

Utah Science

Volume 69 | Number 1

Article 1

11-2015

Volume 69 Issue 1 (Fall/Winter 2015)

Follow this and additional works at: <https://digitalcommons.usu.edu/utscience>

Utah Science is produced by Utah State University Agricultural Experiment Station.

Recommended Citation

(2015) "Volume 69 Issue 1 (Fall/Winter 2015)," *Utah Science*: Vol. 69 : No. 1 , Article 1.

Available at: <https://digitalcommons.usu.edu/utscience/vol69/iss1/1>

This Article is brought to you for free and open access by the Journals at DigitalCommons@USU. It has been accepted for inclusion in Utah Science by an authorized administrator of DigitalCommons@USU. For more information, please contact digitalcommons@usu.edu.



Utah Science

A Publication of the Utah Agricultural
Experiment Station at Utah State University
Volume 69 Issue 1 Fall/Winter 2015

UtahState
University

Agricultural Experiment Stations at the nation's land-grant universities are typically referred to by the acronym AES. Though the S stands for station, it seems there are other "S" words that are integral to what we do: stewardship, science and students.

First off, the Utah Agricultural Experiment Station is not a station in the sense of a single location or building. It is a collection of researchers and facilities all focused on discovery and problem solving. Many research teams examine issues specific to our state, but topics like breeding and cultivating better crops, water quality and conservation, human health, food traceability and many others reach beyond Utah's borders.

Work done by researchers involved in more than 200 current Utah Agricultural Experiment Station projects often informs public policy makers and helps individuals better manage their land, lives and livelihoods. In short, our findings improve stewardship whether it's managing growing numbers of visitors at national parks or caring for water and animal habitat.

In this issue of Utah Science we feature just a few projects connected to improving stewardship, much of it on public land or in places where there is potential for development and growing numbers of people to conflict with the environment and resource management. Questions about public lands are important to people in Utah where more than half the land is federally owned. A mix of government agencies and people with a range of strong opinions manage and use Utah's forests, rangelands, five national parks and seven national monuments. And though politicians, bureaucrats and citizens often battle over how the resources should be managed, sound decisions should depend on sound science.

While UAES research is led by faculty members, the field and lab work involved in discovery nearly always includes Utah State University students—both graduate and undergraduate. Experiences and the understanding gained in hands-on research cannot be duplicated in lectures and textbooks.

We're proud of the roles students play in our research community and proud to be part of developing generations of scientists and decision makers.

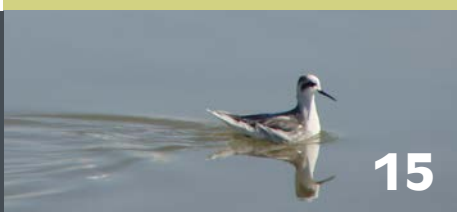
Stewardship, science and students may not be in our official title, but they are at the core of what we do.

Ken White

**Director,
Utah Agricultural
Experiment Station**



Photo: Gary Neuenswander



Utah Science

Volume 69 Issue 1 Fall/Winter 2015

2 Awareness, Appreciation, Conservation

The sage-grouse is an iconic bird that inhabits vast seas of sagebrush in western North America and has been the focus of extensive discussion and concern among wildlife managers, ranchers, mineral extraction and energy companies, land developers and others in the west and beyond. Why all the discussion about a 2-to 5-pound bird?

8 Recreation Ecology in National Parks and Protected Areas

People love national parks, but managing a growing numbers of visitors with a mandate to preserve natural conditions in perpetuity is a challenge. Recreation ecologists are providing park managers with good science to help them with that balancing act.

12 Synthesis: Science at Utah State University

20 Reptiles in the New "Natural" World

Side-blotched lizards in southern Utah deserts and marine iguanas in the tropics may seem to have little in common, but they both live in places where increasing human activity may be changing their behavior and physiology.

24 Economics and Public Lands

UtahState
University

Stan L. Albrecht,
President, Utah State University

Ken L. White,
Director, Utah Agricultural
Experiment Station and
Vice President for USU
Extension and Agriculture

UTAH SCIENCE is a publication devoted primarily to Experiment Station research in agriculture and related areas. Published by the Utah Agricultural Experiment Station, Utah State University, Logan, Utah 84322-4845.

Editor/Writer:
Lynnette Harris
lynnette.harris@usu.edu

Writers:
Julene Reese, Mary-Ann Muffoletto,
Cassidy Woolsey, Dennis Hinkamp

**Graphic Designer/
Illustrator:**
Olivia Yeip
Jason Holladay
Cover photos by Dennis Hinkamp

UTAH SCIENCE will be sent free on request in the United States. Subscriptions mailed to individuals and institutions in other countries cost \$35 annually, which includes shipping and handling. Please include a mailing label from a recent issue of **UTAH SCIENCE** with any request for change of address.

To avoid overuse of technical terms, sometimes trade names of products or equipment are used. No endorsement of specific products or firms named is intended, nor is criticism implied of those not mentioned.

Articles and information appearing in **UTAH SCIENCE** become public property upon publication. They may be reprinted provided that no endorsement of a specific commercial product or firm is stated or implied in so doing. Please credit the authors, Utah State University, and **UTAH SCIENCE**.

Equal Opportunity in employment and education is an essential priority for Utah State University, and one to which the University is deeply committed. In accordance with established laws, discrimination based on race, color, religion, national origin, gender, age, disability, or veteran's status is prohibited for employees in all aspects of employment and for students in academic programs and activities. Utah State University is dedicated to providing a healthy equal opportunity climate and an environment free from discrimination and harassment.



AWARENESS

APPRECIATION

CONSERVATION

by Julene Reese

TERRY MESSMER IS PASSIONATE ABOUT WILDLIFE, THE LAND AND HELPING PEOPLE. SINCE 1996, HIS RESEARCH AND OUTREACH HAVE FOCUSED ON SAGE-GROUSE AND THE LANDSCAPES THEY INCREASINGLY SHARE WITH PEOPLE AND OTHER ANIMALS.

Messmer, a Utah State University Extension wildlife specialist, professor for wildlife conflict management in USU's Department of Wildland Resources and a Utah Agricultural Experiment Station researcher, isn't the only one interested in understanding sage-grouse and their management.

This iconic bird inhabits vast seas of sagebrush in western North America and has been the focus of extensive discussion and concern among wildlife managers, ranchers, mineral extraction and energy companies, land devel-

opers and others in the west and beyond. Why all the discussion about a 2-to 5-pound bird?

"The conservation of sage-grouse is explicitly linked to the sagebrush landscape," Messmer said. "In the west, there are 165 million acres of sagebrush rangelands. Sage-grouse depend on sagebrush for the food and protective cover essential to their survival. Other species, including humans, also depend on the environmental services provided by watersheds in sagebrush landscapes. If we can maintain a working sagebrush landscape inhabited by healthy sage-grouse populations, we all win.

Sage-grouse as indicators of the health of the sagebrush system have become the focal point or lightning rod, if you will, for how we're going to manage the west and what the west is going to look like in the future."

