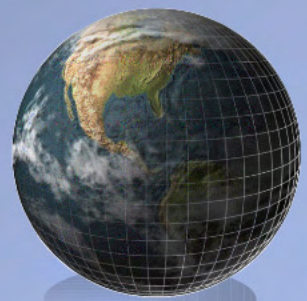
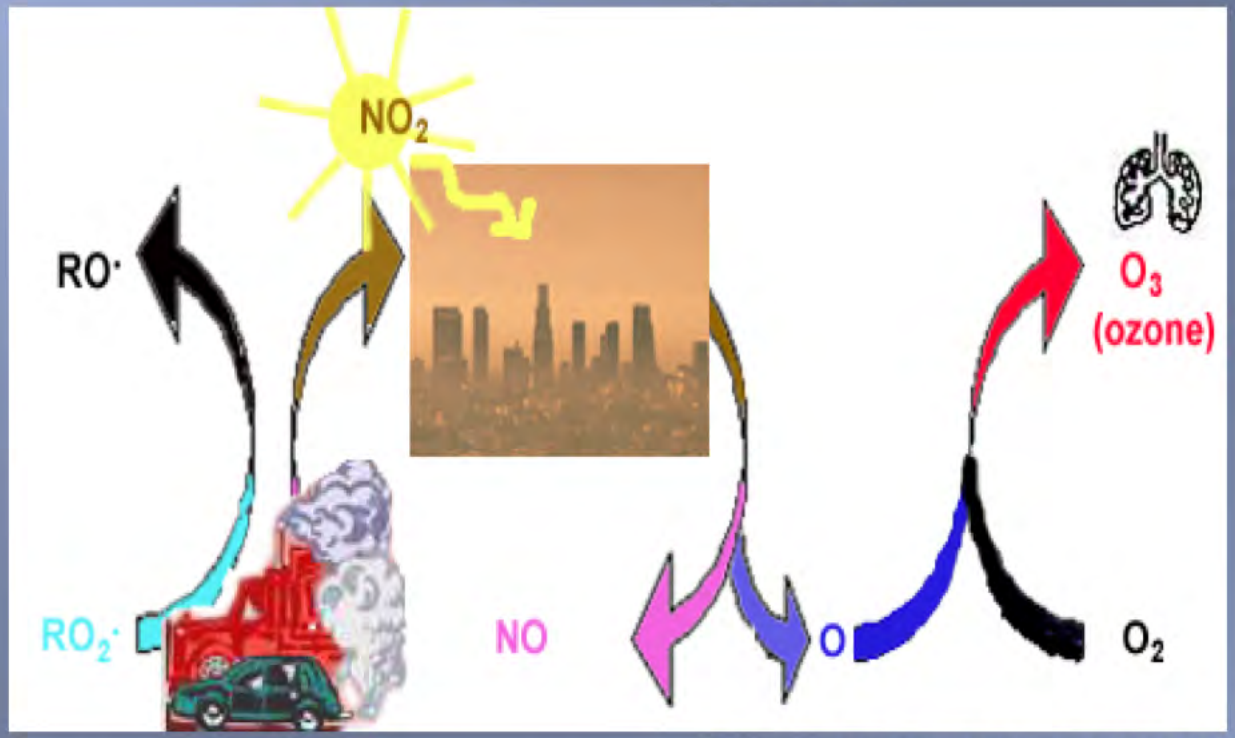
L'ozone, une inquiétude actuelle, un vrai problème demain?

