O ur efforts to mitigate the ef-  
fects of climate change, ur-  
gent as they are, will have  
little effect over the next 50 years.  
Changes during this period have  
already been set in motion by past  
greenhouse gas emissions.

Global warming - impact of climate change on  
global agriculture  
by Eugene Takle, Professor of Atmospheric Science and Professor of Agricultural  
Meteorology, 515-294-9871, gstakle@iastate.edu and Don Hofstrands, value-added  
agriculture specialist, co-director AgMRC, Iowa State University Extension, 641-  
423-0844, dhof@iastate.edu

Handbook updates  
For those of you subscribing  
to the handbook, the following  
updates are included.  
Replacement Strategies for  
Farm Machinery – A3-30  
(7 pages)  
Lease Supplement for Investing  
in Improvements on a Rented  
Farm – C2-07 (3 pages)  
Lease Supplement for Obtain-  
ing Conservation Practices  
and Controlling Soil Loss –  
C2-08 (3 pages)  
Table of Contents - Financial  
– C3-00 (1 page) Note: Files  
have been removed.

Limiting greenhouse gas emissions  
will only affect climate change in  
the long-term (beyond 50 years).  
So we must learn to adapt to the  
changes in climate that will occur  
over the next 50 years.

In the previous article we listed  
several estimated changes we  
may expect to see in the Midwest  
and possible impacts on Midwest  
agriculture. In this article we will  
examine the rest of the world. We  
will identify expected changes in  
major agricultural regions around  
the world.

Suitability for rainfed agriculture  
It takes large amounts of water to  
produce grain. But suitable soil  
and terrain also are necessary for  
successful agricultural production.  
Let’s take a look at regions of the  
world that have a “high suitabil-  
ity for rainfed agriculture”. This  
suitability factor depends on the  
amount of precipitation, the avail-  
ability of soils suitable for agricul-  
ture, and terrain that allows for  
agricultural production.

An index of the suitability for  
rainfed agriculture is shown on the  
world map in Figure 1. The circled  
areas show a high suitability index.

From this we can see the regions  
of the world that are highly suit-  
able for rainfed agriculture. They  
include the U.S. Midwest and Great  
Plains, Europe and European Rus-  
sia, India, Southeast Asia, southern  
and eastern Brazil including the  
Pampas of Argentina, sub-saharan  
Africa, and the rim of Australia.  
These are the traditional agricultural  
producing regions of the world that  
have allowed human population to  
flourish and grow.

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Inside . . .

Average Crop Revenue Election  
(ACRE) .......................Page 4  
Agricultural Outlook & Manage-  
ment Seminar Series ....Page 5

Ag Decision Maker is compiled by:  
Don Hofstrand, dhof@iastate.edu  
Extension Value-added Specialist and  
Co-director of the Agricultural Marketing Resource Center
The population density of various parts of the world is shown in Figure 2. In many instances, areas suitable for rainfed agriculture match the areas of high population density. This includes Europe, Eastern U.S., India, China, and Southeast Asia. Other regions, such as southern Mexico, the Middle East, parts of China, and regions bordering the Nile River, have high populations but low suitability for rainfed agriculture and therefore must rely on either irrigation or food imports. Changes in the suitability index for rainfed agriculture due to climate change can affect the ability of large areas of the world to feed themselves.

Projected precipitation changes
The latest International Panel on Climate Change (IPCC) report outlines potential changes in rainfall patterns over the 21st century. Although this represents the best available science, there still are uncertainties about the projections. However, considerable research currently is focused on this issue. So, more reliable estimates will be forthcoming.

By looking at the projected changes in precipitation due to climate change over the next hundred years (Figure 3), we see there will be winners and losers. The dark shaded areas show increased changes (either increase or decrease) in precipitation.

Since soils and terrain will not change, changes in the suitability index for rainfed agriculture depend on changes in rainfall during the growing season. The suitability index will increase in some areas and decrease in others. A decrease in precipitation will usually result in a decline in the suitability index. However, an increase in precipitation may or may not improve the suitability index. If the precipitation increase leads to more flooding or water-logging of soils, the suitability index will decline. Also, changes in precipitation will increase a region’s suitability index only if it has suitable soils and terrain.