Messmer said increased public awareness is paramount to species conservation, sustainable western landscapes and economic viability, but it is not just a western issue. Why should someone living in New York City care about sage-grouse? Because they are tied to the health of public lands, which are owned by all Americans.

Photographs courtesy of Terry Messmer and the U.S. Fish and Wildlife Service.



“THE CONSERVATION OF SAGE-GROUSE IS EXPLICITLY LINKED TO THE SAGEBRUSH LANDSCAPE. IN THE WEST, THERE ARE 165 MILLION ACRES OF SAGEBRUSH RANGELANDS. SAGE-GROUSE DEPEND ON SAGEBRUSH FOR THE FOOD AND PROTECTIVE COVER ESSENTIAL TO THEIR SURVIVAL.”

-Terry Messmer

SAGE-GROUSE ON THE RANGE

There is an estimated population of 500,000 Greater sage-grouse spread across 11 Western states and two Canadian provinces, including about 8 million acres in Utah, and about 4,000 Gunnison sage-grouse that are found only in western Colorado and in Utah’s San Juan County. In the past century, the birds’ traditional range has increasingly been fragmented by urban and agricultural development, oil and gas extraction, mining, conifer encroachment, wildfires and cheatgrass. The North American Breeding Bird Survey estimates that Greater sage-grouse populations have declined by more than 60 percent in the past 50 years.

In the early 1990s, state agency biologists in Utah expressed concern about declining sage-grouse populations. In 1997, the same concern prompted the Parker Mountain Grazing Association to give Messmer a check for \$3,000 to buy radio collars to find out why the sage-grouse population on Parker Mountain in south central Utah was declining.

“That \$3,000 was the beginning of an over \$4 million investment in research funding from 40 different organizations, including oil and gas companies as well as school children, to support





sage-grouse research,” Messmer said. “And none of this research could be completed without the 30-plus graduate students and hundreds of undergraduate technicians who have worked on our research studies. Their cumulative data created one of the most powerful databases in the west regarding sage-grouse ecology.”

In fact, since that initial investment in tracking sage-grouse, Messmer and his colleagues have been able to map the ecology of every sage-grouse population in Utah. Although similar research work continues in other states as well, the other efforts may not have the same

level of grassroot support and local investments.

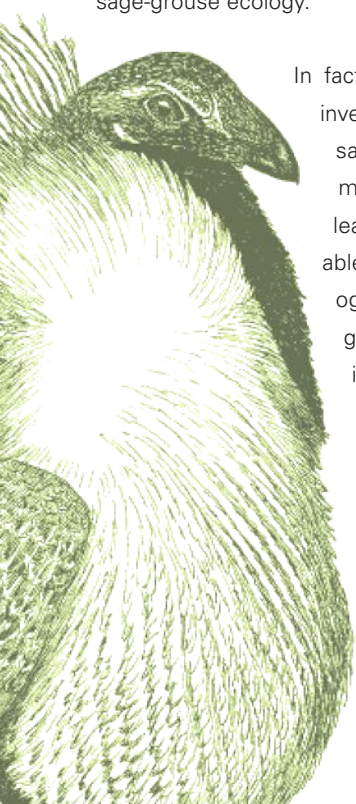
Messmer’s research teams have built and continue to facilitate an on-going, community-based conservation program (CBCP), engaging thousands of Utah and regional stakeholders in local working groups to develop and implement conservation efforts. The essence of the CBCP has been having participants, including ranchers, land managers and energy company personnel, learn more about sage-grouse, the “working landscapes” they inhabit and to actively manage the birds’ habitats.

Ken White, director for the Utah Agricultural Experiment Station and vice president for USU Extension, praised Messmer and his team’s research and efforts to protect sage-grouse and their habitats.

“Their research has had a powerful impact not only in Utah, but across the region as

they have collaborated with multiple agencies to implement conservation programs,” he said. “Their work with sage-grouse is helping put land-management strategies into place that will have beneficial, lasting effects on communities and people.”

Messmer and his team are currently conducting research in northern Utah’s Rich County on the Desert Land and Livestock Ranch and at Three Creeks, a 27-pasture Bureau of Land Management allotment. Seth Dettenmaier, Ph.D. student, has conducted the field work for the project, which combines traditional radio-telemetry with newer global positioning system (GPS) satellite technology. This enables researchers to learn more about how sage-grouse habitats may change as they are grazed by livestock and also how sage-grouse respond to the actual presence of cattle. Messmer and his students are deploying 30-gram, solar-powered GPS transmitters on female sage-grouse to monitor their habitat-use patterns, seasonal movements, nest-



MESSMER AND HIS COLLEAGUES HAVE BEEN ABLE TO MAP THE ECOLOGY OF EVERY SAGE-GROUSE POPULATION IN UTAH. ALTHOUGH SIMILAR RESEARCH CONTINUES IN OTHER STATES AS WELL, THE OTHER EFFORTS MAY NOT HAVE THE SAME LEVEL OF GRASSROOT SUPPORT AND LOCAL INVESTMENTS.

ing and brood success, survival rates and behavior when livestock are present.

In addition, Messmer's faculty colleagues Kristen Hulvey, assistant professor, rangeland management and ecology, and Eric Thacker, assistant professor and Extension range specialist, wildland resources, have deployed 47 GPS collars on cattle on Deseret Land and Livestock to determine how cattle use landscapes under different grazing systems. The objective is to merge the two data sets to help answer questions such as: How do the birds interact with cattle and how do different grazing systems affect sage-grouse production? Do sage-grouse avoid areas where

the livestock are, or come back to them? Does female sage-grouse seasonal habitat use differ under prescribed rotational and season-long grazing practices?

One aspect of the work is to determine how a female sage-grouse in her brood responds to the presence of livestock both before, after and during the grazing of a pasture. If it causes a hen to move her brood, they are at increased risk of predation. Plants are also important as protective covering against predators and weather. The researchers want to learn if it's possible to increase the habitat base by improving the



quality of the habitat for sage-grouse and then subsequently increasing the populations.

“Grazing is the predominant use of western sagebrush landscapes,” Messmer said. “Improper livestock grazing can impact local areas and watersheds, and because livestock grazing is such a widespread use in sagebrush landscapes, it also may be one of the most cost-effective tools in managing for the habitat sage-grouse require. Our research suggests that sage-grouse are more productive in landscapes with a variety of forbs, grasses and sagebrush of different age classes, species and structure. Well managed grazing by domestic livestock can provide these green groceries.”

He added that this study is the first time information will be provided in real-time about how sage-grouse and livestock respond to the landscape as they use it at the same time, and his team is anxious to share that information with the public.

“We have a huge data set of over 40,000 sage-grouse locations in Utah and Idaho and it is growing,” he said. “We want to connect this real-time science with anyone who is interested, and we would like to bring this tracking information to schools so students and others can participate in hands-on science. We want people to understand the landscape from the birds’ point of view.”

The more people learn about the sage-grouse and sagebrush landscapes, the more they begin to appreciate them, and they become something to protect. Many landowners grew up around “sage chickens or sage hens,” as many people



call them, but they had never seen them on a lek – an area where sage-grouse gather and males carry on competitive displays and courtship behavior to entice females in the spring. Messmer said after landowners and others in CBCPs became involved in going to leks to count birds, they became more aware of their behavior and habitat needs. Participants began to feel a sense of ownership, and rather than seeing them as just sage-grouse, they became “our birds.”