Didier LE THIEC

Pierre DIZENGREMEL

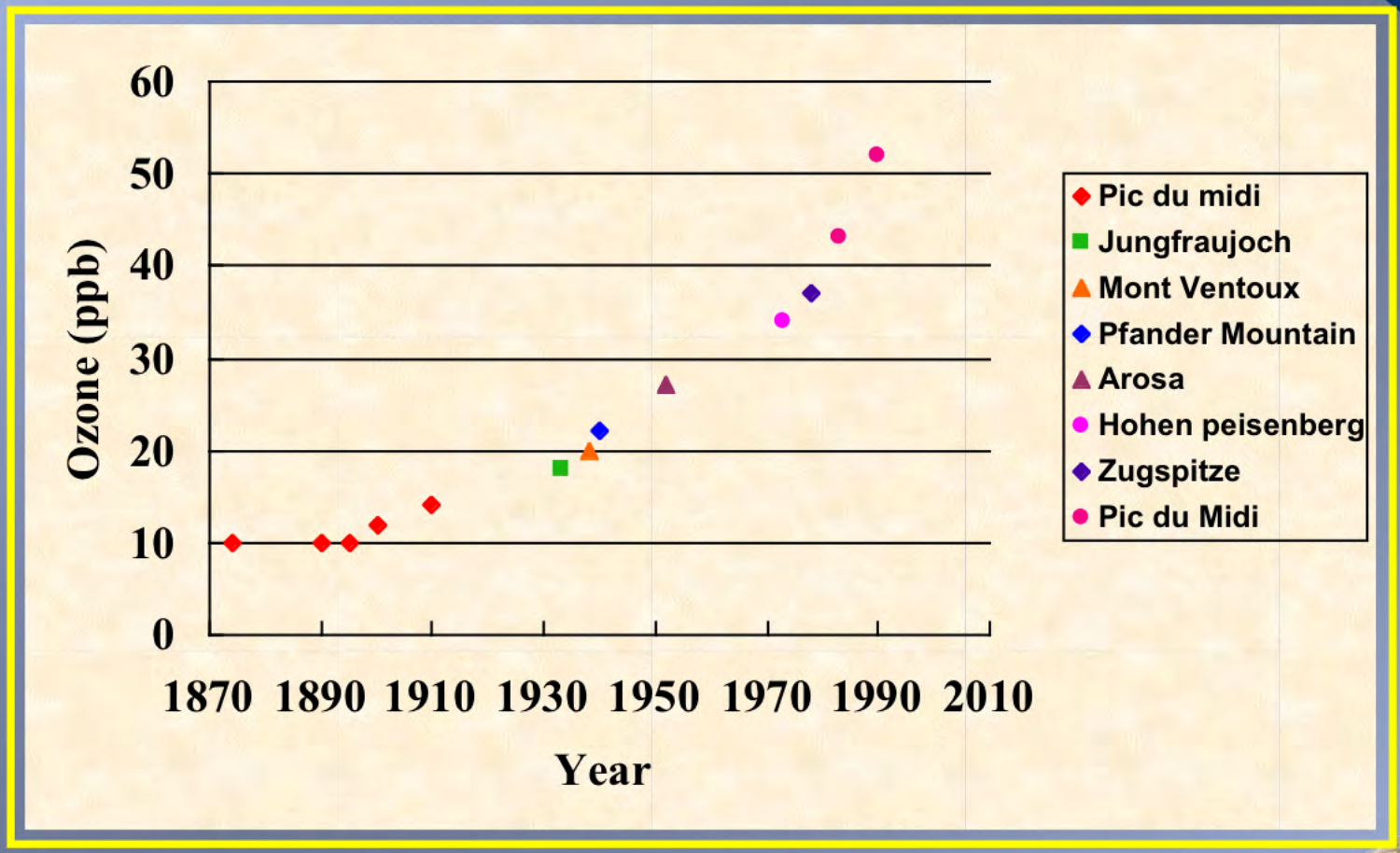


Formation de l'ozone

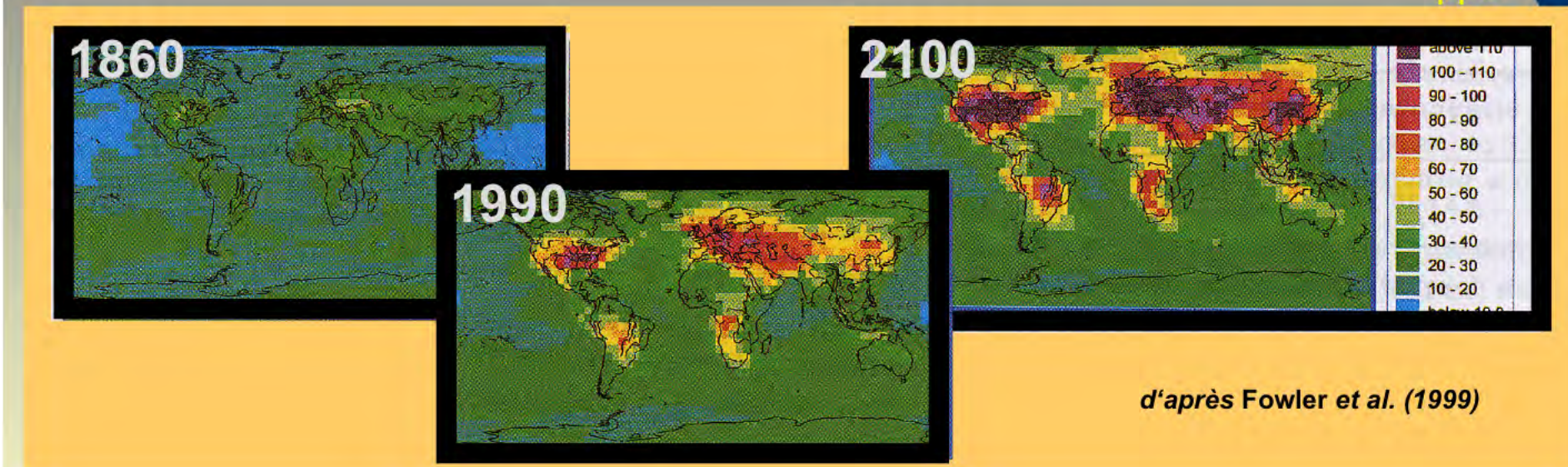


(C .Herman & R. Frey, St-Louis, USA, 2001)

