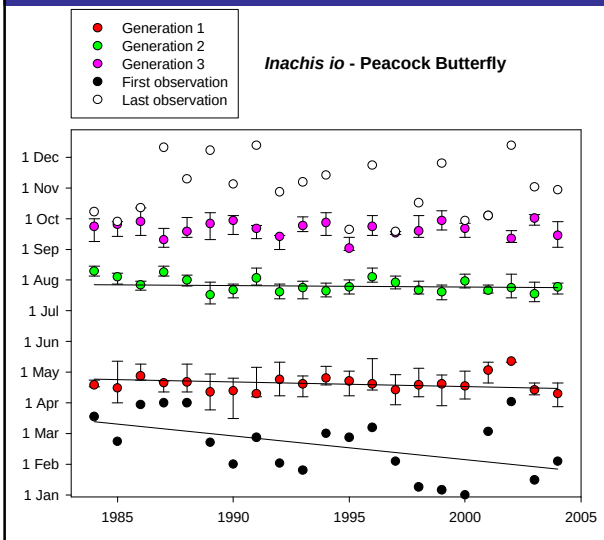
Phenology

- Spring 2.72 days / year
- Autumn 1.94 days / year



Research Institute for Nature and Forest
Kliniekstraat 25 • 1070 Brussel
www.inbo.be
luc.debruyn@inbo.be

Phenology

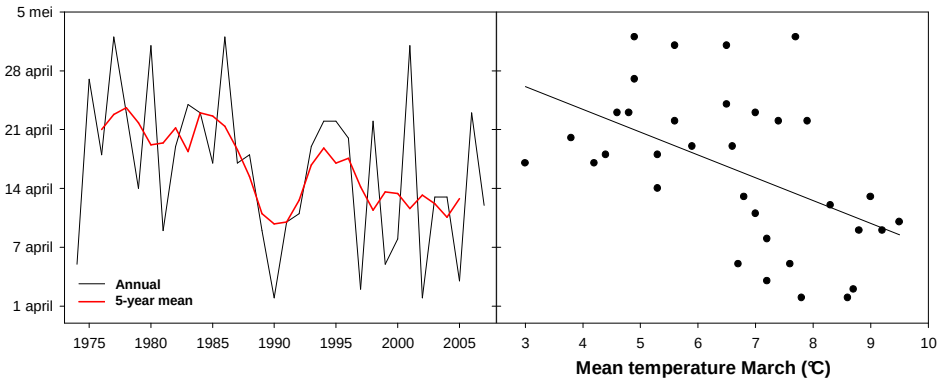


Spring 2.39 days / year

Research Institute for Nature and Forest
Kliniekstraat 25 • 1070 Brussel
www.inbo.be
luc.debruyn@inbo.be

