Developing an Adaptation Strategy for Sustainable Agriculture

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USDA / WAOB
The Challenge: Food Security
Sustainable Agriculture

• Goals: environmental health; economic profitability; and socio-economic equity.
Sustainable Agriculture

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• Principle: meet the needs of the present without compromising the ability of future generations to meet their own needs.
The Challenge: Sustainable Management of an Ever-Changing Planet
Food production needs to double to meet the needs of an additional 3 billion people in the next 30 years.

Climate change is projected to decrease agricultural productivity in the tropics and sub-tropics for almost any amount of warming (IPCC).
Potential Climate Change Impacts

Climate Change
- Temperature
- Precipitation
- Sea Level Rise

Health Impacts
- Weather-related Mortality
- Infectious Diseases
- Air Quality-Respiratory Illnesses

Agriculture Impacts
- Crop yields
- Irrigation demands

Forest Impacts
- Change in forest composition
- Shift geographic range of forests
- Forest Health and Productivity

Water Resource Impacts
- Changes in water supply
- Water quality
- Increased competition for water

Impacts on Coastal Areas
- Erosion of beaches
- Inundate coastal lands
- Costs to defend coastal communities

Species and Natural Areas
- Shift in ecological zones
- Loss of habitat and species
Climate and Weather

Global change

Change in weather event amplitude and frequency

Blocking

Extreme Events

Tropical Storms

Droughts/Floods

Tele-connections

Change in climate event amplitude and frequency

Trends

Tropics - El Niño, La Niña

Extratropics - Jet Patterns

Climate Variability

Natural variability

Weather

Climate Change
Extreme Events (Natural Hazards)

Examples

• Hurricane
• Flood
• Tornado
• Drought
• Heat wave/Cold wave
• Winter storm (ice storm)
• Extreme temperatures
Hazard

(natural event)

Meteorological drought, flood etc.

- Severity or magnitude
  - Intensity and Duration
- Frequency—probabilities
- Spatial extent
- Trends
  - Historical
  - Future projections
- Impacts
Vulnerability
(social factors)

- Population growth
- Population shifts
- Urbanization
- Technology
- Land use practices
- Environmental degradation
- Water use trends
- Government policies
- Environment awareness
Coping Strategy

\[ \text{Risk} = \text{Hazard} \times \text{Vulnerability} \]

(natural event) \hspace{1cm} (social factors)
Agroclimatic Coping Strategy

• **Vulnerability Analyses**
  Required to identify the underlying social, economic and environmental causes of hazardous impacts.
Agroclimatic Coping Strategy

• Vulnerability Analyses

• **Impact Assessments** – Necessary to understand why a combination of environmental, economic, and social factors may produce a significant impact with a given event.
Agroclimatic Coping Strategy

• Vulnerability Analyses
• Impact Assessments

**Mitigation Planning** – Preparedness measures to improve the effectiveness of response and recovery, such as establishing early-warning systems.

• Mitigation measures to prevent or reduce the impact of a catastrophic event prior to its occurrence
Agroclimatic Coping Strategy

• Vulnerability Analyses
• Impact Assessments
• Mitigation Planning

• Adaptation Strategies – Adaptation strategies to prepare for and minimize the potential impacts of extreme events, climate variability and climate change.
Adaptation Strategies

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3. Adaptation occurs at all levels, ranging from local to national and international levels.
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2. Adaptation to short-term climate variability and extreme events are explicitly included as a step toward reducing vulnerability to longer-term climate change.
3. Adaptation occurs at all levels, ranging from local to national and international levels.
4. Equal importance is placed on both the adaptation strategy and the process needed for its implementation.
Adaptation Strategy

• Formulate a coordinated adaptation policy and measures, with the primary objective of reducing the overall vulnerability.
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• Measures are focused actions aimed at specific issues, either individual interventions or packages of related measures.
• Adaptation policy can not be effective “stand-alone” strategy, but should be incorporated into a broader socio-economic (agricultural, water resources, natural resources etc.) policy
Adaptation Strategy Priorities

