LAND MANAGEMENT

FARMING IN A CHANGING CLIMATE

The importance of farming in Maryland

Agriculture is the largest commercial industry in Maryland, employing about 350,000 people, on almost 13,000 farms covering two million acres.

What is changing?

Over the past century, both minimum and maximum temperatures have been increasing. In the future, Maryland should expect higher temperatures, more intense precipitation in the fall and winter, and an increase in short-term droughts in the summer. The two most active farming regions in Maryland are also two of the most vulnerable to the impacts of climate change. The eastern shore is vulnerable to sea level rise, drought, and flooding and the north central region to increased precipitation variability, including flooding and drought. Because of this:

- Water management will become a larger concern.
- Rising temperatures, carbon dioxide, and ozone will increase stress on nearly all crop and livestock species.
- Pests and diseases, such as soybean rust will likely plague farmers in the future.

Who should be concerned?

As the climate changes, farmers, the farm credit industry, and regulators of agricultural management practices will likely face a large and growing degree of uncertainty. These changes occur in the current context of high economic uncertainty and small profit margins and are likely to result in increased costs to both farmers and consumers.

Poultry in Peril

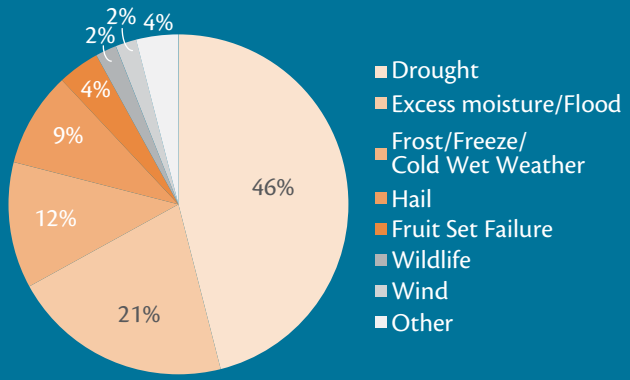
Poultry is the number one agriculture industry in the state and eighth in the nation, bringing in $640 million in 2009. While warming temperatures will require less heat in the winter, the need for better cooling systems is increasing, with record temperatures seen in the summers of 2010 and 2011. Increased temperatures reduce growth rates, increase mortality, and potentially increase the prevalence of *Salmonella*. More intense storms and sea level rise place poultry houses at risk of flooding. In September 1999, Hurricane Floyd flooded the Butler farm on the Pocomoke River, resulting in the loss of 25,000 chickens. Indirect impacts on poultry farmers may arise from changes in food supply. Warmer night temperatures, higher maximum temperatures, and a likely increase in fungal prevalence may impact poultry feed in the state, reducing profit margins.

Credit: Flickr (hmc_fabulous)

Poultry farms will feel the impacts of climate change.

Extreme Events

In 2011, the Maryland Department of Agriculture received federal disaster assistance for droughts, extreme heat, and hurricanes/tropical storms which led to market losses of at least 30 percent in some parts of the state. Nearly all counties were eligible for consideration. This assistance includes USDA Farm Service Agency emergency loans and the Supplemental Revenue Assistance Payments Program. Extreme events are expected to become more prevalent and appropriate measures will need to be in place to reduce these risks.



Drought, flooding, and extreme weather are some of the main causes of failed crops and all of these issues are associated with climate change. Data: 1981–2009, crop insurance claim reasons, University of Maryland Extension Service.

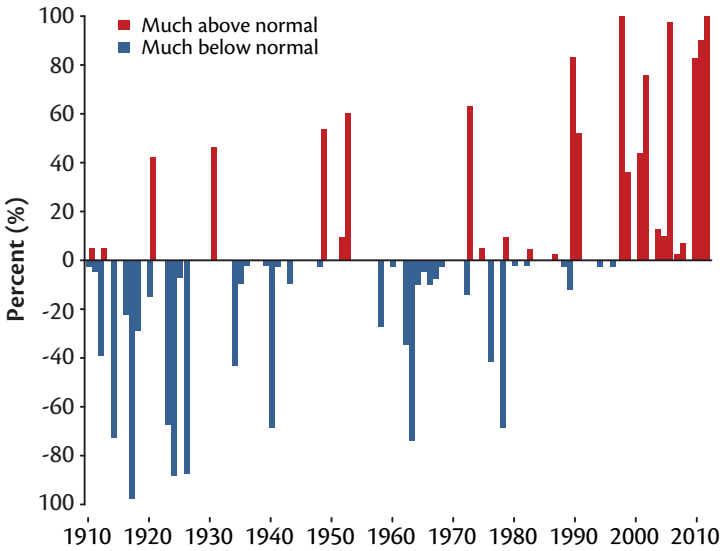
IMPENDING RISKS TO FARMING

Increased temperature and precipitation variability may translate into increased production costs. For example, increased energy usage for animal cooling, additional water usage for irrigation, and the need for more frequent pest treatments, will add to the total cost of farm operation. Loss of viable farmland to sea level rise and an increase in crop damage due to intense storms will also have a negative impact on a farm's bottom line.