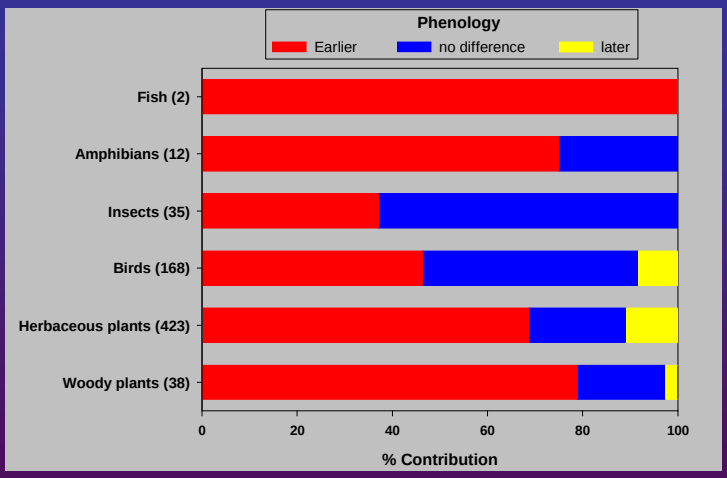
Phenology

Date highest pollen peak Birch



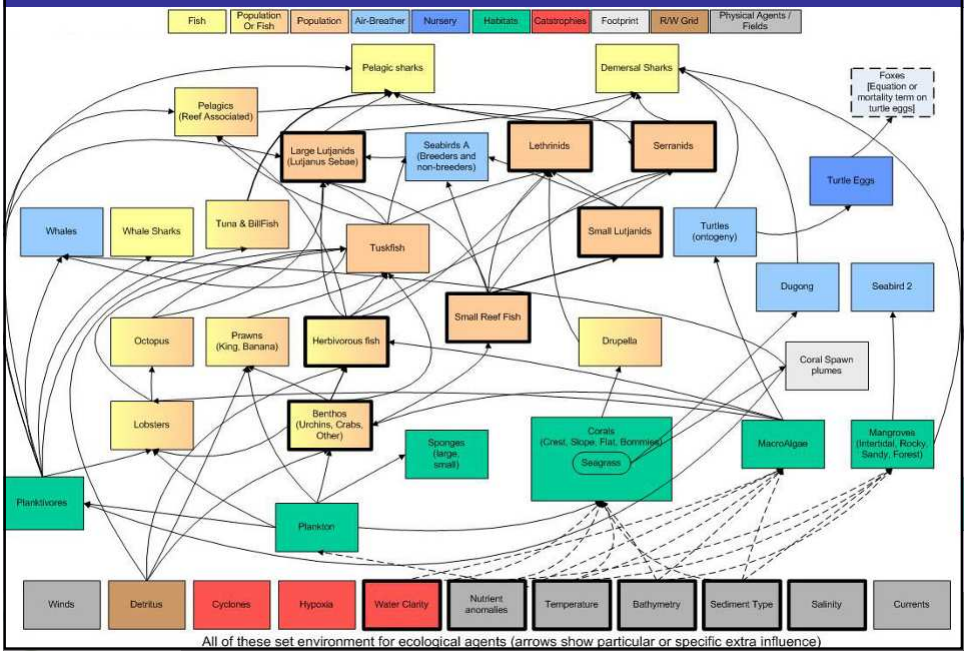
Phenology

- 667 species worldwide
- 62% earlier, 27% no change, 9% later



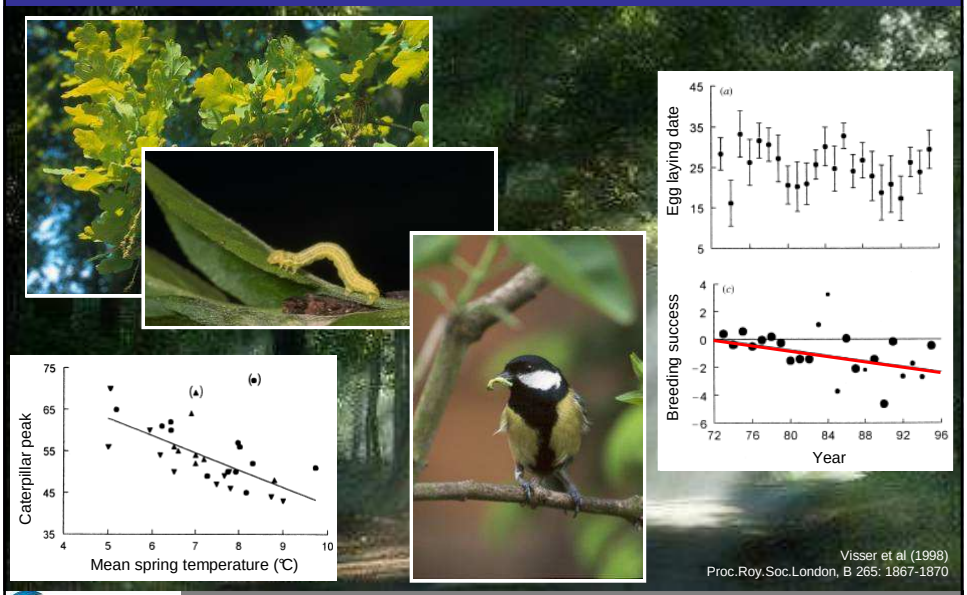
Parmesan & Yohe (2003) Nature 421: 37-42

Interactions among species



All of these set environment for ecological agents (arrows show particular or specific extra influence)

