QUESTIONS ON EFFECT OF CLIMATE CHANGE ON PLANT PROTECTION

Ahmet ULUDAG
Igdir University, Igdir, Turkey
ahuludag@yahoo.com
GLOBAL CHANGE

Large-scale alteration of the natural environment

All of the components considered here are anthropogenic in origin

Bradley et al. 2009
HUMAN POPULATION
(Size and Resource Use)

INDUSTRY

AGRICULTURE

CO₂ INCREASE

NITROGEN BIOGEOCHEMISTRY

LAND USE/LAND COVER CHANGE

GLOBAL CLIMATE CHANGE

LOSS OF BIOLOGICAL DIVERSITY

Vitousek 1994
CLIMATE CHANGE

Long-term changes in global climate
[Climate anomalies and extreme weather events]
Already over the last three decades, warming has had a discernible influence at the global scale on observed changes:

- shifts in precipitation patterns
- rising global mean sea level
- the retreat of glaciers
- decline in the extent of Arctic sea ice coverage
- river run-off
- increases in global mean ocean temperatures
- widespread melting of snow and ice sheets
- increased flood risk for urban areas and ecosystems
- ocean acidification
- extreme climatic events including heat waves

UNLESS ACTION IS TAKEN, CLIMATIC CHANGES ARE EXPECTED TO LEAD TO CONSIDERABLE ADVERSE IMPACTS
Intensive farming systems in western Europe generally have a low sensitivity to climate change, and farmers are well resourced and equipped to cope with changes. However, the agriculture sector in southern European countries may be among the most vulnerable to the direct and indirect impacts of projected climate change.

EEA, 2005
CLIMATE CHANGE MAY ALTER
HUMAN BEHAVIOR, ABIOTIC CONDITIONS, AND BIOTIC INTERACTIONS

DIRECT CONSEQUENCES

1 Δ pathways
2 Δ environmental constraints

INVASION PATHWAY

Transportation → Colonization → Establishment → Spread

EMERGENT CONSEQUENCES

3 Δ distributions
4 Δ impacts
5 Δ management effectiveness

MANAGEMENT RESPONSES

Monitor
Incorporate climate into management
Share information
Conduct research

Hellmann et al., 2008
Changes in seasonal events, flowering dates and agricultural growing seasons are observed and projected.

Phenology shifts have also increased the length of the growing season of several agricultural crops in northern latitudes over recent decades, favoring the introduction of new species that were not previously suitable.

There has been a shortening of the growing season at southern latitudes.

Such changes in the cycles of agricultural crops are projected to continue — potentially severely impacting agricultural practices.
Elevated CO$_2$  Elevated Temperature

C3

c4
Experimental studies and models suggest that invasive plants often respond unpredictably to multiple components of global change acting in concert.

Such variability adds uncertainty to existing risk assessments and other predictive tools.
“WHAT”
to understand flora and fauna changes and farming practice changes

“HOW”
could help us understanding magnitude and shape of problem

“WHY”
could give the main cause
Present CO\textsubscript{2} of ~380 µatm

Future CO\textsubscript{2} of ~700 µatm

Borrowed from Ziska
Why such a strong response?

Many noxious species reproduce vegetatively, from below-ground structures. Plants with large below-ground sinks show a strong response to CO$_2$.

Borrowed from Ziska
$\text{CO}_2$ affects herbicide efficacy in Canada thistle.

Ambient $\text{CO}_2$  

Future $\text{CO}_2$

Borrowed from Ziska
• Do we know what climate change is and how the climate will be in our region?
  • What will be the crop pattern?
  • Will cropping practices change?
  • How crop physiology will change?
  • Will introduction of alien species increase?
  • Will main pests change?
  • Will pests be more aggressive?
  • Will life cycles of pests change?
  • Will control methods change?
  • Will effectiveness of applications change?
  • What will happen with biological control agents?