AGRICULTURE SECTOR REPORT

Session Chairs: Jeff Andresen and H. H. Cheng
Rapporteur: Colleen Garritty

INTRODUCTION

The Agriculture breakout group included participants from academia, state and federal government, and agribusiness. The results of discussions, centered around the U.S. Global Change Research Program Level 1 assessment framework, are summarized below. The group considered the dependence of regional agriculture on climate and the potential impacts caused by climate change, assuming a warmer climate than that currently, and with both increasing and decreasing levels of precipitation and degrees of climatological variability. In general, the potential impacts of a changing climate on agricultural activities in the region are viewed as potentially serious in the long term (i.e. decadal time scale), but at least partially manageable through technological adaptations, and, in general, of lesser importance than the economic and regulatory pressures, which the sector currently faces.

The discussion group was expected to interpret the four questions broadly in an effort to reduce the chance that significant issues would be overlooked. Because this was an initial effort, failing to include potentially critical issues was considered a greater mistake than including issues that, upon further study, turn out to be relatively unimportant. The participants were not asked to make quantitative assessments of the impacts that they discussed.

THE 4 QUESTIONS ADDRESSED

1. What are the current concerns?

Of the many concerns identified by the working group, first and foremost was the problem of economic viability, based heavily on issues such as low commodity prices, high input prices, and domestic/ international competition. Major concerns were categorized as economic, environmental, regulatory, and societal, which are listed below. Specific climatological concerns were considered separately.

Economic Concerns

The most important economic concerns that were identified included:

- ***Low commodity prices and high price volatility.*** In recent times, prices for many commodities have been near or below the costs of production. In addition, commodity price swings and market volatility have made it difficult for producers to market their products and to plan for the future. For some crops, the profit that a producer may make one year has to last five more years before there is another profitable year.

- ***Difficulty of producers obtaining finance capital.*** Without finance, in the form of loans, there is no way to physically produce the product in a capital-intensive production system such as ours.

- ***Domestic/international competition.*** Products from other regions in the U.S. and from other countries are sold in the region at a lower price, which reflects an abundance of cheaper labor and overall lower production costs than are possible in the U.S.

- ***High farm labor costs/labor availability.*** In labor-intensive production, such as that for fruits and vegetables, producers face prohibitively high labor costs and a short supply of labor.

- ***Loss of industry infrastructure.*** The loss of infrastructure is especially true for the production of specialized agricultural crops. If there are no processing facilities and other necessary infrastructure for a product in a region, then the cost of production increases by an amount proportional to the distance to the nearest processing plant.

- ***Economics of scale and corporate farming.*** There has been a significant loss of small and medium size farming operations because large corporate farms are able to produce at a lower cost than are small-to-medium-sized producers. Those with higher costs of production are often squeezed out of the market.

Environmental Concerns

The most important environmental factors that were identified included:

- ***Soil degradation, erosion.*** After being in production for decades, soils are often degraded by water and wind erosion, necessitating more fertilizers to retain their productive capacity and reducing the value of the soil for agriculture.

- ***Livestock waste management.*** As livestock production becomes more geographically concentrated, waste management concerns grow. Ecosystems usually are not capable of accommodating the large amounts of livestock waste that are produced in feedlots or confinement operations. The application of a large amount of waste to a small area can lead to surface and groundwater contamination.

- ***Insect, disease, and weed pressure.*** Pests and plant diseases threaten the health of crops in the field, while weeds compete with crops for soil nutrients, sunlight, and water resources. Often, insects, disease, and weeds are controlled by applications of pesticides and herbicides.

- ***Pesticides and fertilizers use.*** Application of pesticides and fertilizers is often the most economical way to deal with pest pressures and increase crop production. These pesticides and fertilizers, when lost due to runoff or when leached out of the soil, can contaminate surface and groundwater resources and threaten human and ecosystem health.