To help us focus on the areas with suitable soils and terrain, we have pointed out these areas in Figures 3 and 4. Areas with increased rainfall are marked with a square around them. Areas with decreased rainfall are circled.

The IPCC has not evaluated how the suitability index will change due to climate change rainfall projections. Discussions are underway to launch such an effort. However, we can at least make a simplistic estimate of the future of global agricultural production based on projected changes in precipitation.

Of the seven major regions with a high or moderate suitability index (Figure 1), we can see that:

1) The central U.S. will likely experience a modest decrease, particularly in the Great Plains,
2) Mexico and Central America will likely experience a significant decrease. This decline in precipitation

continued on page 3
is a feature of all global climate models. Because of the magnitude of this impact on our neighbors to the south, our U.S. national policy makers should monitor climate change over this region through the coming years.

3) Brazil, Uruguay, and Argentina might see an increase in rainfall that likely will be beneficial,
4) Southern and eastern Europe likely will see a substantial decrease,
5) Central Africa likely will see an increase and southern Africa a decrease,
6) India probably will experience an increase.
7) China and East Asia will probably experience an increase. However, the likelihood of extreme increases in precipitation in these areas may be detrimental to agricultural production.
8) Australia is projected to see an increase in the east and a decrease in the west. Regions with a long history of cereal production, such as Australia, are already facing new challenges (Reuters, 2008). Six continuous years of drought have reduced Australia's rice crop by 98 percent and has shut down processing plants (Bradsher, 2008).

Climate change also will lead to an increase in temperature that will affect agricultural production. However, it is difficult to evaluate whether temperature increases due to climate change will allow new regions such as northern Russia and Canada to expand production.

**Adapt by using irrigation**

Can we adapt to reduced rainfall by irrigating? Although irrigation can provide a short-term solution (a few decades), it does not provide a permanent or sustainable solution. A colleague made the observation that, of all former civilizations that depended on irrigated agriculture for their food supply, none have survived. In the modern world we see numerous regions with widespread irrigation facing challenges relating to water supply (e.g., aquifer depletion, competing uses for reservoir water) or salinization of land under long-term irrigation.

A recent example is Saudi Arabia (Elhadj, 2008), which, having an annual rainfall of only 3-4 inches, discovered in the early 1980s what was thought to be substantial groundwater reserves. By 1992 they were irrigating about 2.5 million acres and producing 4.1 million tons of wheat. But by 2000, the average cost of raising wheat in Saudi Arabia rose to $500 per ton – four times what it cost to buy it on the world market. On January 8, 2008, the Saudi government abandoned its food independence strategy and decided instead to import the country's entire wheat needs by 2016.

So, in the long-term, we will depend on rainfed agriculture. This means we must adapt our agricultural systems to the changes that a changing climate has in store for us.

*continued on page 4*
Implications
We emphasize that, although the research summarized by the latest IPCC report represents the best available science, there are still uncertainties in the projections summarized here. However, climate change will have a significant impact on world agriculture regardless of the specific implications for various growing regions.

Because of the global nature of agricultural markets, agricultural trade patterns may shift. US producers must address both the impact of climate change on their own operations and respond to market signals created by the impact of climate change on agricultural production around the world.

These projected changes in rainfall patterns and the resulting changes in the suitability index for rainfed agriculture provide us with a tool for anticipating the impact of climate change on various agricultural regions of the world. By focusing our attention on the regions of the world where climate change will negatively affect agricultural production, we can develop strategies for adapting to these changes that will help reduce the negative impact on food production in the coming decades.

These strategies must focus on agricultural research and development, including investment in new technologies that can reduce the impact of climate change. Although countries must make these investments individually, a need will arise for a worldwide collaboration to address these issues on a global basis.

References


Average Crop Revenue Election (ACRE)
by William Edwards, extension economist, 515-294-6161, wedwards@iastate.edu

Under the new Food, Conservation, and Energy Act of 2008 producers of USDA program crops such as soybeans, wheat, and corn have the option to enroll in a new counter-cyclical revenue plan. The program is called Average Crop Revenue Election, or ACRE for short. It is being offered as an alternative to the counter-cyclical payment option under the 2003 farm bill, but is based on gross revenue (commodity price times yield) instead of price only.