Impact: phenology

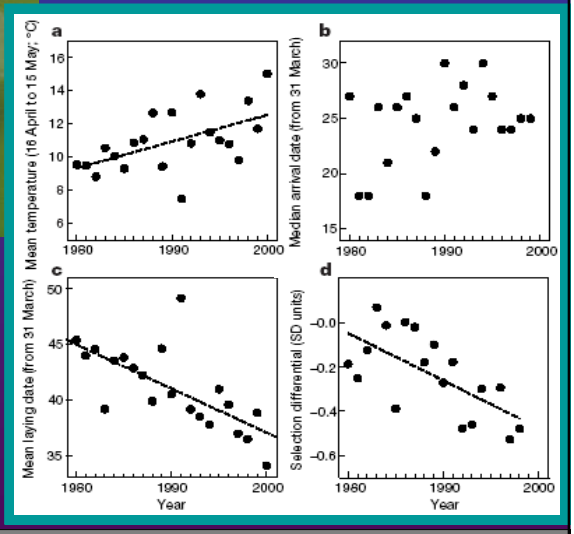


Visser et al (1998)
Proc.Roy.Soc.London, B 265: 1867-1870

inbo
Research Institute for Nature and Forest
Kliniekstraat 25 • 1070 Brussel
www.inbo.be
luc.debruyn@inbo.be

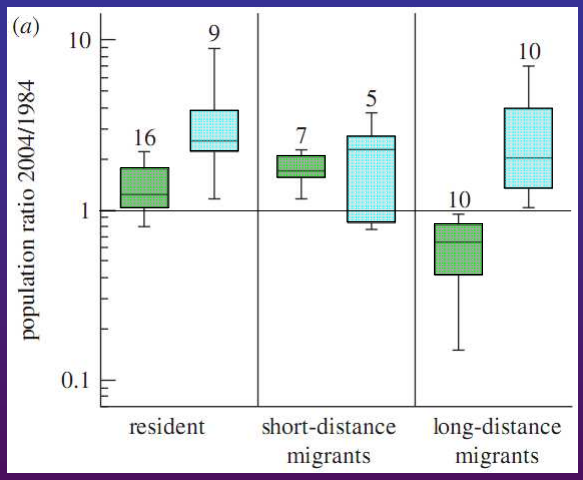
Impact: phenology

Pied flycatcher



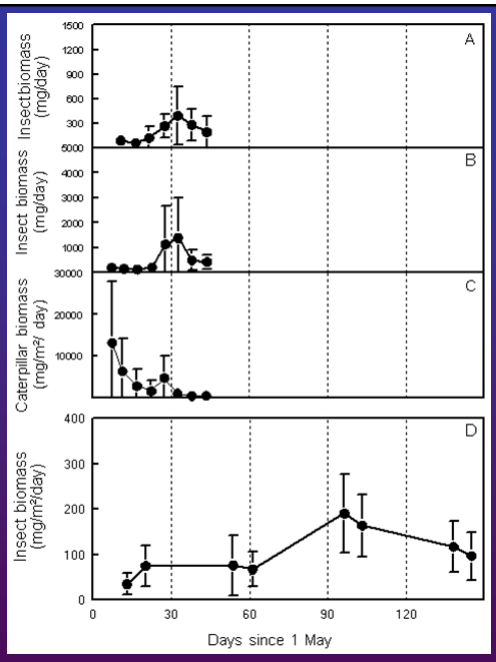
Both & Visser (2001) Nature 411: 296-298

Impact: phenology
Insectivorous passerines



Both et al (2010) Proc.R.Soc (B) 277: 1259-1266

Impact: phenology



forests

marshes

Both et al (2010) Proc.R.Soc (B) 277: 1259-1266

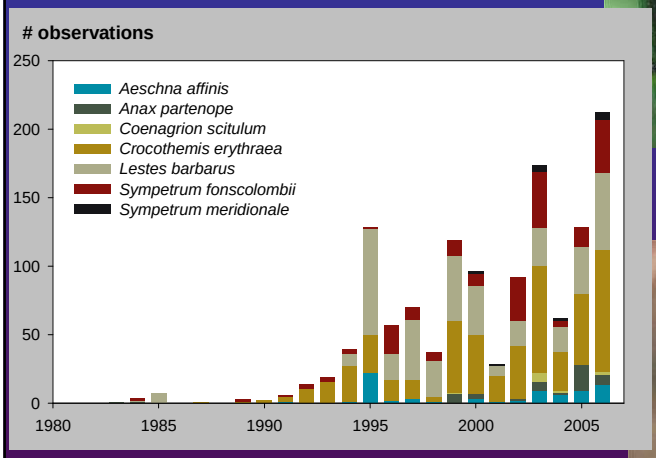
Research Institute for Nature and Forest
Kliniekstraat 25 • 1070 Brussel
www.inbo.be
luc.debruyn@inbo.be