ENDANGERED SPECIES?

In February 2015, Utah Governor Gary Herbert signed an executive order directing state agencies to preserve and protect sage-grouse and the birds’ habitat. The governor’s action was an effort to demonstrate that local governments can effectively manage sage-grouse and help restore their numbers without the U.S. Fish and Wildlife Service



listing them as an endangered species. Conservation work in Utah and other states did, in fact, contribute to the agency's September decision not to list sage-grouse for protection under the Endangered Species Act. The ruling lauded the role of ongoing grassroots conservation efforts to protect sage-grouse habitat and to mitigate conservation threats as the primary reason for not listing the species.

"The governor's executive order essentially tied the ribbon on over two decades of research and community-based conservation efforts, which were voluntarily implemented to eliminate threats to the species that were identified by the U.S. Fish and Wildlife Service," Messmer said. "Utah's incentive-based conservation has encouraged landowners and others to take economic risks to change or implement new conservation strategies. The process is built on trust. Trust in conservation is a fickle partner. Incentive-based conservation builds trust, whereas increased regulation fuels mistrust."

Messmer's experiences have convinced him that awareness leads to appreciation, and appreciation is the first step to conservation.

"The premise of our entire local working group's program is to engage as many people as possible in learning together about the sagebrush systems and wildlife we are trying to manage," he said. "As we learn together, we can make better and lasting decisions, and if those decisions are based on the best available science, then our efforts will have been successful." – JR

➔ CONTACT INFO:

Terry Mesmer
Terry.Mesmer@usu.edu



ADOPT A SAGE-GROUSE PROGRAM

Because the price tag for a GPS transmitter for each sage-grouse is \$4,000, monitoring multiple birds becomes a costly endeavor. To assist the work of research and community-based conservation groups, a new program called Adopt a Sage-grouse is in the works that will allow businesses, private organizations and individuals to contribute to the research. Participants may sponsor a school by donating toward the purchase of a radio transmitter. The program is designed to encourage middle and high school science and biology class participation, but will be open to everyone interested in learning about sage-grouse and their conservation. This adoption process will provide regular, timely information about how the sage-grouse uses the landscape, the biology of the bird, where it was caught, its weight and life history. Those who adopt a bird will be able to track its movement through its life span and learn firsthand about its successes and trials.

"IT IS IMPORTANT TO NOTE THAT MOST SAGE-GROUSE DIE BECAUSE SOMETHING EATS THEM," MESSMER SAID. "IT IS ENTIRELY POSSIBLE THAT THE ADOPTED BIRD ONE DAY MAY BECOME A MEAL FOR SOMETHING ELSE A FEW WEEKS LATER. LIFE FOR THE SAGE-GROUSE CAN BE TOUGH; BUT THAT IS THE REALITY."

Messmer said ideally they would like this research and adopt-a-sage-grouse project to go on well into the future. There are currently 4 years of pre-data, and now with the GPS collars on both the livestock and the sage-grouse, the hope is that the research can continue for years to come. He added that in Utah, the sage-grouse populations the team has monitored in areas with managed grazing are stable or increasing.

Data from the Adopt a Sage-grouse Program provides specific information on the adopted bird including:

- * Biology and weight of the bird
- * Information about where it was caught
- * Information on how the sage-grouse is using the landscape
- * Regular tracking of the bird's movements
- * Conversations with scientists about the bird

To participate, an adoption request can be sent to adoptasagegrouse.org and the participant will be matched with a sage-grouse equipped with a GPS collar, a scientist and a sponsor. Participants will receive access to seasonal curriculum and assistance as they observe the sage-grouse's life cycle.

To find out how to sponsor an adoption or local school, contact Messmer at terry.mesmer@usu.edu.

RECREATION ECOLOGY IN NATIONAL PARKS **AND** PROTECTED AREAS

by Lynnette Harris



PEOPLE HAVE A VARIETY

of reasons for visiting America's national parks and other protected lands. They may be seeking views of remarkable landscapes and iconic natural features, chances to see wildlife roaming freely, opportunities to learn about natural and human history, or hoping for solitude in a place apart from their daily lives.



Whatever their motivations, people love the national parks and visit them in greater and greater numbers every year. As long as they do, Christopher Monz and his colleagues will be trying to help park managers with good science to help them balance the mandate to provide opportunities for people to visit without impairing the resources they came to see.

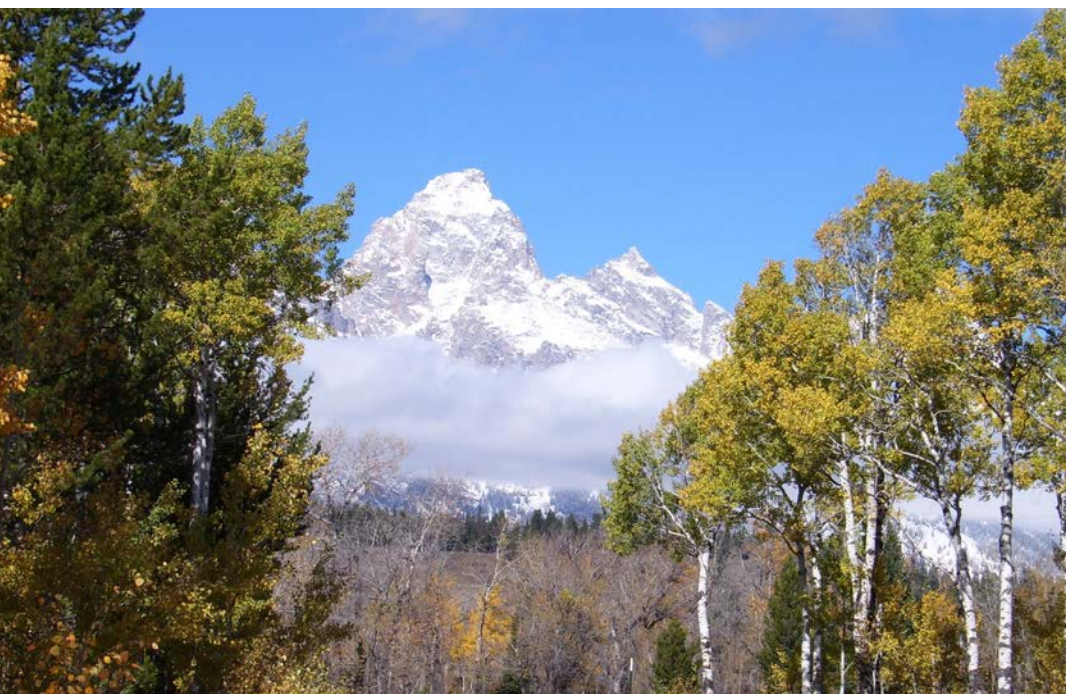
Monz, an associate professor in Utah State University's Department of Environment and Society and Utah Agricultural Experiment Station researcher, is among just a handful of recreation ecologists in the country. It's a hybrid discipline aimed at understanding complex problems in some remarkable places.

