Is fire bad?
The department is very pleased to welcome, beginning this semester, Dr. Guido Cervone (see the story on page 8). Dr. Cervone has been recruited as an associate professor with the department’s strong recommendation being supported by the Institute for CyberScience (ICS) and the College of Earth and Mineral Sciences (EMS). Many department faculty and staff, along with administrators across campus, contributed to this success—thanks to all!

ICS and EMS support is ensuring the creation of a new cluster of advanced expertise in the cyberscience of the earth, atmospheric, and geographic sciences. It’s an innovative area that is developing new data- and computation-intensive techniques to address critical problems, with alignment to major national initiatives such as EarthCube and Cyber-Enabled Sustainability Science and Engineering (CyberSEES) at the National Science Foundation.

Our department’s expanding activities and leadership in “Big Data Geography” extends to numerous faculty members and students. This coming summer we will be joined by Dr. Clio Andris, a new faculty member in GIScience whose expertise includes social network theory and analysis, among other areas. Dr. Andris is currently completing a post-doctoral fellowship at the Santa Fe Institute. Various other faculty (e.g., Alan MacEachren, Donna Peuquet, Alex Klippel, and others) and students are integrally involved in the campus-wide Big Data Social Science/BDSS IGERT that is now in its second year. This IGERT brings together faculty and graduate students from across departments for the purpose of advanced training.

Taking advantage of “Big Data” opportunities will require understanding not only the scientific dimension, but also the ethical, legal, policy, governance, and social issues. It’s also triggering a vibrant wave of new research and learning related to the integration of diverse research methods and techniques.

A simultaneous surge of still other growing department strengths and potential future ones is continuing to heat up (no pun intended!). The fire ecology and pyrogeography group whose interview appears on pages 4–7 of this newsletter—Jennifer Balch (JKB), Erica Smithwick (EAHS), and Alan Taylor (AT)—is fueling a department emphasis without parallel in this area. Future prospects in other areas include environmental governance focused on urban and water issues, ethical issues (e.g., climate justice, big data, and geographies of care), and water science.
A full house at Petra Tschakert’s Coffee Hour lecture. View the spring 2014 Coffee Hour schedule at: http://www.geog.psu.edu/news/coffee-hour, and remember, if you cannot attend the weekly coffee hour in person, the department offers Coffee Hour To Go as a webcast you can view live or at a later time.

The E. Willard and Ruby S. Miller Lectureship in Geography will bring Ann Bisantz, professor and chair, Industrial and Systems Engineering at University at Buffalo, The State University of New York, to Penn State on on March 28, 2014. The Millers are pictured at left during a horseback riding trip in Mexico. Photo courtesy University Archives, Special Collections Library.

Penn State alumni and friends will meet up once again during the AAG meeting in Tampa, Florida. Please join us at the Champions Sports Bar in the Tampa Marriott Waterside on April 10, 2014. For more information and to let us know you will be coming, visit: http://www.geog.psu.edu/aag-reception. RSVP by April 1.

The annual Recognition Reception honors the achievements of students, faculty, and staff and welcomes our alumni, friends, and benefactors. 2013 Jeff Gockley Memorial Award recipient Katherine Meckler is pictured with the Gockley family, who presented the Jeff Gockley Memorial Award. This year’s Recognition Reception is scheduled for May 2, 2014. Watch for your invitation to this special event.
Is fire bad?

The number of large and severe wildfires in the United States has more than doubled in the past decade, even while there has been a decline in all fires over the past three millennia, and passive and active suppression of fire during the last two centuries. In the U.S., the Forest Service and Interior Department spent about $1.7 billion last year fighting fires, a $500 million increase over the previous year and double the average amount spent a decade ago. What is causing this increase in such destructive fires? What are the long-term effects on ecosystems and climate? Can and should we do anything about it? Is fire bad?

A trio of pyrogeographers at Penn State—Jennifer Balch, Alan Taylor, and Erica Smithwick—and their students are conducting research on fire and landscapes and ecosystems to find some answers to the dilemma of how humans can more effectively manage our complex relationship with fire.

Briefly describe your areas of focus and interest in comparison with each other.

JKB: My research explores the diversity and distribution of fire, and consequent ecosystem response to shifting fire regimes. My work aims to address the following major unsolved questions: What is fire’s role in the Earth system, and particularly the climate system? How are fire regimes altered by invasive species? How is the unprecedented increase in human-initiated fires altering tropical forest dynamics?