Regulatory Concerns

The most important regulatory concerns that were identified included:

- ***Federal and state regulations***. These regulations change the standards and alter the economics of the production system (e.g. Food Quality Protection Act). For example, a pesticide banned for regulatory reasons may be a grower's only line of defense against a pest. When new pesticides (or other control methodologies) are not immediately available, the crops cannot be grown economically or to the standards expected by consumers.

Societal Concerns

- ***Land-use change.*** Loss of farmland, increasing land values, property taxes due to population shifts to rural areas, home construction, and suburban sprawl. This reduces the viability of agricultural practices in a region, both directly by purchasing tillable acreage for housing and indirectly by driving up property values so that farmers can no longer afford property tax payments.

- ***Increasing median age of farmers.*** Fewer young people are entering into the business of family-owned farming. The increasing median age of farmers raises concerns about the future of food production in the U.S. as well as the value of farming as part of our national heritage.

- ***Sustainability/Balance.*** One major concern, which integrates a number of the categories, is the balance between economic viability, environmental constraints, and government regulation. This balance determines the long term sustainability of the system.

Finally, the group considered the specific climatological concerns associated with agriculture in the region.

Climatological Concerns

The most important climatological concerns that were identified included:

- ***Precipitation extremes (drought, flooding).*** Water, much of it in the form of naturally occurring precipitation, is the most important single climatological variable that determines a region's agricultural production. Crops cannot achieve their potential when they are under stress from too little or too much water.

- ***Temperature extremes***. Agricultural productivity potential can be reduced dramatically by the occurrence of just one extreme temperature event.

- ***Insufficient growing season length.*** Short growing seasons limit the amount of time that crops can produce biomass, thereby reducing potential crop yields. An anomalously cold summer coupled with a late spring and/or an early fall can have a disastrous effect on regional agriculture.

- ***Frequency of severe storms.*** Severe storms with damaging winds and hail can cause major crop catastrophes. More frequent occurrences of these storms render agricultural operations even riskier.

- ***Excessive cloudiness.*** Many plants are most productive at high levels of sunlight. As cloudiness increases, the potential rate of photosynthesis and the productivity of the crop also generally decrease.

- ***Changes in variability of all of the above.*** Increased variability of climatic parameters significantly increases production risks to farmers. Agricultural technology can generally adapt to shifts in the means of climatological elements, but not nearly as well to increases in variability of the elements (e.g. late spring freezes, growing season droughts).

2. How may climate change impact our lives?

Weather and climate remain among the most important uncontrollable variables involved in agricultural production systems. Future stresses will likely be largely dependent on the nature of climatic trends, especially with respect to variability. The group discussed some recent climate trends for the region and considered their recent effects on agriculture.

Climatologically, the most significant observed trend in the Great Lakes region during the past century is an increase in precipitation, especially during the summer and fall months (Boden et al., 1994). This increase is associated with significant increases in the number of wet days, multiple wet day events, and a general increase in cloudiness.

Mean temperatures in the region have also changed, increasing somewhat during the past 20 years, but increases remain within the observed variations of the past century.

Assuming a warmer and wetter climate, some potential direct and indirect impacts discussed by the group are as follows:

Direct impacts

- ***Carbon dioxide enrichment.*** For crops that benefit from carbon dioxide enrichment, the increasing atmospheric concentrations of carbon dioxide will lead to an increase in biomass accumulation and in water use efficiency, ultimately leading to higher yields and potential productivity.

- ***Soil limitations.*** Expansion of agricultural activities northward with a warming climate will be limited by soils that are unsuitable for agriculture.

- ***Water regulation.*** If evapotranspiration rates increase significantly in a warmer climate, then the Great Lakes could become a major source of irrigation water, which would also likely necessitate regulations dealing with water rights and usage.

- ***Climate variability.*** If future changes in climate are characterized by gradual changes in the means, then there is a good chance that changes in agricultural technology could keep pace. However, if the changes are accompanied by increases in variability such as the frequency of extreme events, then it would likely be much more difficult to adapt to the impacts.