Evolution des niveaux d'ozone 1870-2000

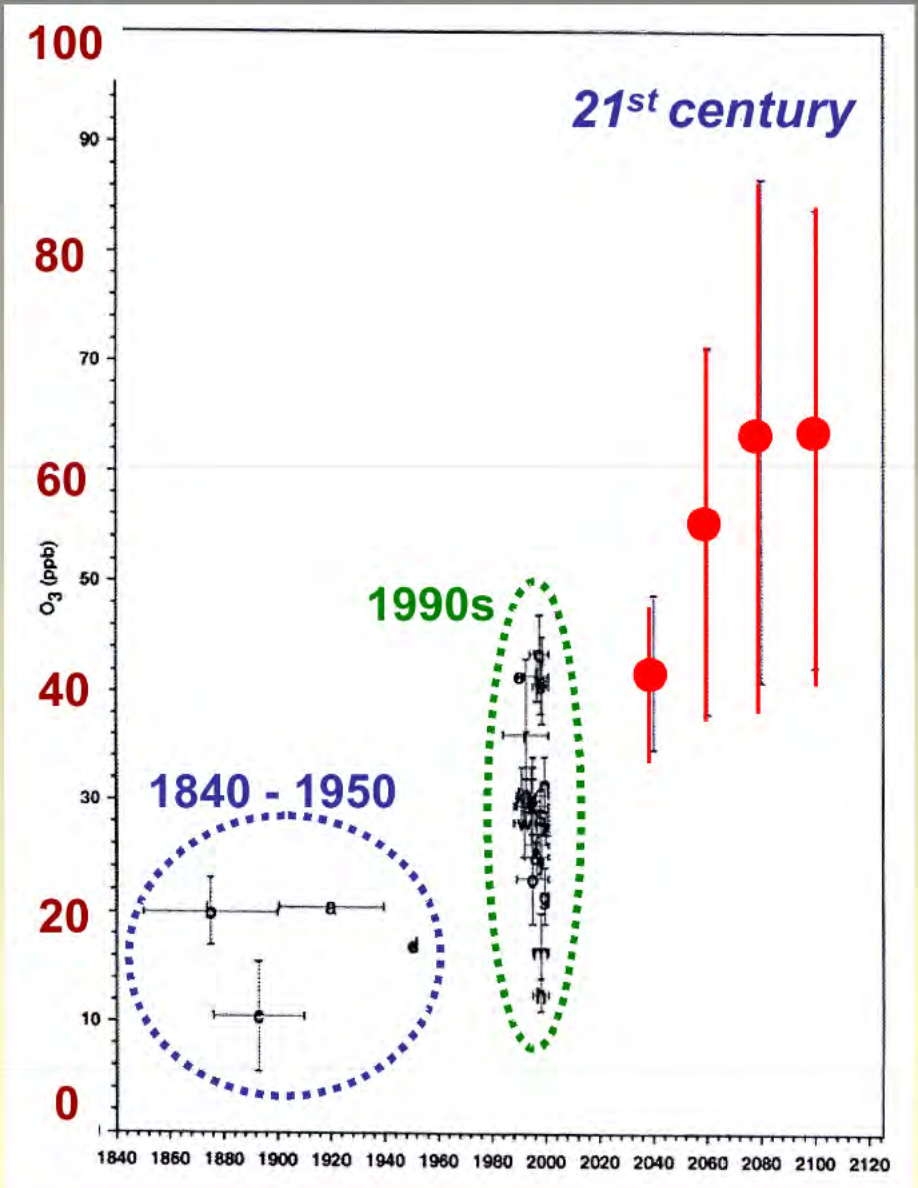


Prévisions pour le 21ème siècle



d'après **Fowler *et al.* (1999)**

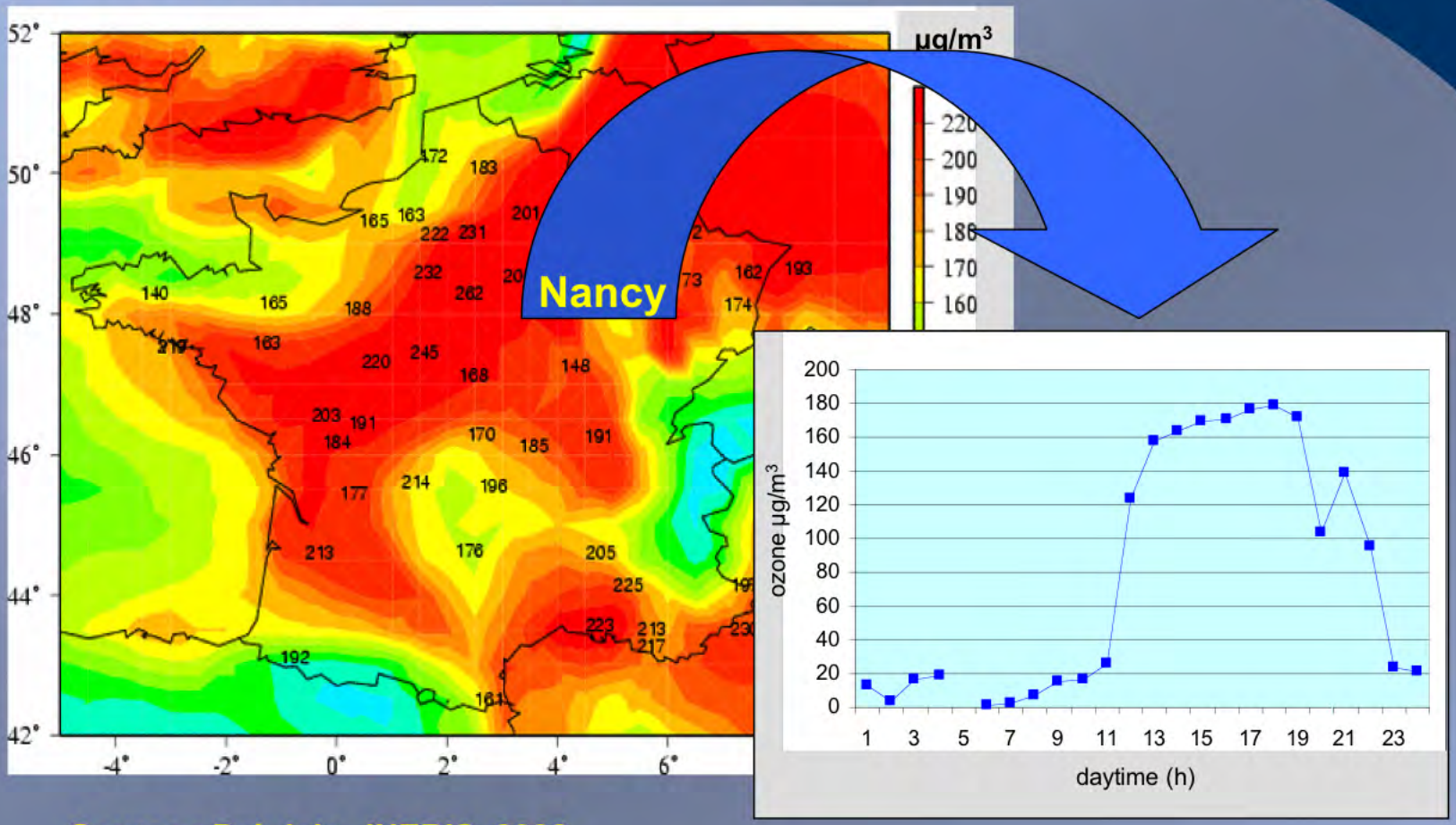
Prognoses for the 21st Century



Ashmore (2005) after Vingarzan (2004)

En France

8 août 2003



Source : Prév'air - INERIS, 2003

Pics supérieurs à 90 ppb

Quels sont les impacts sur les arbres?

