Climate Change and Planting for the Future

PlantNetwork Conference
Royal Agricultural College, Cirencester, 10–12 September 2008
www.plantnetwork.org

Day 1

Forests and climate change: a convenient truth?

A DVD entitled 'A convenient Truth' was shown. A few bullet points from this are:

- **The 20th century is probably the warmest for a thousand years**
- **The 10 warmest years on record have occurred since 1990**
- **Rainfall patterns are changing, sea levels are rising, glaciers are retreating and the artic sea ice is thinning.**
- **Without a reduction in greenhouse gas emissions global temperatures are expected to rise between 1.5 and 6 degrees centigrade by 2100**
- **2080's would see milder wetter winters with a 3-6 degrees c rise in temperature.**
-

Also it was mentioned that in 1900 5% of the country was covered in woodland and in 2000 12% was covered.
It was suggested that certified sustainable wood products should be used wherever possible and that wood products for building need to be utilised over concrete. Use of Bio-mass boilers and wood as a fuel would help reduce carbon emissions.

Climate change, trees and the future

Mark Broadmeadow, Forestry Commission

'Out of 2500 scientists involved in a recent IPCC report on climate change only 62 agreed with its conclusions that man was responsible'

Veteran trees have survived the past and should adapt
It would be useful to look at the French western seaboard as an example of the sorts of conditions and species grown for future reference here.
It was noted that temperature would effect: Length of season (longer), less frost (although potentially more damage as growth could be soft) and regeneration from drought, frost etc)
Wetter winters could increase: water logging, root death and stability.
Drier summers could increase: mortality, reduced growth and fire risk

An interested fact is that soil moisture deficit (Drought) can affect tree crowns upto 5 years after the event.

A reaction to climate change would be to enhance native species, increase diversity of species, use seed origin from more southerly sources.

UKCIP08 climate scenarios - what they mean

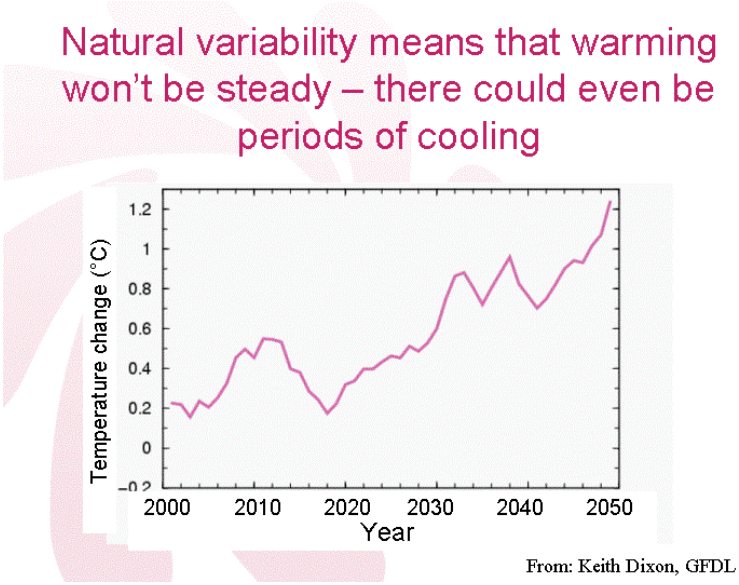
Chris West, UK Climate Impacts Programme

A presentation talking about how UKCIP 2002 has been updated now with UKCIP2008
What is climate change?
Climate refers to the average weather experienced over a long period, typically 30 years. The Earth's climate has changed many times in response to natural causes. The term *climate change* usually refers to changes that have occurred since the early 1900s.
See www.ukcip08.net for details

Climate change: certainties and uncertainties, regional effects and extreme events

Kathy Maskell, Walker Institute for Climate System Research, University of Reading