EAHS: I am interested in fire patterns at ecosystem to landscape scales and how fire modifies biogeochemistry, particularly carbon and nutrient cycles in forested systems. I use observational, laboratory, and ecosystem modeling approaches to understand how past fire influences current patterns in ecosystem function (everything from microbes to landscape carbon budgets) and predict these effects into the future under climate change. Like Jennifer, I am interested in the conditions that produce novel fire patterns.

In addition, I am interested in contextualizing these patterns based on the work that Alan does, as well as thinking about how multiple disturbances (for example, bark beetles and fire) interact and whether we are able to capture those dynamics in models.

AT: My fire research is focused on the spatial and temporal controls of fire regimes, particularly the influence of fuels and vegetation, land use and climate variation. In comparison to Erica and Jennifer, I tend to use a more historical approach that often involves...
techniques such as tree ring or charcoal analysis to capture variability in fire regimes over periods of centuries to millennia. I am also interested in how knowledge of vegetation structure, fire behavior and spatial controls on fire regimes can be used to assist managers in designing effective landscape strategies to reduce fire risk and fire hazard in landscapes prone to severe fire.

**What is your assessment of the current fire regime in the western United States?**

AT: There is high fire hazard in lower-elevation forests that once burned frequently but are now more dense because of fire suppression. This means these forests are likely to burn at high severity. High-severity burns can result in long-term vegetation shifts from trees to shrubs in some areas. I expect a bad fire season in California this summer because of severe drought, as well as in the southwest which has been under an extended drought. Under severe drought most forests have the potential to burn—even those at higher elevation—in fact, extreme drought conditions are about the only time high-elevation forests in the western U.S. will burn.

EAHS: The current fire regime in the western U.S. is very severe; the fires are much more extreme than in the past due to a combination of fire suppression and severe climate conditions. Some places, like Yellowstone, are adapted to severe, stand-replacing fires (when the trees are killed), but have mechanisms in place for rapid recovery, and so fire suppression has had a minimal effect. This is very different than many places in the U.S. however, where frequent fires were more common historically but fire suppression has drastically modified fuel loads. Our models project that the climate conditions that produce these fires are likely to be more common in the future. Our results suggest these novel fire-climate relationships could have significant consequences for vegetation in the region.

JKB: Increased spring and summer temperatures and an earlier spring snowmelt in the western U.S. have led to increased frequency of large wildfires and longer wildfire seasons. Current fire patterns look like they’re departing from historical patterns. And this appears to be a global syndrome. Large wildfires may be a warming sign that something bigger is happening. Changing fire regimes may be a global phenomenon, not isolated disasters.

**Is there a positive feedback loop between severe fire and climate change?**

AT: There could be in some parts of the western U.S. I am familiar with. In these places, if warming and drying promote more severe forest fires, forest will be replaced by shrublands. When shrublands burn they tend to be replaced by shrubs again. If this kind of vegetation switching occurs over wide areas, it can influence the ability of vegetation to sequester carbon taken up from the atmosphere—hence the feedback. There is emerging evidence of this kind of vegetation switching in recent severe fires in California and Oregon.

EAHS: Severe fire that deviates from historical patterns could lead to net carbon losses to the atmosphere, which could have a positive feedback because enhanced carbon in the atmosphere will lead to warmer temperatures that promote more fire. The largest changes will be if forest vegetation cannot recover from fire and instead is replaced by lower-carbon-storing shrublands and grasslands. While the carbon cost of this transition would be high, ultimately these systems would produce fire cycles that are less severe due to lower fuel loads, which could ultimately be a negative feedback. Although each shrubland fire would release less carbon to the atmosphere, the total carbon lost caused by the forest to shrubland transition is more important in terms of net carbon stocks.

JKB: A positive feedback between climate change and biomass burning is plausible given the direct impact of fire on biogeochemical cycles, particularly carbon fluxes. Nonetheless, it is widely assumed that, at the global scale, long-term (i.e. decadal to longer) effects of fire on carbon fluxes are largely cancelled by vegetation regrowth following fire. However, with rapidly changing climates and large social and industrial changes, this assumption may be increasingly (and dangerously) wrong. We can look at past climate and relationships with charcoal deposits to reconstruct climate-fire interaction. In a study of North America, charcoal data show that climate plays a substantial role in determining the major levels of fire activity.