"I think having more people visiting parks is a good thing because I firmly believe that national parks are good for people," Monz said. "On the flip side, it's challenging from a management perspective because they're trying to preserve natural conditions in perpetuity. That is the mandate park managers have. They must support visitors and support wildlife, biodiversity, water and other natural systems that are all really important in parks."

That's where Monz comes in, trying to help parks understand how they might manage visitors in unobtrusive ways to they derive benefits from the experience, but leave a minimal footprint in the area.

A few simple statistics give an idea of the magnitude of that challenge. Grand Teton National Park in Wyoming first topped one million visitors a year in 1954 with 1,003,500 people coming to the park. In 2014, Grand Teton welcomed 2,791,392 visitors. Zion National Park in southern Utah had just 416,800 visitors in 1954, a number that soared to 3,189,696 in 2014.

The places, uses and ecosystems may vary, but in the course of Monz's research in several national parks and other protected areas, he has found some constants in the complex mix of visitors' plans and behaviors and the many elements of the places they visit.



“One thing we’ve found time and time again in our work is that changes in resources proceed fairly rapidly at first in a new area, but as long as people are confined to the same spatial area, the same finite space, impacts to the area level off and don’t continue,” Monz said. “It suggests to us that we can accommodate a lot of people simply by managing them on resources that have been developed and maintained for their use.”

Monz said this philosophy works well at Zion National Park where, as they do in some other busy national parks, visitors mainly get around on shuttles that allow managers to direct them to specific locations and features. Shuttles

also provide places for visitors to learn more about the park and get information to enhance their visit, such as advice on when a particular location or trail is extremely crowded and suggested alternate plans.

Trouble for the ecosystem begins and grows when people spread out into areas that aren’t maintained for their use. Additional facilities can be created, but they come with high fiscal and ecological price tags so planning and

situating them based on good data is crucial.

Monz and a team of graduate students have gathered data on the Moose-Wilson Road, an important and scenic 8-mile stretch at an entrance to Grand Teton National Park, during three periods from 2013 to 2014. Getting a clear picture of visitor use and impacts requires more than just counting cars so Monz’s team developed some novel ways to try to understand where visitors go and gauging things like changes in plant cover, soil disturbances. The road is one means of getting between destinations, it’s the way to the local airport and near the Jackson Hole Mountain Resort.

“I think having more people visiting parks is a good thing because I firmly believe that national parks are good for people,”

— Christopher Monz

“It’s a corridor of human movement and also really critical wildland habitat for plant and wildlife species, particularly at certain times of the year,” Monz said. “You’ve got elk, moose, grizzly bear, black bear, grouse, owls. It’s got wetland habitat and upland habitat. Yet you’ve got all these people traveling through and the park wants to be sure it’s doing its due diligence to maintain the biological diversity and opportunities for people to experience that diversity without compromising either one. That

set the bar pretty high in terms of the kinds of data we needed.”

In addition to gathering data about plants, soils and other elements of the environment, the team gave GPS units to visitors when they arrived at the park and collected them when they left. People in cars, on bikes and on foot were included in the sample, and were almost unflinching willing to help.

“We’ve gotten incredibly high rates of compliance,” Monz said. “People love their parks and they want to contribute to their management. We’ve had people come up to our field crews and ask if they can be part of the study and we have to thank them and tell them we have to have random samples.”

In the case of the Moose-Wilson Road, the researchers found (and have reported to park managers) that depending on the season about one-third to one-half of visitors to the corridor go through without stopping. They also learned that even with the high number of visitors who are just passing through, current facilities such as parking lots at trail heads and the relatively new Laurance S. Rockefeller Preserve Center do not meet current demands.

“That means you get more people parking alongside roads away from facilities,” Monz said. “When people go places that are not managed for them it opens up the possibility of greater ecological disturbance. I don’t know yet what the park will do, but when this happens you get people trampling vegetation and potentially interacting with wildlife. Some of this stems from people traveling on the road and when they see a moose and pull over to get a picture, and then you get a wildlife jam.”

Monz added that park officials are particularly concerned about the safety of visitors who speak little or no English. They don’t always understand that the animals they want to get closer to with their cameras are wild and they will eat or trample people.

Other dangers to visitors and land present themselves even in the absence of large wild animals. Monz is also doing research in Rocky Mountain National Park which gets more than 3 million visitors each year. Many of

them come to hike and climb in the park that includes two watersheds and, unfortunately, often create their own trails that cut up the landscape. Many people also put themselves in danger when they attempt to climb iconic peaks on an approved route but without proper preparation and equipment. At busy periods, there may be 400 people on the route so climbers may be inclined to move off the trail.

Monz is an experienced climber and his skills allowed him to install infrared wildlife cameras near the top of Longs Peak, which puts them at elevations greater than 14,000 feet above sea level. The cameras will allow him to gather data on the flow of people on the mountain and ecological changes. In this case, managers may want to know how visitors would respond to actions like issuing permits for specific dates and times on the route and Monz's team will be ready to help them figure that out.

"I really like what I do," Monz said. "I get to pursue science in places I care about, that we all care about as Americans. I get to help make changes on the ground that managers appreciate and give them the science that helps them make decisions and care for these amazing places."

➔ Contact Info:

Christopher Monz
Christopher.Monz@usu.edu



“ONE THING

we've found time and time again in our work is that changes in resources proceed fairly rapidly at first in a new area, but as long as people are confined to the same spatial area, the same finite space, impacts to the area level off and don't continue. It suggests to us that we can accommodate a lot of people simply by managing them on resources that have been developed and maintained for their use.” — Christopher Monz



synthesis:



Morteza Sedeghi and Scott B. Jones discuss measurement and sampling strategies for near-surface soil water content. See more about Utah State University Physics Group's scientists and research at usu.edu/soilphysics/.

Science at Utah State



University's Environmental Soil

National Science Foundation Funds Research Focused on Water and Soil Interactions

by Lynnette Harris

A number of things can happen to water when it hits the topmost layer of soil. It may runoff and cause flooding, recharge aquifers, evaporate or go deeper into the soil until it's used by plants, but exactly what happens depends on processes at and just below the soil's surface that are not particularly well understood. As drought continues to plague the Western US and other parts of the world, monitoring water in soil is an important part of managing valuable water resources.

To better understand the fate of water at the soil surface, the National Science Foundation recently funded UAES researcher and soils science professor Scott B. Jones with a \$352,500 grant to expand his research on near-surface soil water monitoring. This project is a collaborative venture with Morteza Sadeghi at USU and Markus Tuller at the University of Arizona.

Because soil surface properties and processes vary across the landscape and over time, it is difficult to measure and understand them over large areas. Satellite images of the earth's surface help monitor large-scale areas, but scientists need to connect ground-based

measurements of root-zone water content with the surface image satellites produce.

"The top layer of soil, about one inch deep, has gotten little scientific attention to date, but the top inch of soil is all the satellites can really sense," Jones said. "We need improved measurement technology and models to better calibrate satellite observations."