Site internet symptômes foliaires :

http://hermes.wsl.ch/didado/ozoniwww.page0?sprache=E

charme

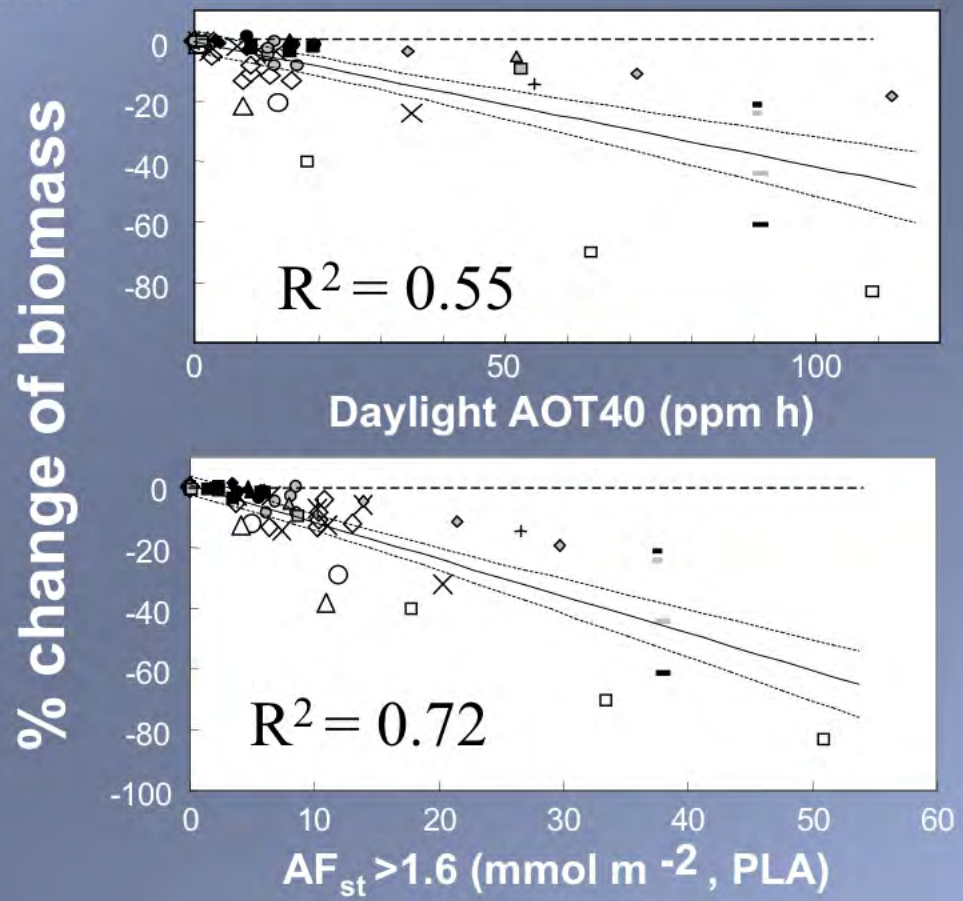
hêtre

tremble

chêne

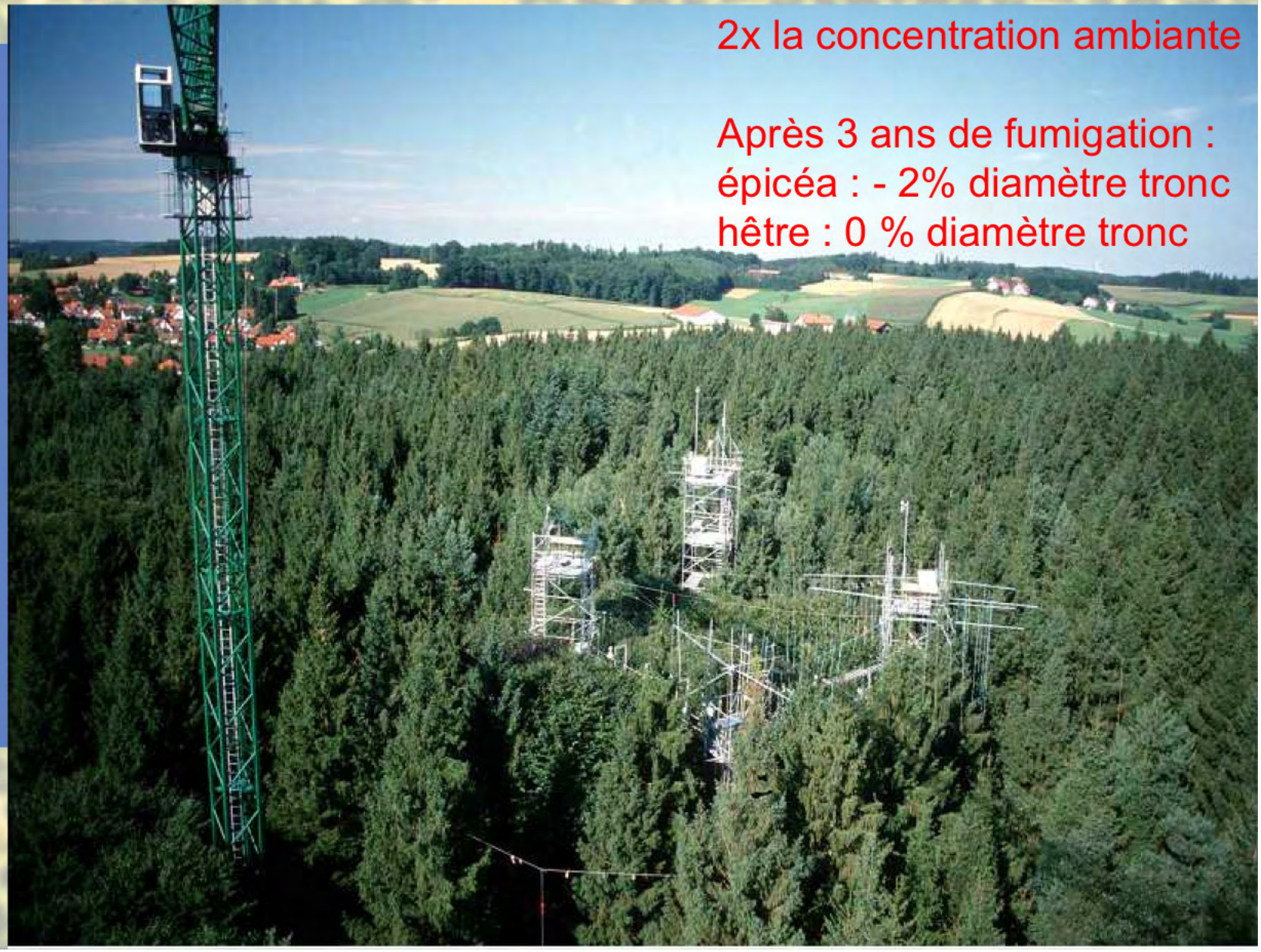
Quels sont les impacts sur les arbres?