- Even with constant co2 levels temperatures will rise
- 5-10% more rain in winter
- 15-20% less rain in summer
- Chances of more hot/record days
- Gulf stream looking to weaken reducing temperatures by 2 degrees C, balanced by climate change temperature rise.
- European surface temperature to drop over next 10 years.
- Greater chance of wetter more intense rainfall in winter with possible flooding



Phenology at the Royal Botanic Garden Edinburgh for the past 150 years

Clare Morter & Christine Thompson, Royal Botanic Garden Edinburgh

Records have been kept since 1850. James Mc Nab started the daily register of 25 spring flowering shrubs. This list went up to 40 in 1845. daily temperatures were also recorded.
'Flowering' means if you can see the stamens or stigma without touching the flower.
Colder temperatures before First Flowering Date will delay flowering. 1 degree C = 4 day delay.
Rhododendron ponticum will adavance 10 days from FFD for every degree warmer
A temperature rise of 4-5 degrees will see plants become desynchronised with other dependent organisms by up to 1.5 months.

Kew's experience with climate change

Nigel Taylor, Royal Botanic Gardens Kew

Weather records since 1980 have shown a trend towards less seasonality, greater extremes, less predictability
The 'Kew 100' is a list of plants that phonological records since 1952. FFD have moved forward between 8-19 days depending on species.
Native daffodil Narcissus pseudonarcissus has gone from 9th March in the 1950's to 27th January in the 2000's

Between 1961-1990 the average growing season was 252 days. Since 200 the number of days is 255-329 mainly due to the early onset of spring
Risks to living collections new pests and diseases, stress from extreme weather events, frost damage on unseasonal unripened wood
Greater expense due to year round grass cutting /maintenance, more pest control

Day 2

Boom and bust, flood and drought - it's a hard life being a garden plant

Ross Cameron, Environmental Biology, University of Reading

A plants water requirement is as follows:-
Rhododendron
30ml- to keep alive
45ml- avoid injury to plant
90ml- improve quality of plant
180ml- growth
(The equivalent to us drinking 40L)
Plants can adapt to limited water regimes as long as they get some water. Little but often goes a long way.
Water logging causes drought stress via a lack of o2.
Summer water logging more damaging than winter temperatures
Establishment will be THE key stage, avoid competition and encourage deep rooting

Effect of climate change on decomposer and mycorrhizal fungi

Lynne Boddy, Cardiff University

Many disease causing fungi thrive in warm wet summers, so with summers becoming warmer and wetter the extent and timing of fungi activity will change
A good example of a 'Strip Canker' here is on a Beech located on the north side of Holman path about half way down. This is caused due to drought stress.
Fungi are the major agents of nutrient movement and re-cycling
Fungi fruiting season has grown from 33 days in the 1950's to 75 now. 25% fruit earlier and 40% later
Wood decaying fungi are now fruit in spring (about 30%) showing increased activity and decay rates.

Horizon scanning for potentially invasive non-native plants

Ruth Waters, Natural England

Natural England survey resulted in: 2271 non-native species of which 1798 were flowering plants. All of which have the potential to 'Escape' from gardens. Acacia dealbata is in the EU's top 100 invasives. Also Ailanthus altissima (tree of heaven), Robinia pseudoacacia.
www.nonnativespecies.org

Tree collections and climate change: taking stock

Richard Jinks, Forest Research, Alice Holt

Challenges to tree collections will be:

Funding

Pest and disease

Storms/snow/ice

Freezing

Drought

Out of 931 species surveyed at Westonbirt 250 proved to be intolerant of drought

Good horticultural practices will be essential for long term establishment of tree in the future

Day 3

Planting for the long-term: climate change and National Trust gardens

Mike Calnan, Gardens & Landscape, National Trust

Need to adapt to the last 50 years of high emissions

Mitigation: Carbon capture

Carbon reduction

Tree forest cover reduces carbon by 13%

Peat bogs store/lock up more carbon than trees (BUT National Trust does not mention that only 4% of peat is commercially used for horticulture)