**What is the role of natural fire in the ecosystem and how is it different from human-caused fire?**

EAHS: The entire study of pyrogeography is trying to address this by recognizing that fire is uniquely adapted to its environment (fuels, climate) and to unravel how the patterns in fire are caused by shifting human use of the landscape versus changes in these other factors. We know people have used fire for over 300,000 years and that it is fundamental to maintaining many systems in the natural state that we recognize

**CONTINUES on next page**
for them (e.g., savannas). In the absence of fire, these systems would fundamentally change. But, it’s important to recognize that there is a gradient in the degree to which humans have modified ignitions as well as the degree to which this modification deviates from the natural fire cycle. In other words, the impacts of human fire modifications is different in different places.

JKB: Humans and their ancestors are unique in being a fire-making species, but natural (i.e. independent of humans) fires have an ancient, geological history on Earth. Natural fires have influenced biological evolution and global biogeochemical cycles for several hundred million years, making fire integral to the functioning of some biomes. Globally, debate continues about the impact on ecosystems of prehistoric human-set fires, with views ranging from catastrophic to negligible. Understanding of the diversity of human fire regimes on Earth in the past, present, and future remains rudimentary. It remains uncertain how humans have caused a departure from natural background levels that vary with climate change. Available evidence shows that modern humans can increase or decrease background levels of natural fire activity by clearing forests, promoting grazing, dispersing plants, altering ignition patterns and actively suppressing fires, thereby causing substantial ecosystem changes and loss of biodiversity.

AT: Geography really matters in answering this question. People have greatly increased ignitions above background levels for their particular purposes. For example, evidence of natural fire before the Polynesians arrived to New Zealand is scant. Upon arrival, they used fire extensively to clear forests and maintain the types of vegetation they wanted. The human-caused fires were clearly different than the relatively infrequent background fires that occurred in this environment. On the other hand, in highly fire-prone dry pine in the West, lightning ignitions are so abundant and fires spread so easily that it is difficult to distinguish ignitions that would be from lightning or people in the historical record.

In your most recent research, what findings have surprised you the most?

JKB: We provided a first estimate of fire’s contribution to the climate system. Surprisingly, fire influences the majority of the components that change global mean temperature. But more importantly, this review is a consensus view of the importance of fire in the Earth system by some of the world’s experts.

EAHS: We really thought, after decades of field and modeling work in Yellowstone, that it was resilient to severe fire. It seems like the vegetation is adapted to it, and that it has successfully withstood severe fire through the Quaternary. We also have documented that the system is able to recover all its nitrogen and carbon before the next fire cycle. However, projections of future fire portend a very different story—that fire cycles could be ten times more frequent (going from 300- to 30-year fire cycles in some places). While we hope our model predictions bound the upper levels for expected change, it is clear that changes in fire regime are more likely than not to affect vegetation in the region. To say that Yellowstone is not a resilient landscape is quite surprising, and not a result we expected.

AT: Two things come to mind. First, the importance of temperature in driving variability of long-term fire activity. Our multi-century tree ring records of fire activity in the Sierra Nevada and other parts of the West show that fire activity increases when it is warm and decreases when it is cool. This pattern even holds during the last 100 years when fires were being suppressed. This clearly points to more fire under global warming. Second, the importance of the physical template, or terrain, in influencing vegetation patterns, and spatial patterns of fire severity and fire effects. Terrain effects tend to promote patterns of fire severity that are repeated in space over periods of at least centuries. This has important implications for biodiversity and how pyrodiversity may beget biodiversity across landscapes.

What research-based practices for preventing or responding to severe wildfires can forest managers adopt now?

EAHS: Certainly efforts should be in place to prioritize fire protection around important structures and places, and efforts need to be increased to educate people on firewise activity (reducing fuel loads around homes in fire-prone areas, for example). In addition, models can be used to prioritize those areas that are most vulnerable to shifts in fire and climate. In some areas, fuel reductions may not be a good way to manage the landscape if fires are driven more by climate than fuel; in other areas, some fuel reduction treatments may be appropriate. Finally, managers should consider what a resilient landscape should look like in the future and expect that that landscape may be a dynamic one and include different patterns and processes than today. Easing ecosystems through dramatic transitions may be a more efficient path than preventing the changes that are surely coming.