Ozone-sensitive species		Moderately ozone-sensitive species	
Deciduous	**Coniferous**	**Deciduous**	**Coniferous**
Fagus sylvatica *Betula pendula*	*Picea abies* *Pinus sylvestris*	*Quercus petrea,* *Quercus robur*	*Pinus halepensis*



Quels sont les impacts sur les arbres?

Site expérimental de la forêt de Kranzberg (Allemagne)

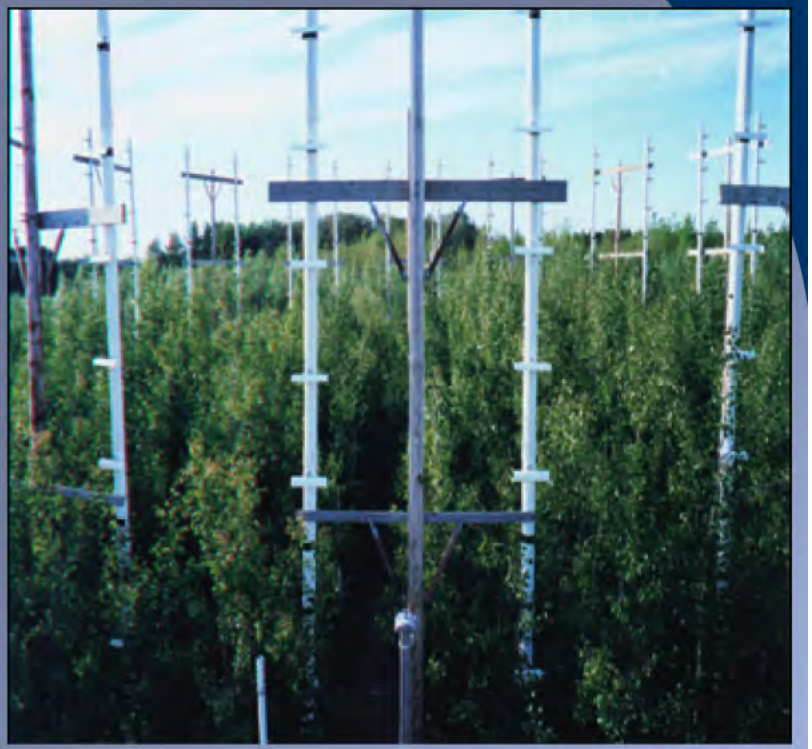


2x la concentration ambiante

Après 3 ans de fumigation :
épicéa : - 2% diamètre tronc
hêtre : 0 % diamètre tronc

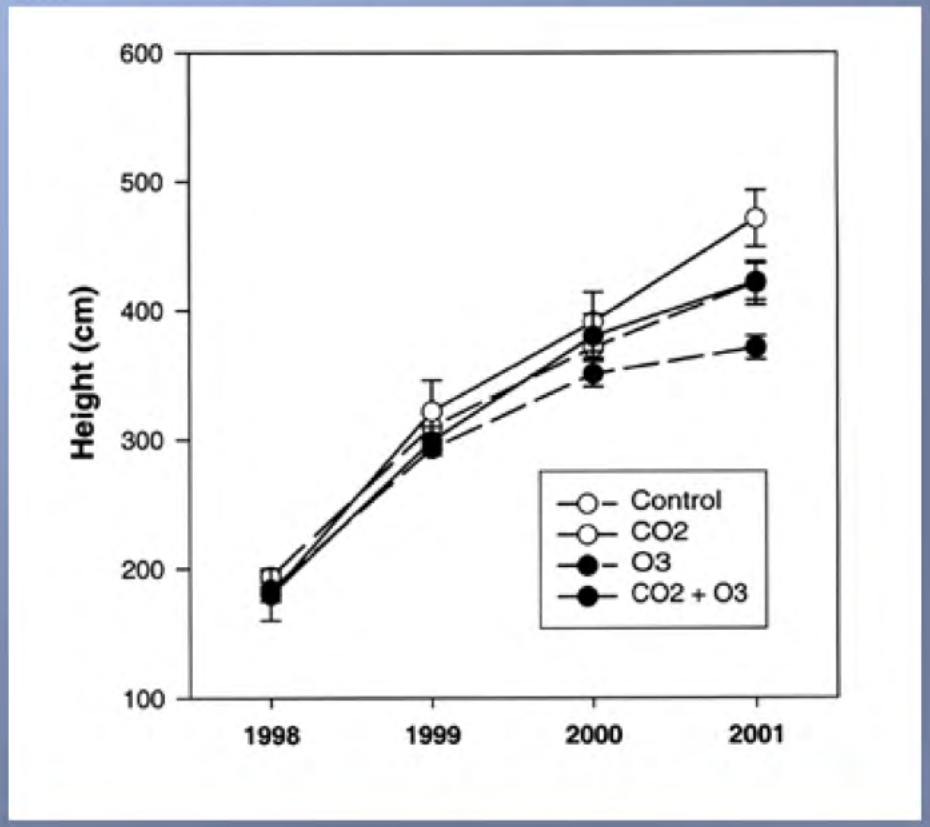
Quels sont les impacts sur les arbres?