The newly funded work aims to develop new sensing arrays, remote sensing tools, and mathematical models that will measure and describe the properties of surface soils and builds on work Jones has done previously with support from the Utah Agricultural Experiment Station and other agencies. Newly developed technologies include models that employ shortwave infrared cameras and novel sensor arrays to detect water content that will help scientists understand the fate of water in near-surface soils at different temperatures and with varying soil texture.

"The goal is to improve satellite-based soil property and process monitoring to better manage soil water, especially in arid and semi-arid regions like ours where water is limited," Jones said.

Woad Warrior Maps Weeds with a Mountain Bike

by Dennis Hinkamp

There is hardly a recreation area anywhere in the world where you won't find someone with a camera attached to their body or helmet. Most of these people are trying to capture their adventures for fleeting fame on social media. Corey Ransom is trying to capture weeds.

Ransom, a Utah State University weed scientist in the Department of Plants, Soils and Climate and Utah Agricultural Experiment Station researcher, was watching a mountain bike video produced using helmet-mounted cameras when he noticed he could identify certain wildflowers even as the bike passed by them at high speeds.

"I thought we might be able to adopt this technology to map invasive species," he said. "We chose to try it out on dyer's woad because it is a bright color in the spring and it is a prominent invasive species in Utah."

The importance of mapping invasive species is that by knowing where they are, you can better form your plan of attack, Ransom said. His research team has collaborated for many years with the Forest Service helping to conduct weed inventories. The agency works to control weeds on wild lands because they displace plants that wildlife depend on, can increase the danger of wild fires and encroach on agricultural land and cut crop production. Cameras mounted on bike helmets looked like a faster, more efficient way to collect the data. By using fewer man hours on the ground agencies would have more resources to actually treat and try to control the invasive species.

"The system we chose includes two GoPro cameras pointing out to the sides of a bike helmet to get a wider perspective," Ransom said. "We collect video data along with

GPS tracking data. We then put both of these into mapping software."

The next modifications the researchers incorporated were stabilizing gimbals so that when the biker moves his head or the trail gets bumpy, they video remains smooth, he said.

"This technology, would have cost tens of thousands of dollars a decade ago, but now we can do this for only a few thousand dollars," Ransom said.

The scientist said he has been doing a lot of the riding himself to test the system but envisions eventually handing it off to mountain bikers at trailheads and asking these citizen scientists for their help collecting data.

Video available:

tinyurl.com/woadwarrior



Professor Corey Ransom is testing helmet-mounted cameras to get video of invasive weeds. The video is combined with mapping coordinates to help in efforts to identify and eradicate weeds that threaten rangelands.



Shorebird Stories on Screen

by Mary-Ann Muffoletto

Utah State University Presidential Doctoral Research Fellow Maureen Frank appears in “Migratory Birds on the Great Salt Lake,” a video released Aug. 17 as part of the Wild Science series produced by Colorado-based High Country News, a non-profit news organization covering public land and natural resource issues of the American West.

“The Great Salt Lake is a huge stopover area for migrating birds,” says Frank, who conducts research with Utah Agricultural Experiment Station research and USU Wildland

Resources and Ecology Center professor Mike Conover. “There are millions of birds that come here every year.”

Her studies focus on phalaropes, slender-necked shorebirds that fuel up on the Great Salt Lake’s abundant brine flies and brine shrimp before migrating to South America. Of concern, she says, are shrinking lake levels and rising salinity.

“With the lower levels of Great Salt Lake, we don’t entirely know how big an impact that will have on different birds that use this area,” says Frank in the 5-minute video.



Photos by Maureen Frank

“(We’re asking) ‘how is salinity affecting the invertebrates and how is that indirectly affecting the phalarope population?’”

Frank, who completed undergraduate studies at Texas A&M University, was a featured speaker during the USU Office of Research and Graduate Studies’ spring 2015 Ignite USU speaker series. She presented “The Amazon in Your Backyard.”

See “Migratory Birds on the Great Salt Lake” at <http://ht.ly/R9M87>.

See Maureen Frank’s Ignite USU talk at ignite.usu.edu/maureen-frank.

“With the lower levels of Great Salt Lake, we don’t entirely know how big an impact that will have on different birds that use this area. How is salinity affecting the invertebrates and how is that indirectly affecting the phalarope population?” -Maureen Frank

New Smartphone App Targets Alzheimer's Prevention

by JoLynne Lyon

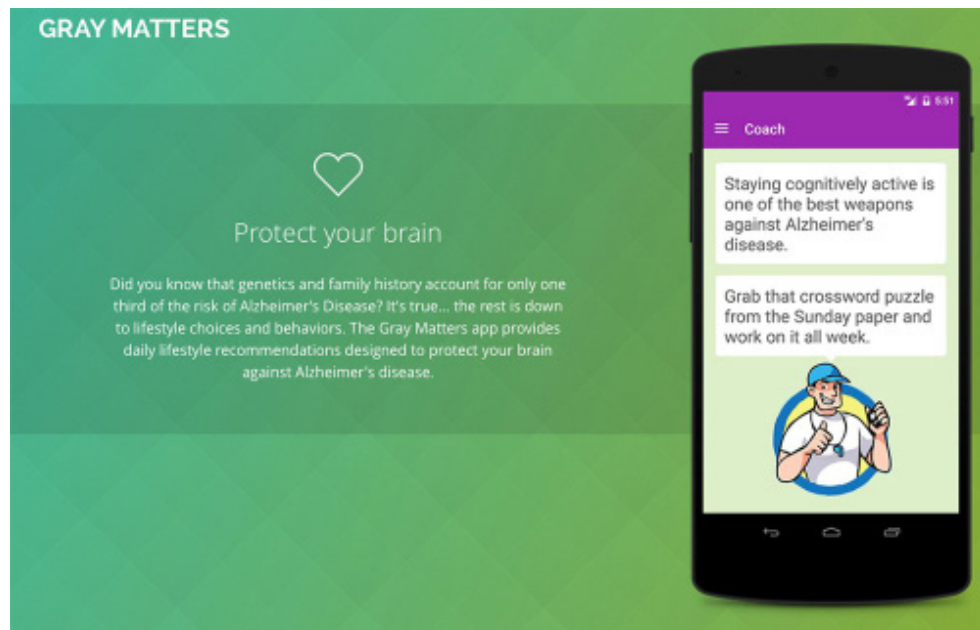
A revolutionary new smartphone app, developed by researchers at Utah State University and Ulster University in Belfast, Northern Ireland, could provide the key to preventing the onset of Alzheimer's disease.

Unveiled at the world's largest convention for Alzheimer's research in Washington, D.C., in July, the Gray Matters smartphone app encourages individuals to set lifestyle goals, ranging from exercise and nutrition to stress management and brain stimulation — all of which are known to have an impact on the onset and progression of Alzheimer's disease.

The Gray Matters app is currently being used for research purposes only, however, the plan is to make it available to the general public in the future.

The research supporting the app's development came through the Gray Matters study at Utah State University. It was led by Maria Norton, a professor in the Family, Consumer, and Human Development Department within the Emma Eccles Jones College of Education and Human Services. Her Utah Agricultural Experiment Station project examines the influences of psychosocial stressors on dementia and Alzheimer's disease risk.