Geographic shift

Research Institute for Nature and Forest
Kliniekstraat 25 • 1070 Brussel
www.inbo.be
luc.debruyn@inbo.be

Geographic shifts

- Southern Dragonfly species

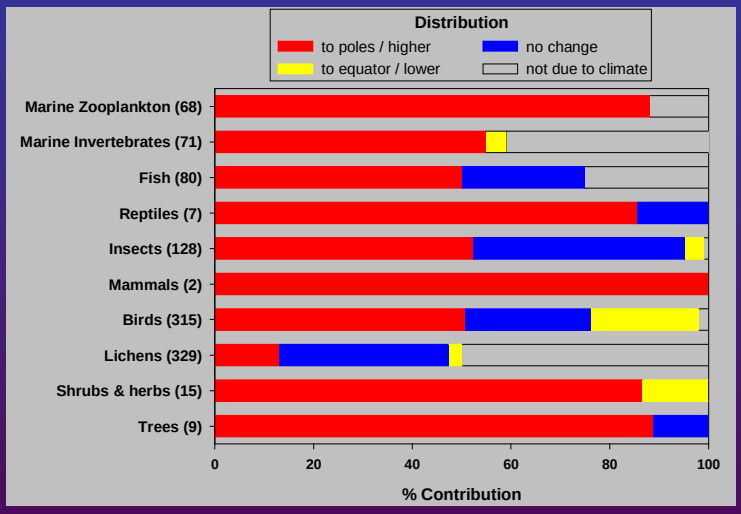


Flemish Dragonfly working group

Research Institute for Nature and Forest
Kliniekstraat 25 • 1070 Brussel
www.inbo.be
luc.debruyn@inbo.be

Geographic shifts

- 1046 species worldwide
- 43 % to poles / higher, 9 % to equator / lower, 26 % no change, 22 % not due to climate

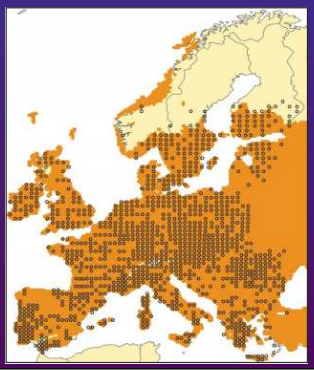


Parmesan & Yohe (2003) Nature 421: 37-42

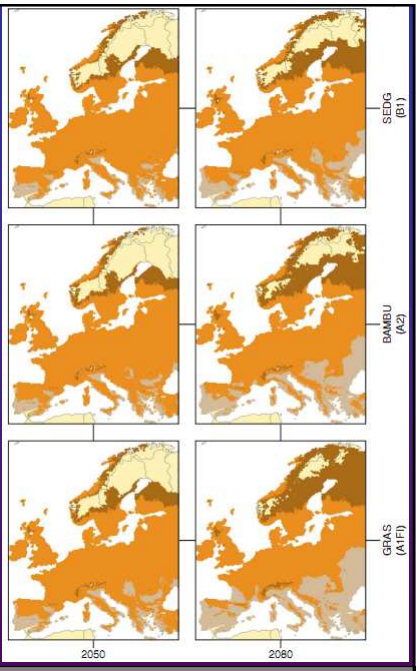
Research Institute for Nature and Forest
Kliniekstraat 25 • 1070 Brussel
www.inbo.be
luc.debruyn@inbo.be