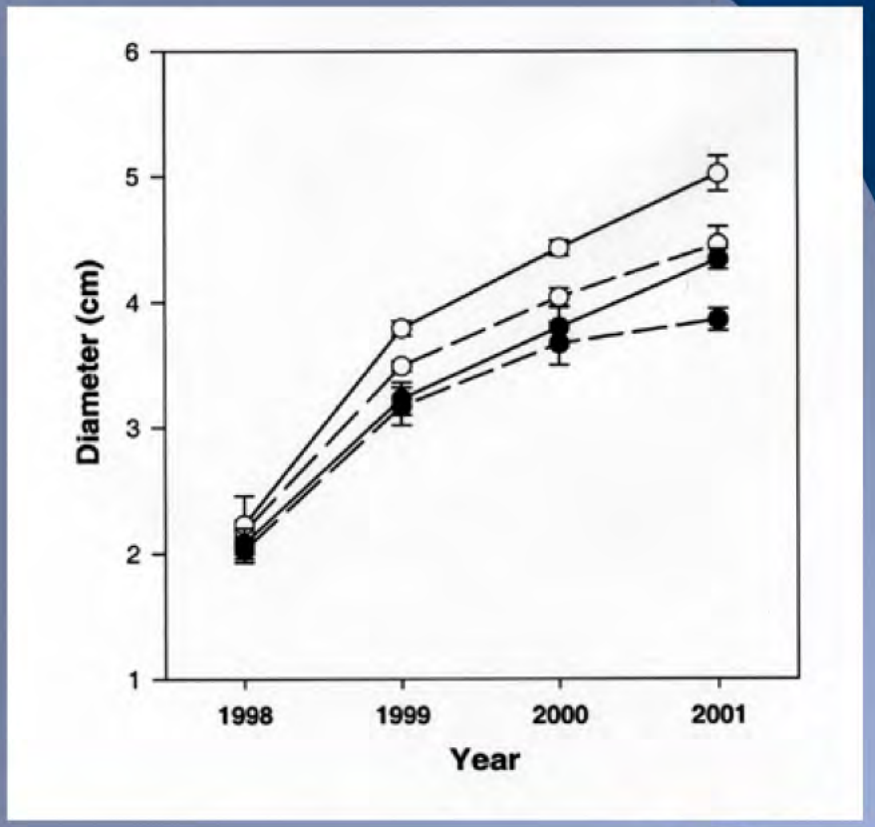
Site expérimental US (tremble ….)