The app provides daily facts on the link between healthy lifestyle behaviors and improved cognitive wellbeing. Through the app, users can track their lifestyle across a range of areas, including diet, physical activity, mental well-being and social engagement. It also provides visual progress reports to help individuals be more aware of their general health and encourage healthy changes in behavior.



“Over the six month intervention period, improved diet and increased physical activity were linked with improved health,” said Norton. “This included decreases in blood pressure and inflammation, and increases in HDL (good) cholesterol levels, among those at higher cardiovascular risk. The incidence of Alzheimer's disease is increasing worldwide. With no known cure, it is imperative that people understand modifiable risk factors for cognitive decline and take steps to protect their brain health in their younger years.”

Professor Chris Nugent, acting director of Ulster University's Computer Science Research Institute, said “Ulster University's world-leading research in assistive technologies is not only helping to solve challenges faced by people already living with Alzheimer's disease, but it is also creating pioneering technology that is improving prevention strategies.”

“Making positive adjustments to lifestyle can significantly reduce the risk of Alzheimer's disease, and our research findings show that Gray Matters both edu-

cates and empowers users to make these changes. We are now working closely with Utah State University to identify partnerships to further enhance functionality and usage of the app.”

The app will also support continued research by collecting data from participants.

The research is being undertaken at Ulster University's Computer Science Research Institute and Utah State University's Center for Epidemiologic Studies. Further information on the Gray Matters app can be found at graymattersapp.org.

Research teams

- Ulster University: Phillip Hartin, Ian Cleland, Chris Nugent, Sally McClean and Bryan Scotney.
- Utah State University: Maria Norton, Christine Clark, JoAnn Tschanz, Julie Gast, Elizabeth Fauth, Michael Lefevre, Heidi Wengreen, David Robinson and Travis Dorsch.

Scientist Named SSSA Fellow

by Mary-Ann Muffoletto

Utah State University soil scientist Helga Van Miegroet has been named a Soil Science Society of America Fellow. The honor is the highest recognition bestowed by the international society, which grants less than one percent of its members this designation.

Van Miegroet, a Utah Agricultural Experiment Station researcher, professor in USU's Department of Wildland Resources and the USU Ecology Center, will receive formal recognition at a ceremony during the society's 2015 annual meeting in November.

"Fellows are selected based on their professional achievements and meritorious service," said Sara Uttech, SSSA senior manager of governance and membership.

Van Miegroet is recognized as a pioneer in forest soil carbon and nutrient dynamics. A highly cited author, she has published nearly 100 professional papers. The Belgium native, who joined USU in 1993, was previously employed as a scientist at Tennessee's Oak Ridge National Laboratory. She says her involvement in SSSA convinced her of the power of mentorship.

"My former advisor at University of Washington, where I earned my doctorate, made a point of encouraging me

to attend the society's meetings, where I could network with professionals and present my research," Van Miegroet says. "His efforts to include me gave me credibility and helped me form important collaborations."

She provides similar support for her students.

"More than serving as an example of a



consummate scientist, Helga encourages her students and early career scientists in the society to pursue careers in soil and natural resource science," wrote Van Miegroet's colleagues Jeff Hatten, Astrid Jacobson, Lucas Nave and Brian Strahm, who nominated her for the award. "She makes a concerted effort to meet, encourage, advise and, when possible, engage (young scientists) in collaborative research."

Hatten says Van Miegroet makes particular efforts to recruit and encourage

underrepresented students and early careerists. For her efforts, she received the 2014 Women in Agronomy, Crops, Soils and Environmental Sciences Mentoring Award, a national honor jointly given by the SSSA, the American Society of Agronomy and the Crop Science Society of America.

At the pinnacle of her career, what is Van Miegroet pursuing? She's returned to school as a master's student in USU's sociology program, exploring gender inequality in science. A step backward? Not at all. For Van Miegroet, it's an important step forward and a time of revelation.

"For a long time, I believed I had total control of my professional destiny," she says. "But I became aware of an implicit gender bias. Now, I want to understand societal mechanisms behind this bias."

She credits her late father with encouraging her to explore big questions and to arm herself with knowledge — not solely emotion — in her academic quests.

"I used to be very angry when I encountered sexism, but my dad would have told me, 'Stop whining and do something,'" Van Miegroet says. "So, that's what I'm doing. I hope my experiences will benefit the next generation of women."

"I used to be very angry when I encountered sexism, but my dad would have told me, 'Stop whining and do something,' so, that's what I'm doing. I hope my experiences will benefit the next generation of women." -Helga Van Miegroet

USU Professors Contribute to Water Project On Tribal Lands

by Cassidy Woolsey

Utah State University economists and Utah Agricultural Experiment Station researchers Eric Edwards and Kynda Curtis are participating in a 5-year program to help Great Basin and Southwestern tribal communities develop plans and practices for sustainable agriculture and water management.

Beginning July 1, faculty and students from the University of Nevada, Reno, Utah State University, the University of Arizona, and Ohio University along with the First American (1994) Land-Grant Consortium (FALCON); Desert Research Institute; and the U.S. Geological Survey began integrating research and Extension programs to address potential water issues.

“The purpose is to work with organizations on the reservations to understand the potential threats or changes that could be occurring under climate change specific to those areas,” Edwards said. “We want a collaborative approach that builds capacity within each reservation to manage their water in effective and efficient ways.”

The Native Waters on Arid Lands Project is funded by a competitive, \$4.5 million grant awarded by the U.S. Department of Agriculture’s National Institute of Food and Agriculture. The provides for assessing the effects of Indian land use and agricultural practices, integrating paleoecological data with tribal knowledge to understand the impacts of a changing

climate, testing the efficiency of water systems, and other facets of water management.

American Indian farmers and ranchers provide an important economic base for these arid lands. Declining water supplies, urbanization, ecosystem change and federal Indian policies challenge American Indian agriculture for ceremonial practices, sustenance and trade.

Edwards looks forward to extending his prior work studying water rights to understanding how land and water ownership structure affects decisions on irrigation and water efficiency. He hopes this will be a collective effort that helps predict the effects of climate change and develops tools needed for adaptation.

Curtis will devote her efforts to examining economically efficient water systems, profitable low water-use crops, and producer adoption issues. Additionally, she will be involved in Extension activities, such as conducting focus groups and presenting study results to people in the study areas. Curtis has worked with tribal members in the past, but never with a focus on water.

Many reservations have little or no water access, Curtis said. Efficient and productive agriculture depends on the cultivation of low water-use crops and efficient water delivery systems.



Eric Edwards



Kynda Curtis

Biologists Discover Large Mimicry Complex

by Mary-Ann Muffoletto



In the animal kingdom, survival essentially boils down to eat or be eaten. How organisms accomplish the former and avoid the latter reveals an immense array of defense mechanisms. Perhaps you can outrun your prey. Maybe you have a nasty weapon to fend off predators. Or you may sport an undetectable disguise.

