UF | IFAS Research
UNIVERSITY of FLORIDA

CLIMATE CHANGE

NATURAL RESOURCES

AGRICULTURE

HUMAN SYSTEMS

Climate change is one of the most important and controversial scientific topics today. Many scientists believe that an accumulation of heat-trapping "greenhouse gases" in the atmosphere is causing a slow but inexorable increase in the Earth's average surface temperatures. This process is blamed for polar ice-cap losses, rising seas, coastal flooding and extreme weather events.

Critics question whether human activity can impact global temperatures, and suggest that natural phenomena may be responsible for unusual weather events that are cited as proof of global warming. They sometimes assert that only the passage of time can demonstrate the correctness of their position.

At the University of Florida Institute of Food and Agricultural Sciences, researchers have no time to wait. They are taking action now to address challenges posed by increasing temperatures and rising coastal waters, regardless of the cause. Projects under way include efforts to increase carbon sequestration, improve heat and drought tolerance in food crops and livestock, protect coastal areas from flooding and understand how higher ambient temperatures may affect pest populations.

Ongoing Research

SPACE RESEARCH ON PLANT GROWTH

The vast majority of plants are sessile organisms – meaning they spend their lives in one location, exposed to environmental extremes that mobile organisms could escape. Consequently, plants have become highly adaptable to novel environmental conditions. To explore this phenomenon, plant molecular geneticist Anna-Lisa Paul , a research professor with the UF/IFAS Horticultural Sciences Department, is investigating gene activation patterns in the model plant *Arabidopsis thaliana* when its seedlings are grown in low gravity during space flight. Changes in gene expression suggest that the plant's cell walls loosen, hormone signaling declines, and the plant relies more substantially on light signaling in the absence of gravity. These findings will help guide efforts to pinpoint genes associated with specific growth traits in crop plants, knowledge that could help breeders develop improved varieties.

ECOSYSTEM SERVICES FROM SHELLFISH

Florida aquaculture production of the hard clam, *Mercenaria mercenaria*, generates about $20 million annually and improves coastal water quality, as the clams consume large quantities of microscopic plankton containing nitrogen, an essential nutrient that harms water quality in excessive amounts. Clam farming also generates cleaner water by facilitating the activity of bottom-dwelling bacteria that feed on nitrate, a water-soluble form of nitrogen, according to Shirley Baker, an associate professor with the UF/IFAS Fisheries and Aquatic Sciences Program. Baker is part of a research team investigating how the presence of high-density clam populations may accelerate the bacterial activity and remove nitrogen from water faster. The team will also assess the potential effects of a warming climate on the clams and bacteria, and estimate the dollar value of clam farming's water-quality benefits.

PESTS AND EXTREME WEATHER

Climate change is predicted to cause more frequent and extreme temperature fluctuations in the Earth's atmosphere, potentially altering insect distribution and population dynamics. Dan Hahn, an associate professor with the UF/IFAS Entomology and Nematology Department, leads a team investigating the effects of rapid temperature drops called "snap freezes." Using the common fruit fly, *Drosophila melanogaster*, the researchers identified about 100 genes associated with short- and long-term temperature acclimation, providing a starting point Hahn will use in predicting how climate change may affect insects that have significant positive or negative impacts on humanity. If pest species can survive snap freezes, they might gain advantages such as the ability to reproduce faster, colonizing previously inhospitable ecosystems and thereby cause more damage.

Research with Impact

GRASSLAND MANAGEMENT TO CONTROL CARBON

Grasslands cover one-fourth of the world's land area, and many of these ecosystems are being converted to more intensive agriculture or replaced with urban development. This trend could have important implications for atmospheric carbon reduction efforts, said Maria Silveira, an associate professor with the UF/IFAS Range Cattle Research and Education Center in Ona. She led a study showing that conversion of native rangelands into managed pasturelands increased soil carbon by 50%. She advises that adequate pasture management include proper forage species selection, and adequate fertilization and grazing strategies. Ranchers who manage their pastures for increased productivity can also promote carbon accumulation in the soil, a practice which also benefits the environment.

HEAT-TOLERANT CATTLE BREEDS

The Black Angus is America's most popular beef cattle breed, but on Florida ranches its dark coat absorbs solar radiation, making the animals susceptible to heat-stress issues. Researchers at the UF/IFAS Range Cattle Research and Education Center in Ona have developed a breed that seemingly combines the best of both worlds, the Ona White Angus. Center director John Arthington, a professor with the Range Cattle REC, said the Ona White Angus is the result of crossbreeding light-coated cows and Angus bulls. Genetically, these cattle are similar to Black Angus and possess some of that breed's best traits, such as fast growth and high fertility. The white coat enables the Ona White Angus to stay cooler in sunny pastures and could make it a logical choice for producers in tropical or sub-tropical climates.

PREDICTING SEA-LEVEL RISE EFFECTS

If the Earth's average surface temperatures continue to increase, coastal cities worldwide will face the threat of flooding – a particularly significant issue for densely populated areas in Florida, of which most are near sea level. Greg Kiker, an associate professor with the UF/IFAS Department of Agricultural and Biological Engineering, is part of a team helping officials in St. Augustine and other coastal cities identify vulnerable areas and take steps to protect lives and property. The researchers combined multiple computer models to produce a predictive tool that shows which areas are likely to flood under a given scenario and what damage can be expected. These projections are helping planners make decisions on future land use, erosion control, flood protection enhancements, and even the possibility of moving historic structures out of low-lying coastal areas.

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