CLIMATE CHANGE AND AGRICULTURE

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Why should farmers and ranchers care about climate change?

 Climate variability, and climate change have effects on agriculture and land use.

- Crops and grazing lands exist in an atmosphere that is increasing in concentration of CO2.
- Agricultural and forest systems are important sources of greenhouse gases and carbon sinks
- Forest and agricultural emission reductions and carbon sinks offer potentially significant low-cost opportunities to address climate change

Global Temperature Change Decade Averages





Projection US Surface Temperature





http://usda.gov/oce/climate_change/effects.htm

Changing Climate Conditions



Temperature increases: longer growing seasons, less frost, warmer nights
Precipitation changes: deficits, excesses, timing shifts, changing mix of rain/snow
Increased intensity of precipitation events: more flooding and more droughts
Increasing carbon dioxide concentrations

Effects and Sensitivity Vary by Commodity

- Corn: high nighttime temperatures, high temperatures during pollination, water stress
- Soybean: water stress, high temperatures
- Wheat and small grains: extreme events, frost during flowering, water stress



- Cotton: high temperatures during boll fill
- Pasture and rangeland: water stress
- Fruit trees: chilling requirements not met, high temperatures during fruit development
- Specialty crops: water stress, high temperatures





Increased Biotic Stresses Will Significantly Affect Agriculture

Insect pests

- Greater numbers, increased insecticide resistance
- Geographic ranges increases & decreases
- Imports from foreign sources
- Pathogens
 - Host-pathogen response changes (plants, insects, non-crop reservoirs)
 - Cultural control measures may be less reliable
 - Extreme events can spread
- Weeds
 - Increased vigor, herbicide resistance
 - Geographic range increases & decreases





Livestock Production is Vulnerable

- Feed Grain & Forage

 Quantity & <u>Quality Decrease</u>
 <u>Production Cost Increase</u>

 Animal Heat & Humidity Stress

 Reduces growth, reproduction,
 production (meat, dairy, eggs)
 Climate control costs increase
- Disease & Pests
 - Frequency, intensity, distribution
 - Abundance and/or distribution of competitors, predators, & parasites of vectors themselves



To use this chart: Simply match up the temperature on the vertical scale with the day's relative humidity on the horizontal scale.

2012 USDA Climate Change Adaptation Plan

Presents vulnerabilities and opportunities for each of the impacted agencies within the Department

Submitted to CEQ

Released for public comment.

http://usda.gov/oce/climate change/adaptation/adaptation plan.htm

US Department of Agriculture Climate Change Adaptation Plan

The US Department of Agriculture (USDA) provides leadership on food agriculture, mutrition, and related issues through its evolving service indexed The US Department of Agriculture (USDA) provides leadership on food agriculture (usda) provides leadership on food agriculture (usda) and fiber production and the evolution and thevolution and the evolution and the evolution and

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greenhouse as concentrations affects forest and agro-ecosystems af national costs. Such projections are accompanied by a great deal of uncert Jocal scales. These changes may have significant implications for USDA program policies will need to be flexible enough to adapt to this uncertainty.

USDA is well positioned to meet the requirements of the federal agency climate change USDA is well positioned to meet the requirements of the federal agency climate change adaptation for climate change adaptation planning. Two Agency Priority Goals a strong adaptation guidance. The Department's Strategic Plan for 2010.2015 provides a strong foundation for climate change adaptation planning. Two Agency Phonity Goals for largeted

¹DLAFT - Clause Change and Agriculture in the U.S. An Assessment of Effects and Potential for Adaptation Technical

Participation and costs. Such projections are accompanied by a great to be therable enough to adapt to this uncertainty.

Background

I. Introduction

Role and Mission of USDA

Building Agricultural Resilience

- Enhanced understanding of the role of natural resource base (water and soil)
- Understand Potential <u>Exposures</u>
 - Focus on extremes as well as mean changes
- Understand <u>Sensitivities</u>
 - Define critical thresholds & interactions
- Enhance <u>Adaptive Capacity</u>
 - Resilient systems: <u>Climate-ready crops & production systems</u>
- Improved treatment of uncertainty and risk in climate and adaptation decision-making and policy
 - Potential impacts are real but inherently uncertain

Within the US, in 2008: Agriculture accounted for 6.1% of total GHG emissions Carbon sequestration offset 13.5% of U.S. emissions



Source: USDA 2011. 2008 Data. (Supplemented with EPA, 2010)

Emissions from agriculture: About half of emissions are from livestock and grazing. A third are from cropland nitrogen.



Crop and grazing land soils sequester carbon to offset a portion of agricultural emissions



NOTE: Cropland soils sequestration equals the sum of mineral soils (-42.4 Tg CO2e) and organic soils (emission of 30.3 Tg CO2e) and soil liming (emission of 3.8 Tg CO2e).

From USDA, 2011, based on 2008 inventory data

Exhibit 1-1: Summary of Mitigation Options



February 2013

Climate Change Effects Vary by Region

Pacific Northwest

Reduced Snowpack Increases in extreme precipitation events Longer growing seasons Warming could adversely affect wine, apples, and other tree crops with chilling requirements

Southwest

Greater uncertainty in water supply Increased probability of heat stress to crops Fire risk Changes in plant diseases, pests, insects, and weeds Specialty crop distributions



Northern Plains

New crops possible Increased competition for water/irrigation Changed crop growth cycles resulting from warmer winters Rising temperatures /lengthen the growing season Increase in precipitation extremes

Southern Plains

Increased drought Increased temperature Possible northward shift in crop production, Wildfire Range quality Higher temperatures Reduced crop yields and milk production from heat stress Extreme precipitation events Longer growing season Coastal Flooding

Northeast

Midwest

Extreme Rainfall/Flooding Increased heat events Growing seasons have lengthened by almost two weeks since 1950 Wetter springs/fewer workable field days

Southeast

Sea-Level Rise Drought Temperature increase Spread of Nonnative Plants, Weeds, Pests Increased insects and pathogens

Sulf of Mexico

Features of a Regional Approach to Climate Adaptation and Risk Management :

- Emphasize rural communities and economies and focus on working lands production agriculture, grazing systems and forest lands;
- Support USDA programs and activities at the regional and local levels;
- Utilize the Cooperative Extension system a partnership of USDA and the land-grant university system –as well as USDA service agencies (e.g. NRCS, FSA, RD)
- Deliver knowledge, tools and information to farmers, ranchers and foresters.
- Build upon the research and development expertise of USDA through ARS, FS R&D and ERS.

A regional approach should provide....

Technical Support:

- Supplement USDA agriculture and land management program delivery
- Deliver evidence-based agriculture and land management tools and strategies for climate change response
- Support applied research and development and innovation partnerships

Assessments and Forecasts:

- Perform periodic regional assessments of risk and vulnerability
- Provide usable and easily accessible regional data and climate change
- forecast services

Outreach and Education

- Provide outreach and extension to farmers, ranchers, and forest landowners
- Educate natural and agriculture resource managers climate change science and the vulnerability to agro-ecosystems and forests

Groups we are interested in engaging....

- Land Grant Universities and Agricultural Extension Services
- Private Sector (companies addressing climate change adaptation and mitigation, and developing innovative tools and solutions for risk management, crop consultants, insurance companies, seed companies)
- State, local, and regional governments and agencies with natural resource and agriculture responsibilities
- NOAA and DOI regional climate change experts/institutions
- Non-profit sector (conservation groups, foundations, and others that provide assistance to landowners in addressing land management issues.)
- Allied efforts in Canada and Mexico