Carbon reduction measures:

Source as much material locally

Buy small or bare root plants

Renewable heating i.e. wood chip boilers

Recycle as much as possible

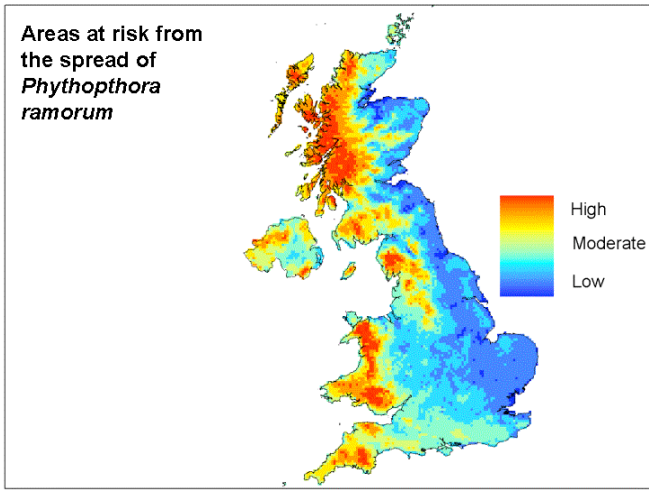
Avoid mains water consumption

After 1990 storms natural re-generation out grew planted specimens

Different species and clones of plants need to be selected to adapt to wet and dry periods

Path surfaces can be used to direct water run away from problem areas (think of the stone gully's used as traditional path edging)

Pest and disease out breaks Phythopthora ramorum



Climate change and long term plant collections
Better records kept and archived
Propagation of suspect at risk plants
Partnerships with other gardens, micropropagation etc
Storage, millennium seed bank etc
Dispersal of material

Adapting planting at Royal Horticultural Society gardens

Christopher Bailes, RHS Garden Rosemoor

RHS has plant collection of 71500 with 30000 taxa
Has no formal policy in place for climate change
Noted the 'Blurring of seasons' with 'lack of winter chill'
Shred green waste direct to beds as well as compost material.
Grow plants hard meaning minimal watering and feeding to produce hardier stacky plants
Plants growing now with out pwinter protection:
Tetrapanx papifera
Cornuc capitata
Echium wildpretii
South African bulbs
Also more use of winter flowering plants like sarcococca and Daphne bhoula
Asiatic species are flowering well 1 in 5 seasons (RHS Rosemoor) affected by frost regardless of flowering stage
Hydrangeas affected by light but late frosts when growth is soft
RHS stance respond and adapt to climate change

Adapting alpine and woodland plantings at Kew

Katie Price, Royal Botanic Gardens Kew

Kews obligation is to :
Maintain national reference collections
Represent as many plant families as possible
Represent as many parts of the globe as possible
Options in the face of climate change are:
Better horticulture:
Soil management is key, mulching ,composting,
Better facilities for growing
Multiple sites for experimentation

Exotic pests and diseases likely to flourish or be encountered with climate change

Ray Cannon & Helen Moran, Central Science Laboratory

First leaf date 1.1 days earlier per decade

Tree species north and south fringes will migrate north east

Direct effects of climate change are:

Increased growing season

Milder winters

Increased precipitation

Increased summer temperatures

Indirect effects are:

Increased water run off, flash floods

Reduced water availability

Doubling of Co2 will increase temperature by about 3C

Co2 and temperature rise has been in phase since the ice ages

Pests will enjoy higher sugar levels while plants will endure lower nitrogen levels making them weaker and more prone to attack

Will our gardens become reserves for species threatened by climate change?