Geographic shifts

Pararge aegeria



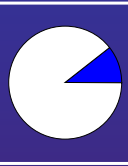
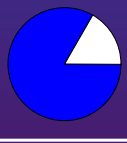
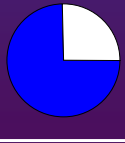
Settele et al (2008) Climatic Risk Atlas of European Butterflies



inbo
Research Institute for Nature and Forest
Kliniekstraat 25 • 1070 Brussel
www.inbo.be
luc.debruyn@inbo.be

Species loss

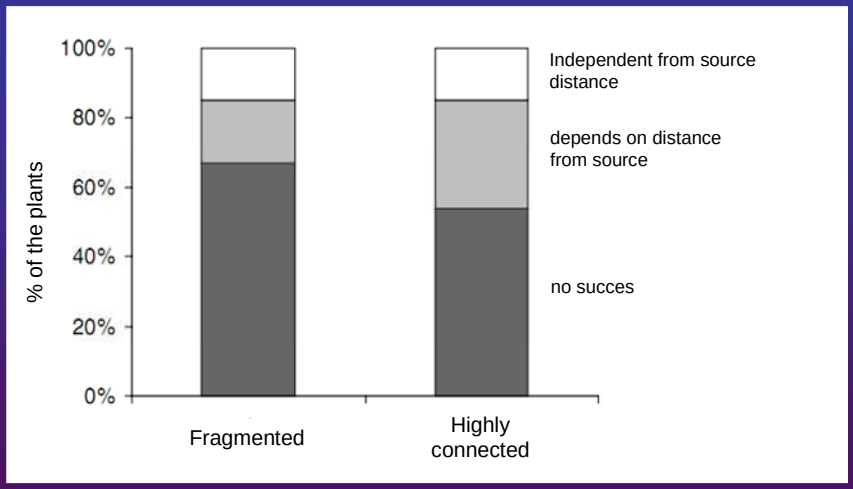
- 1103 species, area in 2050

	Maximal dispersion capacity	No dispersion possible
Minimal		
Average		
Maximal		

Thomas et al (2004) Nature 427: 145-148

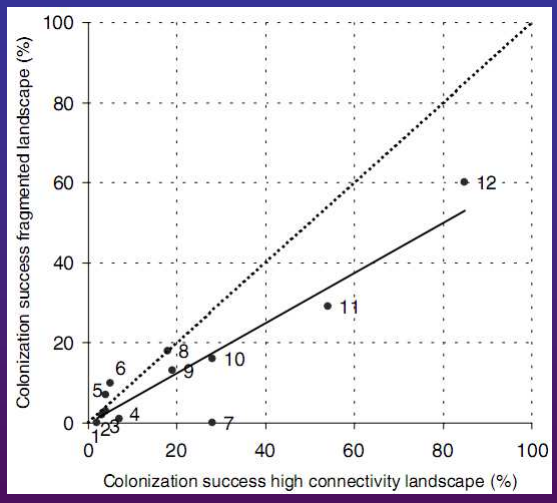
inbo
Research Institute for Nature and Forest
Kliniekstraat 25 • 1070 Brussel
www.inbo.be
luc.debruyn@inbo.be

Habitat fragmentation



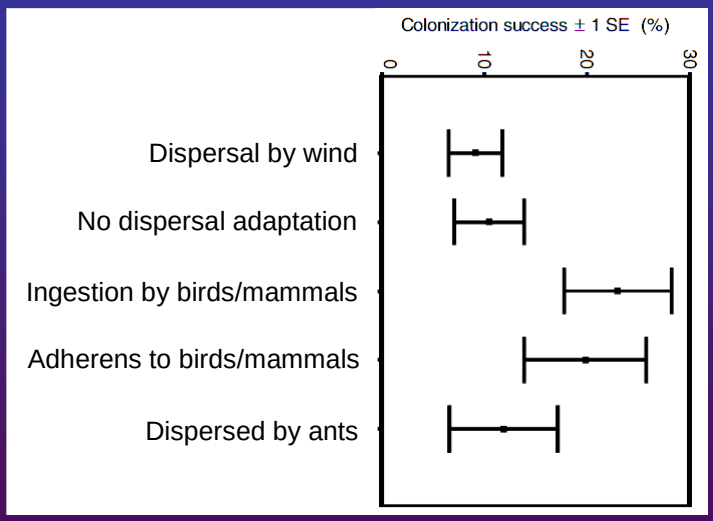
Honnay et al (2002) Ecol.Letters 5: 525-430

