Agricultural Adaptation to Climate Change in Yolo County, California

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Introduction

In California, the Global Warming Solutions Act (AB32) has been the impetus for major new efforts within the government and agriculture sectors to assess impacts, mitigate GHG emissions, and adapt production strategies. Successful mitigation and adaptation at the regional and local scales will depend on effective exchange of ideas, tools, and data between scientists, policy makers, industry leaders, and rural stakeholders. Here we present four case studies set in Yolo County, CA which describe ongoing research activities on agricultural greenhouse gas (GHG) mitigation and adaptation that cut across scales and involve participation from a range of agencies and stakeholders.

Landscape Hydrology

Planning for an Uncertain Climate Using the WEAP Model

Collaborative research with managers of the Yolo County Flood Control and Water Conservation District and the Stockholm Environment Institute (SEI) is focused on the development of a water evaluation and planning (WEAP) model for the Cache Creek watershed (Mehta et al., in prep.).

Figure 2. Map of Cache Creek watershed in the Yolo County Flood Control and Water Management District (Mehta et al., in prep.).

Farmland Production Practices

Linking Data to Stewardship Index for Specialty Crops

Various groups in the agricultural sector are working on the concept of a stewardship index for specialty crops to better inform consumers about products. It will be important to include climate change mitigation and responses.

Figure 1. Diagram mapping the hypothetical flow of sustainability information and feedback between tomato growers, processors, scientists, non-profit partners and consumers.

Example: Alternative Water Management in Tomatoes

Field research on tomatoes is examining how conventional furrow irrigation (i.e. all furrows irrigated) and alternate furrow irrigation (i.e. every other furrow irrigated) affect yield, water use, and N2O emissions (Barrios-Masias et al., in prep.).

Figure 3. Diagram illustrating the WEAP-model delineation, calibration, scenario analysis, and management applications.

Yolo County GHG Inventory

Scientists, growers, and other rural stakeholders are working with local officials to carry an inventory of Yolo County’s GHG emissions as part of a county-wide climate action plan that considers the role of agriculture in GHG mitigation and climate change adaptation. Inventory methods developed by the International Panel on Climate Change (IPCC) and the California Air Resources Board (CARB) were adapted to county-level data to estimate changes in agricultural emissions of CO2, N2O and CH4 between 1990 (AB32 base year) and 2008 (Haden et al., in prep.).

Table 2. Inventory of agricultural GHG emissions for Yolo County in 1990 and 2008 (Haden et al., in prep.). The mass of greenhouse gases (CO2, N2O and CH4) are expressed in kiloton of carbon dioxide equivalents (kt CO2-e).

Local Agricultural GHG Emissions

Yolo County GHG Inventory

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机遇和挑战为GHG减排提供有利条件（Jackson等，2009）。

• 降低N肥化率和提高N的利用效率
  • 传统化可能减少N2O的排放
  • 植物的绿体和根部的N2O的排放

挑战 - 反效应和地下水的耕地

• 提高灌溉效率（i.e., biogas production）
  • 有效工程师对生产者（i.e., biogas production）
  • 有些作物不适应某些竞争

Conclusions

Outcomes of this collaborative research include:

• Shared-learning about climate change risks and adaptation among various stakeholders and sectors.
• Development of locally-adapted planning tools:
  • (i.e. WEAP model, GHG Inventory)
  • Market and government-based incentives for improving crop and water management, mitigating GHG emissions, and restoring riparian forests.
• Improved mitigation and adaptive capacity at the local level

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Jackson等（2009）扩大了对适应气候变化对农业生产领域的研究。

• 降低N肥化率和提高N的利用效率

Smukler等（2010）在实现了对农业的可持续性和生物多样性职能的有机农场研究。


Figure 4. Carbon (kg ha⁻¹) as a function of farming practice. (Adapted from Smukler et al., 2010)

Farmscaping for C Sequestration

On-farm research measuring carbon stocks, agro biodiversity, and nutrient losses to the environment in fields, hedgerows, and riparian corridors assessed ecosystem services provided by various farmscaping practices (Young et al., 2010). County government officials, who are developing a climate action plan, are using the results to evaluate the opportunities to sequester carbon and offset GHG emissions.

Restoring Hedgerows and Riparian Zones

Farmscaping for Biodiversity and Resilience

Riparian corridors and hedgerows can also improve biodiversity, provide habitat for beneficial insects, reduce runoff, and improve water quality. Thus, farmscaping may also enhance ecosystem stability and resilience to climate change. Partners in the non-profit sector (e.g. Audubon Society) and various government agencies (e.g. Yolo Resource Conservation District) are helping promote incentives for growers and ranchers to plant hedgerows and restore riparian zones.

Figure 5. Soil and plant carbon stocks as a function of farmscaping practice. (Adapted from Smukler et al., 2010)

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