Mimicry, a form of defense in which one animal copies another of a different species in appearance, actions or sound, is an evolutionary phenomenon scientists identified in the late 19th century. Among the most common examples is Batesian mimicry, which includes harmless copycats of brightly colored poisonous butterflies and frogs that trick predators into leaving them alone. Another type is Müllerian mimicry, where multiple harmful species look alike as a similar warning to predators.

Most of the well-studied mimicry “complexes” — that is, group of organisms with common characteristics — are found in tropical butterflies. Now, Utah State University biologist Joseph Wilson and colleagues have identified North American velvet ants as one of the world’s largest known Müllerian mimicry complexes.

“We’ve discovered more than 300 different species that participate in this complex,” says Wilson, assistant professor of biology at USU’s Tooele campus. “This group is unique as many of the species aren’t tropical and they have more formidable defenses than most known Müllerian mimics.”

With USU associate professor and Utah Agricultural Experiment Station researcher James Pitts, undergraduate Erica Sheehan, as well as Joshua Jahner and Matthew Forister of the University of Nevada, Reno and USU alum Kevin Williams ('12 PhD) of the Florida State Collection of Arthropods, Wilson published these findings in the August 17, 2015, edition of *Current Biology*.

Velvet ants, members of the Mutillidae family, are actually wasps, though females are wingless. Found throughout the world, the fuzzy insects are especially common in arid regions of the southwestern United States and northern Mexico. So named because of their dense, velvet-like hairy covering, velvet ants range in color from reddish orange, black, gold and light yellow to white and silver. (Contrary to popular belief, no bright blue velvet ants have been identified. The myth is perpetuated by a well-circulated image created from deft strokes of a Photoshop enthusiast’s brush.)

“In some areas, velvet ants are known colloquially as ‘cow killers’ because their venom packs a painful punch,” Wilson says. “In addition, their ‘sting’ — the scientific term for what many of us refer to as a ‘stinger’ — is agile and half as long as the wasp itself. This enables the insect to inject venom into a predator from varied angles and free itself.”

In addition to a sharp, smarting prick, Wilson says velvet ants possess a unique arsenal of defenses to keep predators at bay.

“They squeak to startle and warn predators and they emit pungent chemical secretions,” he says.

The wasps’ bright coloring provides an additional warning and, if they are caught in a predator’s clutches, they have a hard exoskeleton that buys the insect a bit of time to inflict a stinging defense before a hunter can take a fatal bite.

By investigating morphological variation in hundreds of New World velvet ants, the researchers identified and described eight distinct mimicry rings based on the insects’ physical appearance, as well as their geographic distributions.

“We hypothesize this unique blend of defenses may have influenced the development of this extraordinarily diverse and widespread mimicry complex,” Wilson says. “We think the physical similarities across species benefit the wasps by quickly and effectively training their predators to avoid velvet ants displaying the local color pattern. This tells us that mimicry, rather than close genetic ties, may explain why the majority of velvet ants in a particular region to be the same color.”

In Utah, for example, most velvet ants are orange, the “in” color to protect the insects from hungry lizards and other predators. Members of the black-headed “Texan” ring hang out — you guessed it — in Texas and northern Mexico, while the fluffy white Thistledown velvet ants favor southwestern deserts.

“Knowledge of this mimicry complex provides us with a novel system to test ecological and evolutionary hypotheses,” Wilson says.

(Photographs courtesy of Joseph Wilson)



Joseph Wilson



James Pitts



REPTILES IN THE NEW

by Lynnette Harris

Aside from being reptiles, it might seem that marine and rock iguanas on the humid, tropical islands of the Galapagos and Bahamas have little in common with side-blotched lizards in the sun baked deserts of southern Utah. But they share the distinction of living in places that increasingly put them in contact with human activity and they react to the stresses that causes. Many of these reptiles also share being acquainted with Utah State University physiological ecologist Susannah French and students on her research team.

The associate professor of biology, USU Ecology Center and Utah Agricultural Experiment Station researcher, and her team of graduate and undergraduate students, examine whether environmental changes result in changes to the lizards' and snakes' stress responses, reproductive success and immune functions.

Stress amps up energy hormones—a title French prefers over what are sometimes referred to as stress hormones—in humans and animals, and prolonged stress effects on both species. The energy it takes to survive and reproduce has limits, so creatures' make physiological trade-offs. The hormones mobilize energy all the time, but where that energy is directed differs.

French primarily studies how unprecedented amounts of human-driven change in habitats and ecosystems affects the physiology of the Galapagos marine iguana (*Amblyrhynchus cristatus*), Bahamian rock iguana (*Cyclura cychlura*), side-blotched lizard (*Uta stansburiana*), and another reptile, the wandering garter snake (*Tamnophis elegans*).

Although other wild animals are also challenged by habitat change, several traits make these reptiles particularly good subjects for this research. The lizards and snakes are prevalent in different environments, although the Bahamian rock iguana is among the world's most endangered creatures. There are natural variations in the populations, which makes them better suited to this kind of research than captive lab animals that are typically bred for specific traits and to minimize variations. Their hormone responses are much like human responses to stress. In addition, they are highly territorial, making it relatively easy to locate the same individuals on repeated visits.

"These lizards are plentiful and very territorial," French said. "When we see one on a rock, it will be there or very nearby when we come back in a month or more. We can track them and



“NATURAL” WORLD

that allows us to monitor the lifetime reproduction of individuals.”

Those lifespans vary widely, with the side-blotched lizards living just one or two years, as opposed to their tropical cousins that live into their 70s. Typically, scientists studying wild animal populations count individuals in an area, identify genders and may record observations about physical condition. In trying to understand the her subjects’ responses to stress, French and her team also capture individual animals and record their body mass, take blood samples and ultrasound females to see the number and size of their eggs.

When it’s time for field work, the research team trades lab coats and pipettes for outdoor gear and fishing rods outfitted with nooses of fishing line or dental floss. The side-blotched lizards are especially abundant and French’s team sometimes captures lizards to bring back to the lab for more controlled studies. They are especially interested in how stress affects the ways animals’ use their limited energy in terms of reproduction and immunity.

“We can collect them and we’re not removing an endangered species from its environment,” French said. “We can manipulate their





temperatures, environment, and simulate urban pressures. We study reactions to noise, predators and temperature changes.”

French studies side-blotched lizards at six sites in and around St. George, in southwestern Utah. Half the sites are urban and half are rural. The most recent U.S. Census shows the metro area, which includes St. George, Washington City, Santa Clara and Ivins, was fifth in the nation for growth with the population increasing from 147,800 in 2013 to 151,948 in 2014 – a 2.9 percent increase. That trend has been steady, with the area ranking among the top 10 fastest growing cities for the past decade.

French found in 2009 that when she went to southern Utah to establish non-urban field sites, the wide open areas she envisioned were already being used by humans. She found people on ATVs, cattle grazing, geocachers coming through, campers, bikers and hikers. She wonders what effect this new ‘natural’ will have on animals when human contact becomes almost inescapable, especially because it’s not in the lizards’ nature to leave their territory. Another driver of population dynamics she is interested in is water availability. Preliminary evidence suggests differences in precipitation from year to year influence the lizards’ physiology.

Her team has found that when compared with rural side-blotched lizards, urban lizards have larger egg clutches both in size and numbers of eggs.