Habitat fragmentation



Honnay et al (2002) Ecol.Letters 5: 525-430

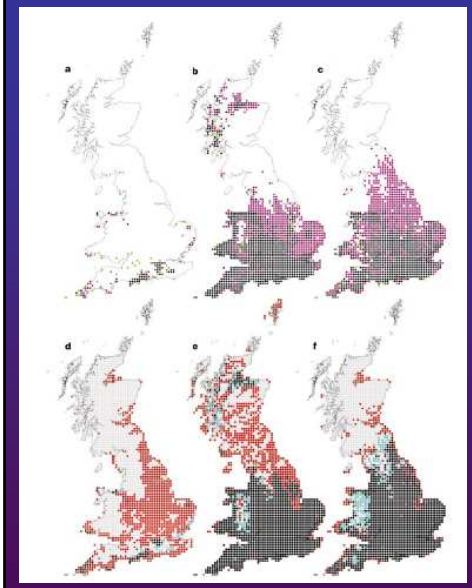
Habitat fragmentation



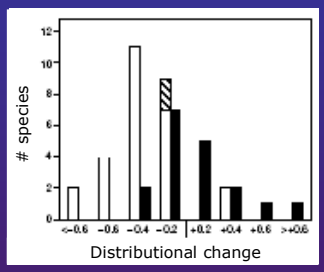
Honnay et al (2002) Ecol.Letters 5: 525-430

Research Institute for Nature and Forest
Kliniekstraat 25 • 1070 Brussel
www.inbo.be
luc.debruyn@inbo.be

Generalists versus specialists



- distributional shift during last 30 year



- 50% (mobile) generalists increased
  => climate change
- 50% generalists + 89% specialists decreased
  => habitat loss

Warren et al (2001) Nature 414: 65-69

Research Institute for Nature and Forest
Kliniekstraat 25 • 1070 Brussel
www.inbo.be
luc.debruyn@inbo.be