ACRE uses a combination of state average yields, farm level yields, and the national marketing year price to determine levels of revenue guarantees and payments for each covered commodity. There are two revenue triggers that have to be met before any ACRE payments are generated, one at the state level and one at the farm level. To trigger a payment under ACRE the “actual” revenue for both the state and the farm must be less than their corresponding guarantees. The actual revenues...
are the current marketing year price multiplied by the state average yield and the actual farm level yield, respectively. If both triggers are reached, the payment to the farm will be the difference between the state guarantee and the state actual revenue.

Producers who sign up for ACRE will forfeit 20 percent of their current direct payments through 2012. They also will give up any potential price counter-cyclical payments, and the loan rate used to calculate their loan deficiency payments or marketing loans will be lowered by 30 percent. The loss of potential CCPs and LDPs may not be too critical, because if market prices fall enough to trigger those payments it is likely that the ACRE payment will be at least as large.

Although the ACRE program may resemble crop revenue insurance, there are some important differences. The ACRE guarantees are based on longer term average prices and yields, so they will not fluctuate as much from year to year as crop insurance guarantees. In fact, ACRE regulations state that the guarantees cannot increase nor decrease more than 10 percent each year. This helps accomplish the fundamental goal of ACRE, which is to stabilize gross revenues over the next 4 years.

On the other hand, one of the two ACRE guarantees and the size of the payment are based on state level yields, not farm yields like most crop insurance policies. ACRE does not protect a farmer who has a poor production year when the state as a whole does not. In addition, ACRE revenue uses the marketing year cash price to calculate actual revenue while crop revenue insurance uses futures prices at harvest time. So, while ACRE payments can be a useful risk management tool for sharply falling prices or widespread yield losses, they do not replace farm level crop insurance protection.

More information is available in Information File A1-45, Average Crop Revenue Election (ACRE). A Decision Tool is also available on Ag Decision Maker to help estimate ACRE payments.

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Agricultural outlook & management seminar series
by Ann M. Johanns, extension program specialist, 641-732-5574, aholste@iastate.edu

Iowa State University Extension is offering Agricultural Outlook and Management seminars throughout November 2008 to address outlook and management issues.

These seminars are designed to provide agribusiness leaders with a concise evaluation of current market conditions, expected trends in crop and livestock income potential, and management implications. Participants also will receive an overview of the agricultural industry and learn how changes may affect Iowa producers.

Meeting registration begins at 8:30 a.m. for each location with the program beginning at 9:00 a.m. Most locations will conclude at approximately 3:00 p.m., though some sites may go longer.

The registration fee is $35.00 for most locations (Amana is $45.00). Registration includes lunch, refreshments, and materials at all locations. Pre-registration is required one week prior to the seminar.

Locations

- **November 12**: Fort Dodge
  - Best Western Starlight Village

- **November 13**: Waterloo
  - Hawkeye Community College - Tama Hall

- **November 14**: West Des Moines
  - DMACC West Campus

- **November 17**: Amana
  - Holiday Inn - I-80, Exit 225

- **November 19**: Cherokee
  - Western Iowa Tech Community College

- **November 21**: Atlantic
  - Cass County Community Building

continued on page 6
Updates, continued from page 1

Energy Measurements and Conversions – C6-86 (2 pages)
Please add these files to your handbook and remove the out-of-date material.

Internet Updates
The following updates have been added to www.extension.iastate.edu/agdm.

Average Crop Revenue Election (ACRE) – A1-45 (3 pages)
Location, Location, Location—Value-added Processing/Manufacturing – C5-113 (2 pages)
Liquid Fuel Measurements and Conversions – C6-87 (4 pages)
Biomass Measurements and Conversions – C6-88 (1 page)
Natural Gas and Coal Measurements and Conversions – C6-89 (2 pages)

Current Profitability
The following profitability tools have been updated on www.extension.iastate.edu/agdm to reflect current price data.

Corn Profitability – A1-85
Soybean Profitability – A1-86
Ethanol Profitability – D1-10