Indirect Impacts

- ***Dairy***. Expected changes could lead to less production per cow because of a longer season for forage production, lower forage nutrient quality, greater potential for herd sickness/disease, more pest pressure for forages, and significant economic investment for modification or reconstruction of dairy barns (necessitated by a changing warm season climate).

- ***Field crops.*** With a longer frost free growing season, potential crop productivity should in general be higher. There will also likely be greater pest/weed/disease pressure, some possibly caused by organisms that are not currently problems in the region. Combined, these trends suggest an overall increase in potential productivity for most crops, with reductions in water stress playing a major role.

3. What additional information do we need?

This group discussed a wide range of information needs, from better climate models, to more collaborative research, to improved farming practices. Some of the highest priority needs included:

- ***Improved General Circulation Models.*** Given the current problems with General Circulation Model (GCM) performance at the regional level, The Upper Great Lakes region could experience changes that differ significantly from GCM predictions. The need to improve GCM climate modeling capabilities, especially at the regional level, is a high priority. Because of their importance in describing the present day climate, the Great Lakes need to be included in the models (i.e. parameterized as large bodies of water).

- ***Improved agricultural production models.*** Characterization and realistic simulation of agricultural production systems, from the production level to the market level, are needed. These activities would help facilitate research on farm/agricultural management in the context of climate change and help identify technological/management options for the producer (e.g. diversification, new crops).

- ***More collaborative research***. Trans-disciplinary research is needed to investigate production practices and policies that are ecologically sensible/congruent with environmental goals (e.g. "agro-eco-region management"). This type of research may also help determine the potential impacts of environmental and/or other regulations before they are implemented.

- ***More education***. Exchange of information about climate change should take place between different agricultural sectors. Many people in the industry do not even believe that climate change is a real possibility.

- ***Improved farming techniques.*** Research in no-till farming practices, aimed at carbon sequestration, is needed.

- ***Maintaining the cooperative observer network.*** Agriculture, as an economic pillar of the American landscape, is dependent on weather events and requires a significant commitment by the government to maintain and enhance weather- and climate-monitoring capabilities.Serious concerns were expressed about the degradation of the nation's Cooperative Climatological Network, which is an integral part of the monitoring and understanding of long term climate change. Environmental monitoring of other climate related variables is also essential.

4. How do we cope with climate change?

The ability to adapt to any future changes in climate will strongly depend on the nature of the change. Should future changes in climate be characterized by gradual shifts of the means, there is the likelihood that changes in agricultural technology could keep pace. However, changes such as increases in variability pose many potential problems for agriculture. Among the possible adaptations that were discussed are:

- ***Diversification.*** The ability for any one farmer to grow a variety of crops will be beneficial for sustaining farmers through dry/wet/ hot years.

- ***Increasing use of irrigation.*** A warmer growing season combined with irrigation would increase potential productivity.

- ***New policies.*** Government policy could help facilitate adaptation to climate change. Producers will need assistance as climate changes occur, and tax policy and incentives for crop insurance may need to be implemented to get farmers through difficult years and to ensure continuity of the industry. The government could also underwrite the higher risks involved in climate change by subsidizing crop insurance.

- ***Flexible infrastructure.*** An agricultural infrastructure flexible enough to adapt to shifting crop regions would facilitate coping with climate change.

- ***Education.*** Education is vital for understanding the effects of climate change on agriculture and for solving current and future problems in our food production systems. The Cooperative Extension Service can and must play an integral role in this effort.

- ***Reduce tillage.*** Depending on the type of tillage practice, organic matter in the soil may become either a source of carbon dioxide or a sink. Increased use of reduced tillage systems across this region could provide the potential for significant carbon sequestration as well as the benefits of improved tilth, soil fertility, and water holding capacity.