Generalists versus specialists

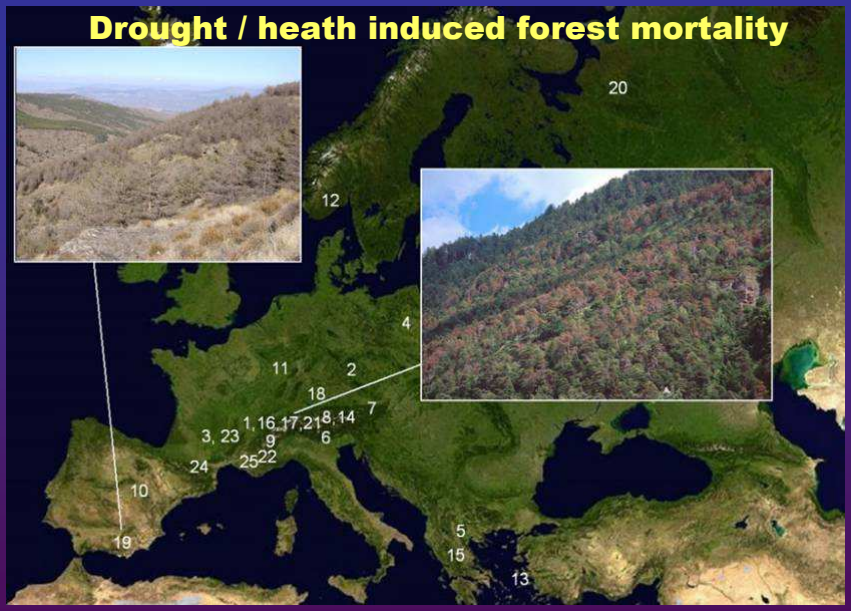
Disappear

Increase

Small Pearl-bordered Fritillary

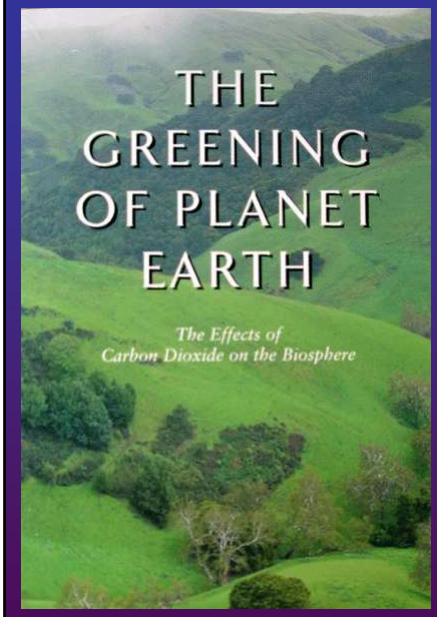
Research Institute for Nature and Forest
Kliniekstraat 25 • 1070 Brussel
www.inbo.be
luc.debruyn@inbo.be

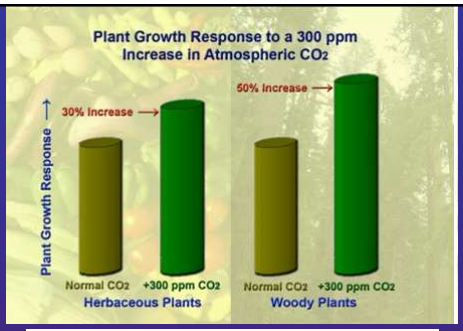
Drought / heath induced forest mortality

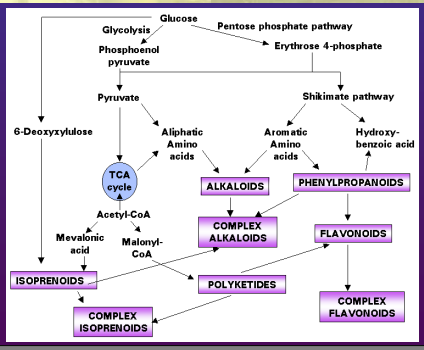


Allen et al (2010) Forest Ecol.Managment 259: 660-684

Research Institute for Nature and Forest
Kliniekstraat 25 • 1070 Brussel
www.inbo.be
luc.debruyn@inbo.be



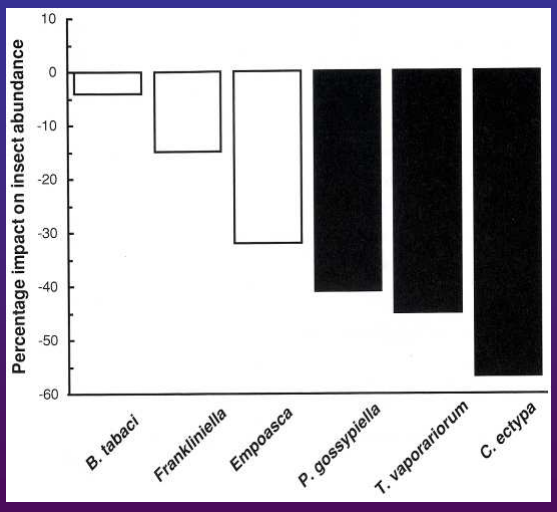




Research Institute for Nature and Forest
Kliniekstraat 25 • 1070 Brussel
www.inbo.be
luc.debruyn@inbo.be

Increased CO_2 concentration

Herbivore survival



Watt et al (1995) Insects in a changing environment

Research Institute for Nature and Forest
Kliniekstraat 25 • 1070 Brussel
www.inbo.be
luc.debruyn@inbo.be

Generalists versus specialists

Increase pest species

- Gan (2004) Forest Ecol.Management 191: 61-70
- Hodar & Zamora (2004) Biodiv.Conserv. 13: 493-500

Research Institute for Nature and Forest
Kliniekstraat 25 • 1070 Brussel
www.inbo.be
luc.debruyn@inbo.be

What now ?

Research Institute for Nature and Forest
Kliniekstraat 25 • 1070 Brussel
www.inbo.be
luc.debruyn@inbo.be

Possible adaptation measures

Temperature increase (℃)	Effects on biodiversity
2	Small number of species disapears Several management measures possible
4	Many species disappear Limited number of possible measures Which will be very expensive
6	ghastly / apocalyps

inbo
Research Institute for Nature and Forest
Kliniekstraat 25 • 1070 Brussel
www.inbo.be
luc.debruyn@inbo.be