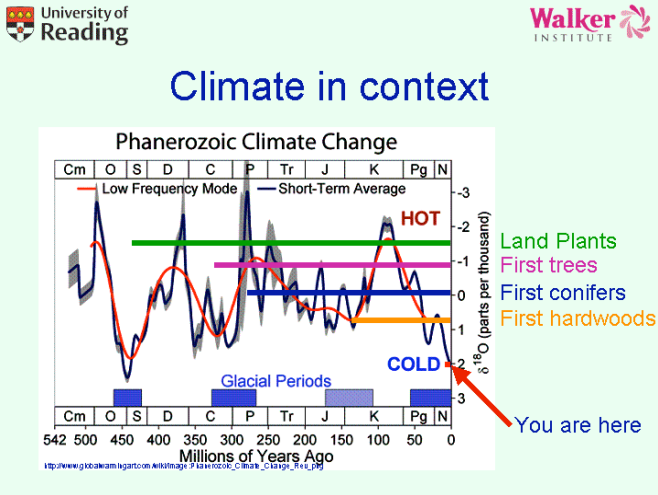
Alastair Culham, University of Reading

Collect species that won't naturally migrate (i.e. plant collecting trips, support)

Grow populations of plants to increase genetic variation

Share plants amongst others

Keep good records of provenance etc



Rare and ornamental trees: some candidates for planting

Owen Johnson, Tree Register of the British Isles

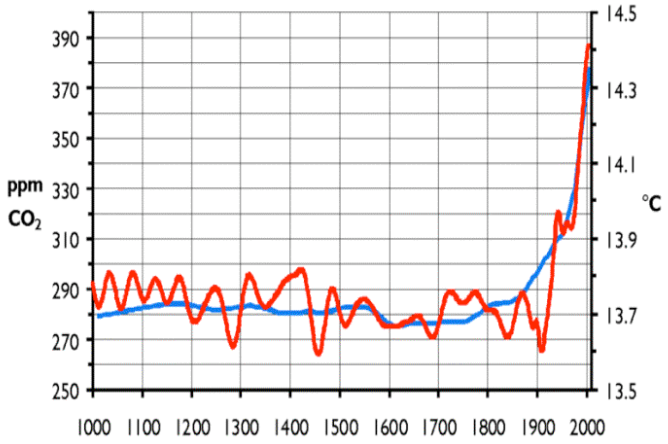
A list of semi-hardy tree species to try:

Auracaria heterophylla, Leucadendron argenta, Agathis brownii, Lagarostrobus franklinii, Euonymus tingens, Persea lingue, Aruacaria angustifolia, Melia azedarach, Albizia julibrissin, Acacia baileyana, Grevillia robusta, Eucalyptus nitens, Acacia melanoxylon, Jubaea chilensis, Brahea armata, Butia capitata, Arbutus canariensis, Quercus acuta, Quercus pentaphyla, Maytenus nitida, luma apiculata, Euonymus lucidus, Laurelia sempervirens, Weinmania trichosperma, Gevuina avellana, Polylepis australis,

Summary:

Full presentations can be viewed on the plantnetwork web site www.plantnetwork.org

Climate change is happening.
Blue line is temperature, red line C02 levels



As a garden we will have to adapt planting strategies to react to the change.
Temperatures will increase and winters will be wetter with drier summers. Continued blurring of the seasons is inevitable.
Irrigation is crucial as is good drainage and water run-off capabilities. We will have to manage where the water is directed and ultimately stored.
Good sound horticultural practices to enable plant establishment is going to be key.
Continuation of our mulching regime is paramount.
Record keeping of all events (planting, death, provenance etc) need to be robust and kept up to date.
New varieties/species need to be sourced and planted even if of dubious hardiness. As you can see from Owen Johnson's list we already grow several species capable to handle climate change.
Continued and regular checks are a must in the control of pest and diseases

Some plants could 'Escape' the confines of the garden environment. These could become invasive weeds in the future. Some examples are Acacia, Buddleia and Crocosmia. The latter already endemic but could become a problem as more seed will become viable as temperature increases. Some research work has hinted that a 3 degree rise in temperature would mean seed viability would jump from a low 20% to in excess of 90%.

Gary Long
Trewithen gardens
Sept 2008