Warmer winters and increasing salinity from sea level rise may also threaten the health of oyster beds in the Bay and increase the presence of *Vibrio*, a foodborne pathogen. This threatens the state's burgeoning aquaculture industry. However, oyster beds are capable of withstanding large environmental changes and buffering climate impacts, which stresses the importance of managing this species for a changing climate.

A longer growing season and higher carbon dioxide levels may initially benefit some crops, however, temperature increases, increased frequency of drought, and increased ozone may negate this effect. When optimal temperatures are exceeded for crops, their life cycles are shortened, which can significantly reduce their viability and yield.

Weed species may out-compete crops with higher carbon dioxide levels and wetter winters may promote the growth of plant disease, such as the fungus that causes wheat scab.



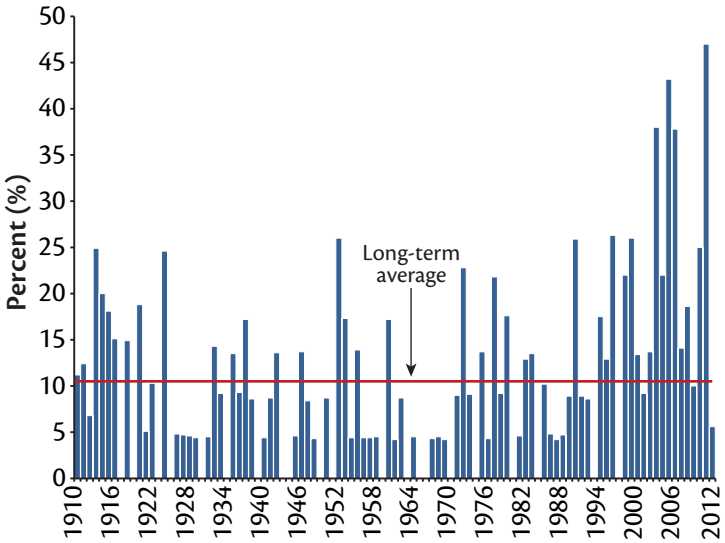
Minimum temperatures in the Northeast United States are rising, particularly in the last decade. Data: National Climatic Data Center.

Both drought and flooding conditions have negative effects on agriculture, resulting in production losses and requiring increased irrigation. Although farmers are accustomed to adapting to both dry and wet years, the variability and extremes associated with climate change are more difficult to predict. Delays in harvest and cover crop planting, like those that occurred in September of 2011 due to heavy rains, are likely to become more common.

Winter wheat is used as a cover crop to reduce erosion and nutrient runoff during winter storms. Credit: Jane Thomas.

Drought conditions reduce crop yields and dry pasture grasses where grazing animals feed. In certain areas, increased winter precipitation may cause fields to flood and delay spring planting. This may hamper a farmers' ability to produce and competitively market early-season, high-value crops such as melons, sweet corn, and tomatoes.

In areas such as the lower eastern shore, where water drainage ditches are used to manage standing water from current average storms, the insufficiency of this drainage infrastructure to manage future high water flows will make it more difficult for an individual farmer to manage soil moisture. More intense fall and winter storms will also impact storage capacity of waste lagoons and may increase overflows into nearby waterways.



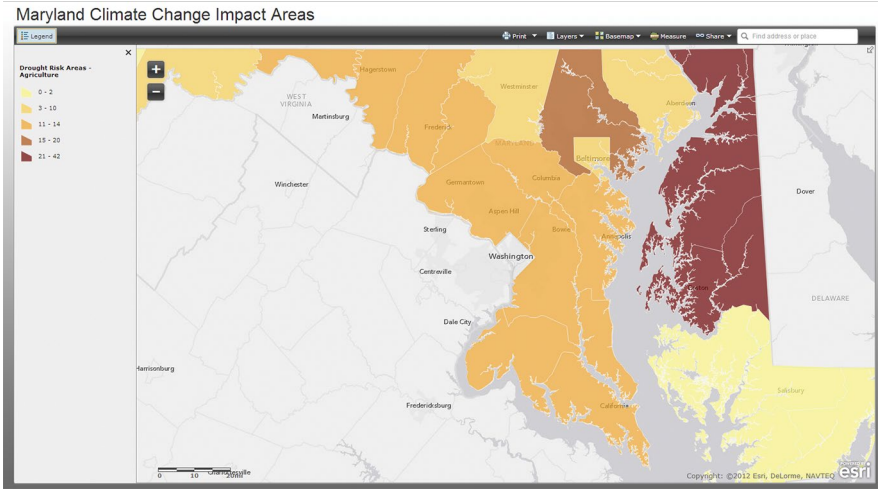
Average daily precipitation is increasing in the Northeast United States. This graph shows the percentage of the United States with a much greater than normal proportion of precipitation derived from extreme (equivalent to the highest tenth percentile) 1-day precipitation events. Data: National Climatic Data Center.