• Strengthening capacities in technical and planning disciplines to understand potential climate impacts and response strategies;

• Financial resources to guide action plans from drawing boards to local implementation;

• Poorer countries that will require resources to improve capacity, undertake specific adaptation measures, and cope with impacts as they occur.
Agricultural Weather and Climate Policy

• Preparedness is the key to a proactive policy.
Two U.S. Examples

Good Example

U.S. Drought Management
Drought
Key Indicators For Monitoring Drought

- climate data (precipitation, temperature)
- soil moisture
- stream flow
- ground water
- reservoir and lake levels
- snow pack
- short, medium, and long range forecasts
- vegetation health/stress and fire danger
Why Monitor Drought?

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• Drought impacts are significant and widespread, affecting many economic sectors
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  – Transportation
  – Energy
  – Recreation and tourism
  – Environment/ecosystems
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• Impacts can be reduced or avoided through improved decision support
National Drought Policy

• POLICY STATEMENT:
  • Favor preparedness over insurance, insurance over relief, and incentives over regulation.
  • Key research priorities – potential to reduce drought impacts!
  • Key operational priorities -- coordinate, cooperate and collaborate on delivery of services (proactive and reactive).
Two U.S. Examples

Bad Example

U.S. Flood Management
Hurricane Katrina
New Orleans, LA.
New Orleans Levees

New Orleans levees broke at two sites, amid two major breaks in the levees that are supposed to protect New Orleans from flooding.
Impact of Hurricane Katrina

Gulf Coast areas brace for flooding

Forecasters warn that Hurricane Katrina could produce a storm surge of 18 to 28 feet, topped by locally generated surges. Storm surges push water toward the shore by the force of storm winds. Sources: Army Corps of Engineers.

Elevation of Gulf coast states

New Orleans is particularly vulnerable to flooding because of its low elevation and close proximity to Lake Pontchartrain and the Mississippi River.

Mississippi River

City of New Orleans

Lake Pontchartrain
Hurricane Katrina

• Katrina was the single most catastrophic natural disaster in United States history, according to the Federal Emergency Management Agency (FEMA). It devastated more than 90,000 sq. miles (233,099 km x 2), led to the displacement of 270,000 Americans, and inflicted more than $81 billion in damage.

• Over two and one-half years later, the major damage is still clearly evident.
Katrina’s Impact

• Katrina's economic impact far-reaching -- and still evolving

• Sunday, September 11, 2005: By Brad Foss, The Associated Press

*Hurricane Katrina's economic toll continues to mount -- its cost evident in near-record energy prices, snarled shipping traffic, lost jobs and wrecked businesses. But nearly two weeks after landfall, its impact is shaping up as one of extremes.*
Katrina’s Impact

• There were many losers, most notably the 400,000 who lost their jobs, many of whom became homeless.

• The storm reduced the U.S. gross domestic product by 1 percentage point in the second half of 2005 and about half that amount in 2006.
Katrina’s Impact

• Two weeks after Katrina's devastating landfall, corn, wheat and soybean farmers in the Midwest were also suffering. They were at the mercy of Gulf Coast energy and transportation bottlenecks. Grains were piling up in storage, devaluing each new bushel that is gathered, while the diesel that fuels tractors, combines and trucks skyrocketed in price.
Katrina’s Impact

• For farmers, the financial burden was immediate, albeit short-term. The American Farm Bureau said the industry took a $2 billion hit due to lost livestock, sugar cane and rice crops; a decline in exports; lower grain prices, and higher fuel and fertilizer costs.
Summary

• Developing an agricultural weather and climate policy that addresses major climate issues for policy makers and scientists would aid risk management, conservation of natural resources, and mitigation of climate variability/change.

• A win-win scenario!
"I don't care how many meteorites hit the earth, I still say it had to be global warming."

Source: http://www.english.uiuc.edu/baron/cartoons/global.htm
Any more of this Global Warming stuff and I'm moving to Arizona!

Source: http://www.thepsychicspot.com/fun_global_warming.htm
Thank You