“Maybe that is because they have more resources available and can use energy for reproduction, but immunologically they don’t do as well and their survival rate is lower,” French said. “It may be they are investing more energy in reproduction and less in themselves.”

French added that it’s important to note that the lizards she studies are generalists that do well in urban environments. But it’s important to note that not all species can live in an urban environment. We can’t study them because they’re just not there.

The research team uses an integrated approach to examine how different animals cope with competing demands for their energy, integrating methods of studying endocrine and immune function, behavior and energy use to determine the role energy plays in regulating these interactions. Their methods provide physiological information about the condition of the whole population more rapidly than some other methods because they are not waiting generations to see changes emerge.



Biologist Susannah French, recipient of a 2014 National Science Foundation Faculty Early Development Award, (photos far left and center) and colleagues ultrasound a marine iguana as part of their effort to determine how human activity may impact reptiles' stress responses, reproductive success and immune functions. French studies reptiles in the Galapagos, Bahamas and southern Utah.

Utah high school students from Venture Academy in Weber County and home-schooled students near the St. George study site (photo above) joined researchers for field work examining side-blotched lizards.

(Photographs courtesy of Susannah French)

The Bahamian rock iguana French studies in a collaboration with the Shedd Aquarium are long-lived, but it's clear that increasing development is changing their behavior and, consequently, their physiology. Iguanas one might expect to be skittish about human contact actually approach people on the beaches like dogs begging for food. The researchers are especially interested to see the effects this change has on the iguanas' bodies because they are fed grapes and other foods that are much higher in sugar than the leaves and grasses in their normal diet. In addition, changes in their body temperature may have an effect on immune function.

"The immune system in reptiles tends to perform better at lower temperatures," French said. "Some of these rock iguanas stay out all day while it's very hot looking for food as opposed to being in the forest canopy where the shade would bring their temperatures down."

French says that while human pressures change animals' physiology and behavior, managing the creatures and human activity requires a balancing act.

"It may be not an entirely bad thing to have human contact in some places," she said. "Having people see them brings in

money, raises awareness about the iguanas and may help the species as a whole. It's a balancing act. The Bahamas is not a wealthy country so it's hard to say development has to be all or nothing. Hopefully we can figure out when they are less susceptible and perhaps help educate people and limit where the iguanas can be fed."

Closer to home, the study of garter snakes in northern Utah's Cache Valley allows more student researchers to gain experience doing field and lab work. Among the things French's team is investigating is how human-introduced toxins in the environment may affect the snakes because their place in the food web means they eat rodents that have eaten insects that have likely ingested pesticides, each step concentrating the amount of toxins.

These populations of reptiles are far removed from each other, but the common questions about how they use their energy and how that affects them as individuals and groups will provide important insights into how they and their human neighbors will be able to coexist.



Economics & Public Lands

By Paul Jakus

Thirty years ago

I served as a Peace Corps Volunteer in West Africa. I suddenly found myself—just a kid from Nevada—thrust into new experiences almost every day for two years. I learned a new language, ate new foods, and experienced a fundamentally different way to structure families and society. In short, living overseas taught me how thoroughly American I am.

I missed many things about my home country while living in Africa, but what I missed most desperately were the wide open spaces of the American West and its public lands. As a young adult, my initial interest in public land came as my friends and I drove lonely highways in search of new places to climb rocks.

Of course, public land gives us more than recreation opportunities. Public land provides forage for our livestock, minerals and energy to fuel our modern lifestyles, and the ecosystem services needed to maintain clean water, healthy forests, and abundant wildlife. Public lands contribute jobs and income in our state, especially in our rural communities, as well as providing unspoiled scenery that can soothe the soul.

Today when I drive the highways of Utah I have a much greater appreciation for public land and all that it gives us.

But how do we balance all of the uses for which we can manage our public lands? Recent research with colleagues at the University of Utah and Weber State University has revealed information that may help policymakers make better management decisions about public lands. For example,

- Federal ownership of land is not unambiguously good or bad for Utah's counties. The federal government provides job and income growth in many rural areas, though the positive impact of federal land ownership begins to diminish when it owns "too much" land.

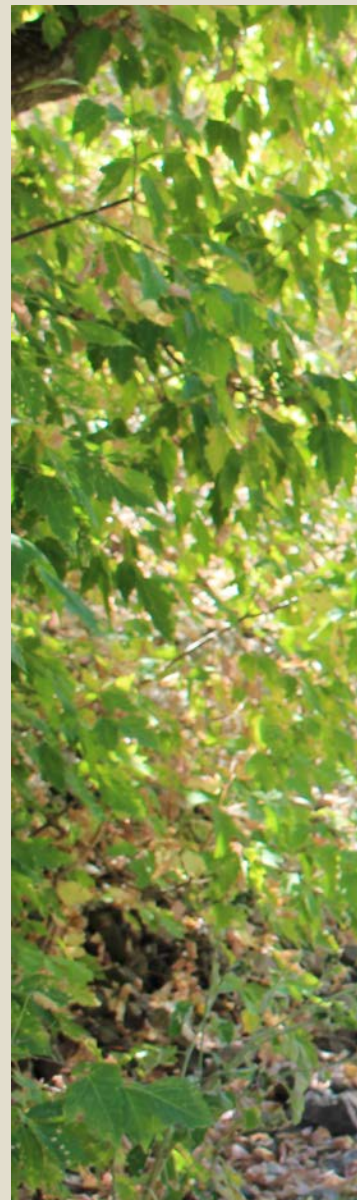
- Similarly, state ownership of public land is not unambiguously good or bad for economic growth. Our models suggest that increasing state ownership of public land—in some counties—may increase growth rates. Further,

economic growth is faster where state lands are found in larger, more contiguous units rather than a series of small, scattered parcels.

- Outdoor recreation is a steady economic driver. Counties that have managed to leverage recreation assets into their local economic structure benefited from accelerated population, job, and income growth.

While the debate over public land management is often framed as "resource use" vs. "recreation use," our modeling indicates this is a false dichotomy. Counties with diversified management of public land across multiple uses enjoyed stronger economic growth relative to counties that rely upon only one economic sector.

Today when I drive the highways of Utah I have a much greater appreciation for public land and all that it gives us. My hope



“ I missed many things about my home country while living in Africa, but what I missed most desperately were the wide open spaces of the American West and its public lands. As a young adult, my initial interest in public land came as my friends and I drove lonely highways in search of new places to climb rocks. ”

is that conversations about how best to manage public land can move away from the false tradeoffs that characterize much of the current debate and recognize that

an efficient, diversified approach will lead to greater economic vitality in regions with large amounts of public land.

 **Contact Info:**

Paul Jakus
Paul.Jakus@usu.edu



Photo by Cassidy Woolsey

Professor Paul Jakus was part of a team of researchers responsible for an extensive study on the economic implications of different scenarios for managing public lands in Utah.

UtahState University

Utah Agricultural Experiment Station
4845 Old Main Hill
Logan, UT 84322-4845

Nonprofit Org.
U.S. Postage

PAID

Permit 1
Logan, Utah