WE MUST TAKE ACTION NOW TO PREPARE FOR THE IMPACTS OF A CHANGING CLIMATE

Adaptation Toolbox: Climate Change Impact Area Mapper

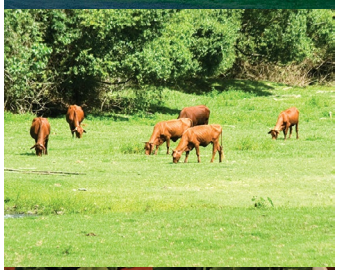
The Climate Change Impact Area Mapper is an online tool provided by the Maryland Department of Natural Resources for management decision-making, planning, and education purposes. The Climate Change Impact Area Mapper brings together multiple data layers from different sources to illustrate land areas in Maryland that are projected to be the most sensitive to anticipated changes in climate. The layers include areas vulnerable to sea level rise, storm surge, flooding, drought, and rising temperatures.

http://bit.ly/UIX4Hw



The Climate Change Impact Mapper includes several different layers related to agriculture, such as drought risk (low risk–light yellow; high risk–red).

Adaptation strategies:

	Product (ranked by 2007 market value, USDA Census)	Climate impact	Adaptation strategy
	Poultry	Increased cooling costs; decreased production; changing disease presence	Improve energy efficiency of housing; bioenergy use; improve ability to monitor disease and quarantine
	Grains, oilseeds, dry beans, peas	Increased irrigation use; winter flooding; changes in crop yield quantity and quality	Diversify cultivar and crop types; improve water management systems; improve pest forecasting
	Nursery, greenhouse, floriculture, sod	Increased cooling costs; water stress	Establish emergency response systems; improve energy efficency of housing
	Millk and dairy	Decreased milk productivity; changing disease presence; low-quality pasture during drought	Increase shade and cooling; improve ability to monitor disease and quarantine; manage pastures for drought
	Cattle and calves	Changing disease presence; heat stress; low-quality pasture during drought	Increase shade and cooling; improve ability to monitor disease and quarantine; manage pastures for drought; farm heat-toleant breeds
	Vegetables, melons, potatoes, other crops, hay	Increased irrigation use; winter flooding; changes in crop yield quantity and quality	Diversify cultivar and crop types; improve water management systems; improve pest forecasting
	Horses, ponies, mules, burros, donkeys	Heat stress; low-quality pasture during drought	Increase shade and cooling; manage pastures for drought education about heat stress
	Fruit trees, nuts, berries	Increased irrigation use; increased pest damage	Diversify cultivar and crop types; improve water management systems; improve pest forecasting

Credit (top to bottom): Ben Fertig, Jane Thomas, Adrian Jones, thebittenword.com

PLANNING GUIDELINES

A changing climate will affect the success of farming across the state and require specific strategies to guard against impacts from extreme weather, rising temperatures, and disease. The agricultural community should consider the implementation of the following management practices to reduce risk and build resilience.

Management practices	Risk management	Water quality	Crop and species diversification	Pest, weed, and disease management
Plant heat-, disease-, and drought-tolerant cultivars, and longer or earlier maturing cultivars.			✓	
Reduce impacts of pests through crop rotations and integrated pest management.				✓
Develop efficient early-warning systems for likely invasions of insects, weeds, and diseases.				✓
Explore incentives for agricultural bio-fuel development, methane recapture, and carbon and nutrient trading.	✓	✓		
Establish emergency response plans for drought, extreme heat, flooding, and damaging winds.	✓			
Evaulate the effectiveness of best management practices during extreme heat, drought, and large rainfall events.		✓		✓
Revise targets for agricultural land preservation in light of sea level rise, future drainage, and crop diversification needs.	✓	✓	✓	
Invest in techniques to promote water-use efficiency, such as rainwater capture, improved irrigation systems, better water allocation, and livestock watering areas.	✓	✓		
Develop and expand local food production through community gardens, school programs, and regional foodshed mapping.	✓	✓		
Encourage local growers to attract pollinators by planting appropriate habitats, building bee homes, and discouraging insecticide and pesticide use.	✓			✓
Provide improved access to markets and finance (e.g., microcredit), enhanced insurance, and technology transfer programs.	✓			
Pursue aquaculture opportunities in areas impacted by sea level rise.		✓		

FOR ADDITIONAL INFORMATION

Department of Natural Resources' Climate Change Website: www.dnr.maryland.gov/climatechange
Drainage Management: http://mda.maryland.gov/resource_conservation/Pages/pda_pwa.aspx
Nutrient Management: http://mda.maryland.gov/resource_conservation/Pages/nutrient_management.aspx
Water Quality Cost Share: http://mda.maryland.gov/resource_conservation/Pages/financial_assistance.aspx
Maryland Invasive Species Law: http://www.invasivespeciesinfo.gov/laws/md.shtml
Maryland's Coastal Atlas: http://www.dnr.maryland.gov/ccp/coastalatlas/
Northeast Regional Climate Center: http://www.nrcc.cornell.edu/

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