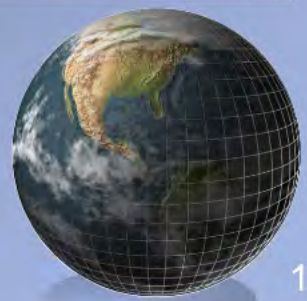


Site expérimental US

Ozone : 1,5x la concentration ambiante

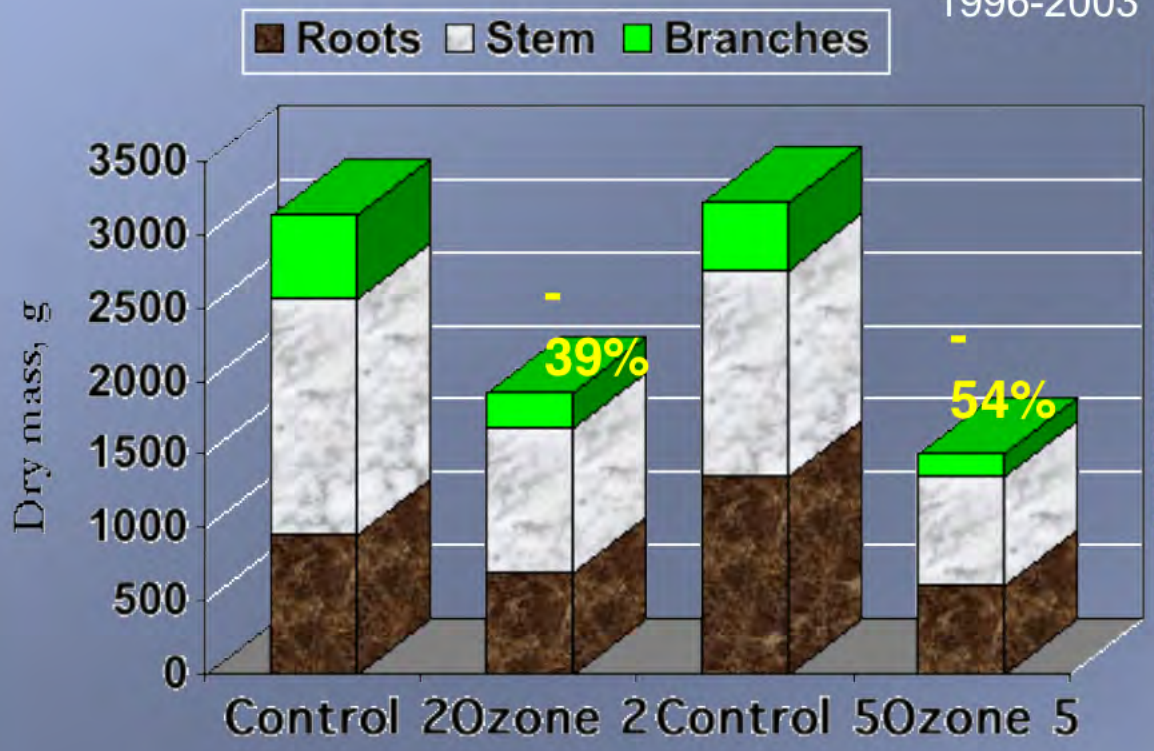






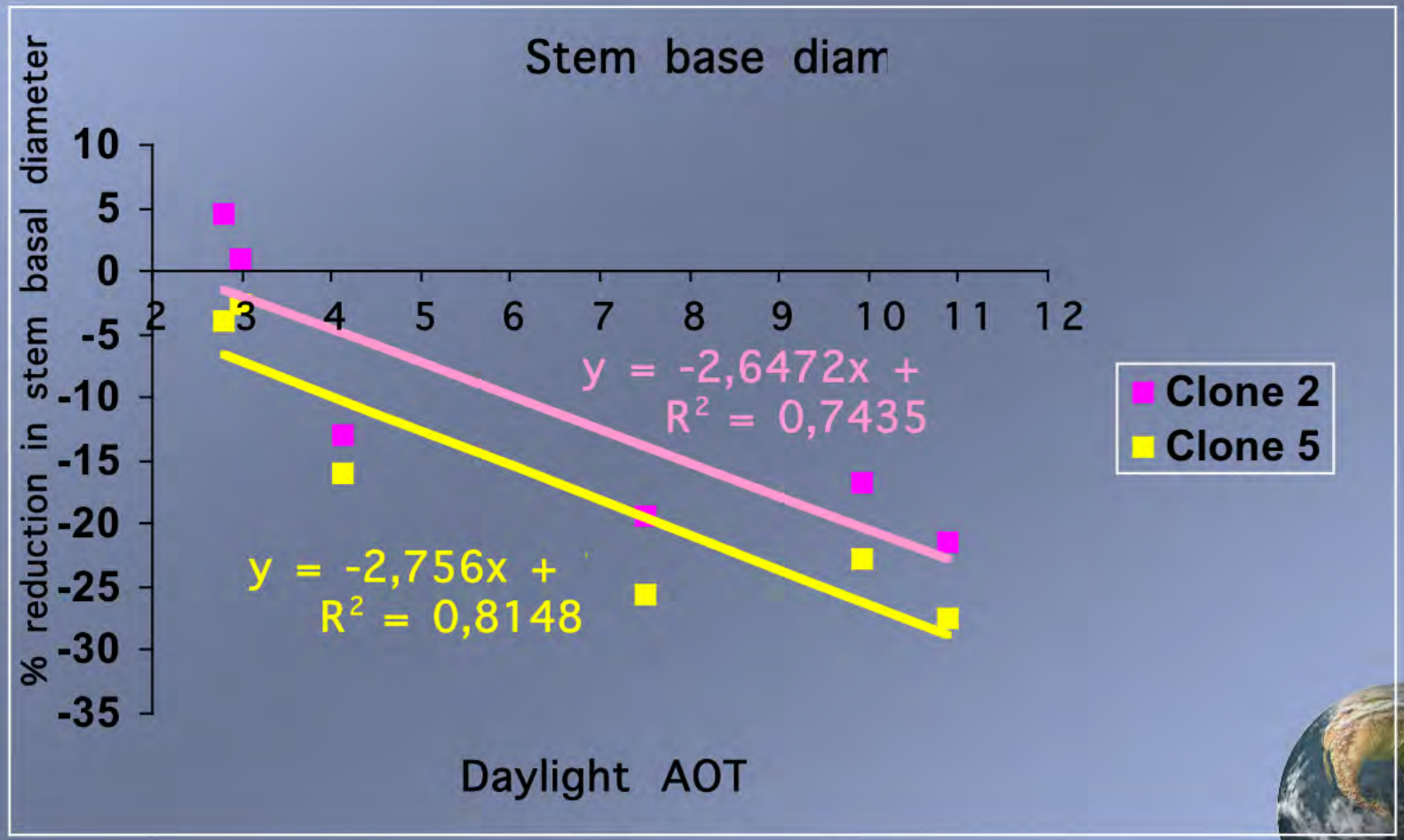
Site expérimental finlandais

Final harvest for silver birches (*Betula pendula*) after exposure to 1.5 x ambient ozone over 1996-2003

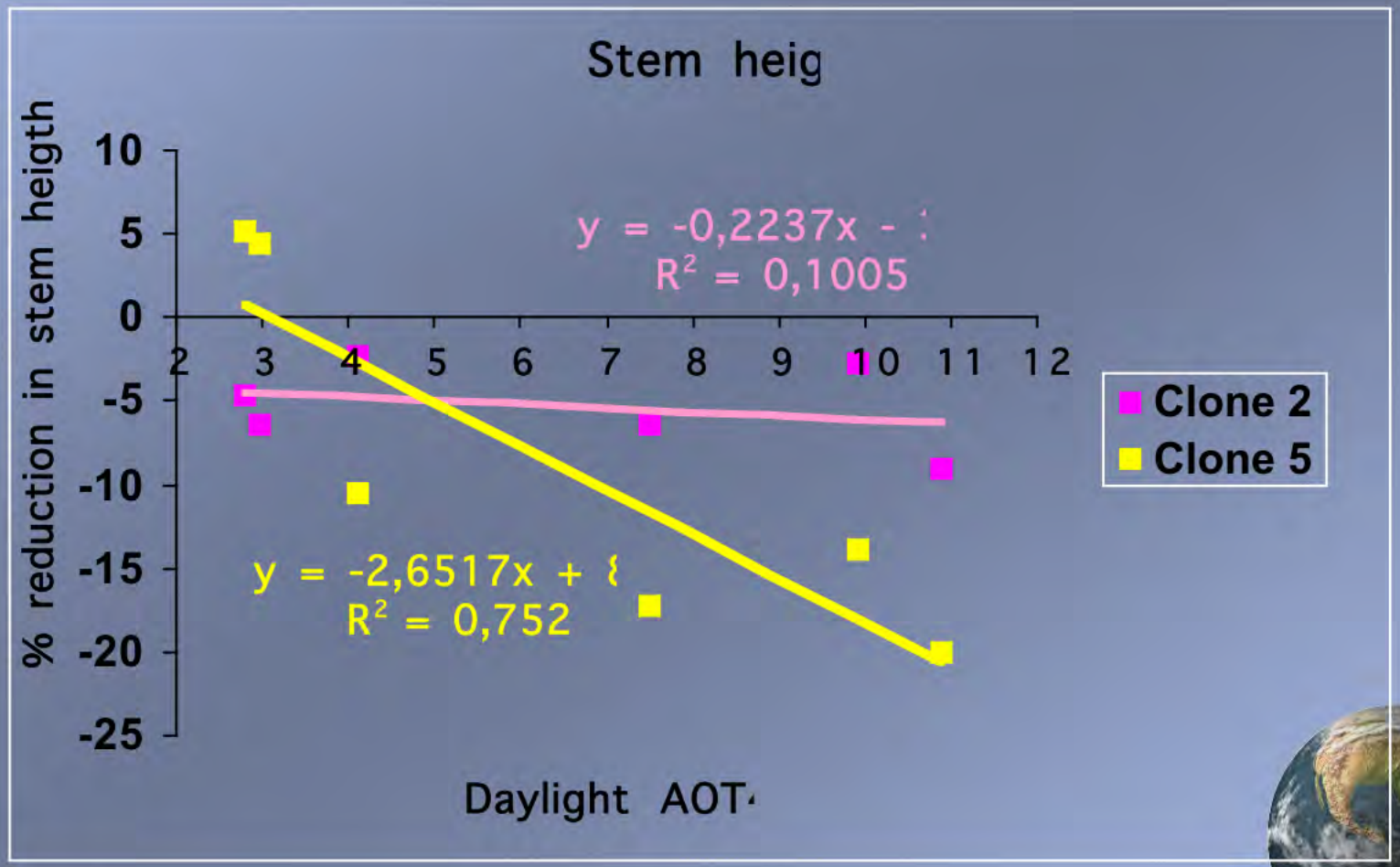


Less sensitive clone 2 More sensitive clone 5

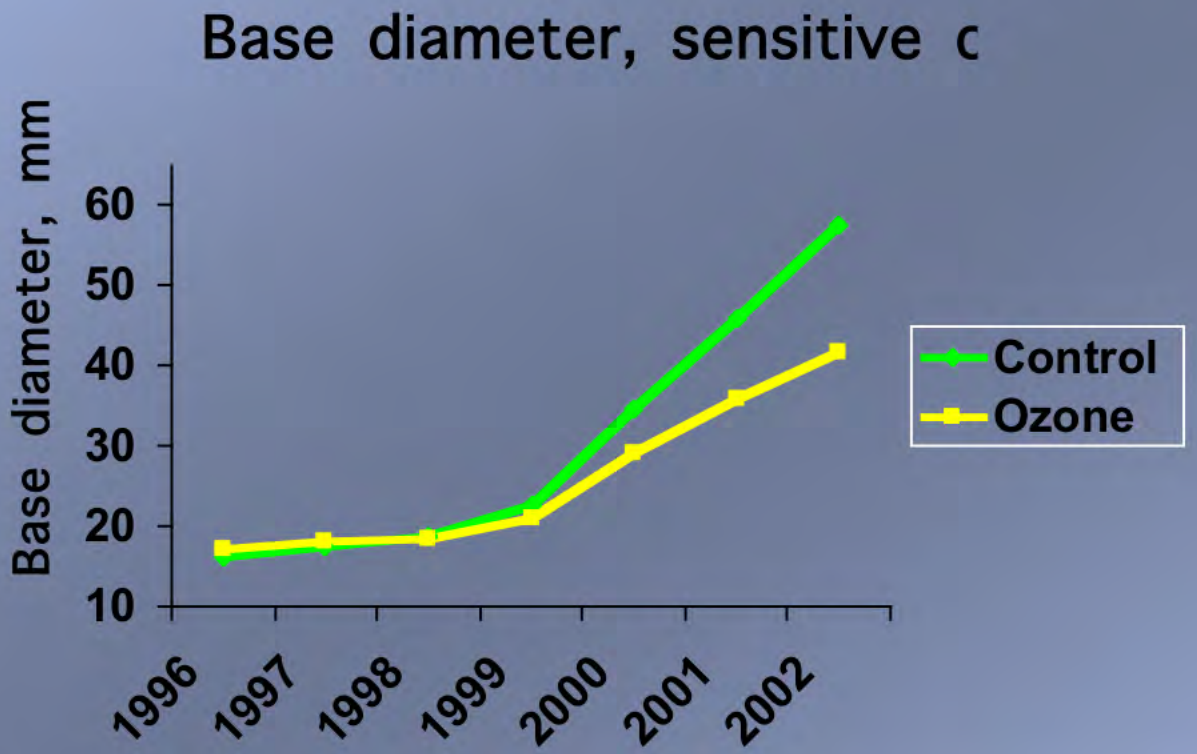
Looking for the best non-destructive indicators for ozone risk assessment



Looking for the best non-destructive indicators for ozone risk assessment



Exposure time is important



D'après Karlsson *et al.* 2005 . Ambio 34 (1) 32-40

Per Erik Karlsson, Håkan Pleijel, Mohammed Belhaj, Helena Danielsson, Bo Dahlin, Mikael Andersson, Max Hansson, John Munthe and Peringe Grennfelt

Economic Assessment of the Negative Impacts of Ozone on Crop Yields and Forest Production. A Case Study of the Estate Östads Säteri in Southwestern Sweden

Ground level ozone concentrations, in combination with the prevailing climate, at the estate Östads Säteri in southwestern Sweden were estimated to reduce the yield of wheat and potato ranging between 5% and 10%. Occasionally, in years with the highest ozone concentrations and/or climatic conditions favoring high rates of ozone uptake to the leaves, yield loss levels above 10% may occur. Based on simple extrapolation, these ozone-induced reductions of crop yields at Östads Säteri represent a potential total annual yield loss in Sweden in the range of 24.5 million Euro for wheat and 7.3 million Euro for potato, respectively. A simulation of forest growth at Östad Säteri predicted that prevailing mean ozone exposure during 1993–2003 had the potential to reduce forest growth by 2.2% and the economic return of forest production by 2.6%. Using this value for extrapolation to the national level, the potential annual economic loss for Sweden due to negative impacts of ozone on forest production would be in the range of 56 million Euro (2004 prices).

of ground-level ozone on forest and crop growth as recently presented in the Mapping Manual (7) of the LRTAP convention. It is focussed on a specific site, the estate Östads Säteri in southwestern Sweden, where detailed information on ozone concentrations, local climate and growth conditions for crops and forest were available.

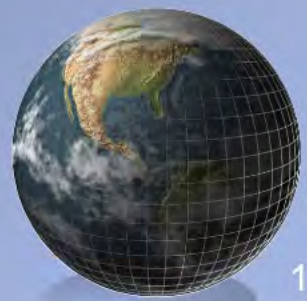
DESCRIPTION OF THE ESTATE ÖSTADS SÄTERI

The estate Östads Säteri is situated in the interior of southwestern Sweden (8) in a hilly landscape dominated by forested areas. The estate consists, in total, of approximately 5000 ha, with about 3700 ha forest and 630 ha arable land (Fig. 1). The climate is continental (9) with low nighttime temperatures and frequent air inversions during the summer nights. The climate is humid with a mean annual precipitation of 700 mm and a mean annual temperature of 7°C. Agriculture used to be more extensive in this type of landscape. Although yields tend to be somewhat lower, as compared to the most fertile intensively managed agricultural areas of southern Sweden, most important Swedish crops can be commercially grown in the

Que doit-on attendre? Interactions avec sécheresse, CO_2

Epicéa clone Istebna + 50 ppb+ sécheresse

Epicéa clone Istebna + 25 ppb
+ sécheresse



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