AT: We know a lot about how to manipulate vegetation to alter
fire behavior. Managers are using this knowledge mainly in areas where there are high values at risk and where there is a hazard of high-severity fire. Areas of focus for these treatments are usually around communities that border or are surrounded by highly flammable vegetation. These treatments will work, but one of the challenges is that they have to be maintained to continue to be effective. These treatments have a natural lifespan because vegetation grows back. A one-shot approach does not get you very far, and managers are having to grapple with the increased emphasis to treat more area and keep up with what they have already done. The spatial scale of the fuel-fire hazard problem is enormous—even geologic, making progress difficult.

What are the most pressing research questions that need to be investigated and answered?

EAHS: How multiple disturbances interact over time and space. We need to develop observational studies and models to explore how these processes interacted in the past, how they are patterned now, and how they are likely to interact in the future. Tipping points in landscape function are likely to be a product of these interactions rather than a result of a single disturbance event. We also need to understand how spatial tools such as remote sensing can be used to quantify these patterns at regional to global scales and to integrate them into global scale models that include feedbacks from terrestrial systems to the atmosphere.

JKB: We need to turn our attention to the effects of altered fire regimes in the Earth system. This requires better understanding of the diversity of human fire use, especially possible positive and negative feedbacks across a range of scales. This demands integrative, multidisciplinary perspectives on landscape fire, its ecological effects and relationships with human societies, spanning geographic scales from the local to the global, whilst retaining an ecological and evolutionary frame of reference. Comparative studies of past and current human influences on fire regimes amongst biomes are required to identify excursions from the historical range of variability, a key step in identifying locally sustainable and unsustainable human–fire relationships. An understanding of different cultural traditions and political (local to global) influences in the management of fire is essential for evaluating the costs and benefits of contrasting fire regimes within individual landscapes and biomes.

AT: There are several. From the standpoint of dealing with the fire problem, optimal landscape strategies need to be designed that significantly reduce fire behavior across landscapes. We need to understand how variation in treatment type, treatment area, and spatial arrangement would affect fire behavior over large areas. This is an inherently geographical problem which needs focused work so that prescribed fires or wildfires can be used over wide areas to do the things we want them to be doing. We also need fundamental research on people’s attitudes about fire, how they develop, and how they could be changed if fire is going to be widely used as a tool to reduce fire hazard and manage natural resources.

Alan Taylor studies repeat photography at a GLO survey marker in Lassen Volcanic National Park in California. Photo provided by Alan Taylor.
How did you first get interested in applying your research methods to the problems of environmental hazards?

GC: While growing up in Rome, Italy when I was a child, I was exposed to many environmental hazards including several strong earthquakes—Italy is very seismic—and extreme weather events. I particularly remember living through the nuclear radioactive contamination from the 1986 Chernobyl accident, which extended all the way to parts of Southern Europe. Living first hand these potentially life-threatening events sparked an interest that I retain to this day.

Throughout my studies I have always considered studying hazards paramount for the development and sustainment of our society. Perhaps, the turning moment in my career was in 2002 during my second year Ph.D. studies, when I attended a NASA presentation about remote sensing. Up until that moment, I worked on the development of spatio-temporal machine learning algorithms, but predominantly applied to synthetic computer-generated data. Learning that it was possible to observe the entire planet with high spatial and spectral resolution daily was love at first sight! From that moment I started studying remote sensing, and using my machine learning background to find anomalies and similarities in the data.

Imagine the future of how geoinformatics and machine learning would be used in managing environmental hazards: what does it look like?

GC: In recent years, the advances in our ability to observe Earth and its environment through the use of air-, space-, and ground-based sensors has led to the generation of large, dynamic, and geographically distributed spatiotemporal data. The rate at which geospatial data are being generated exceeds our ability to organize and analyze them to extract patterns critical for understanding our dynamically changing world. New challenges arise from an unprecedented access to massive amounts of Earth science data that can be used to study the complementary nature of different parameters. These developments are quickly leading towards a data-rich but knowledge-poor environment.

Geoinformatics algorithms are needed to address these scientific and computational challenges and provide innovative and effective solutions to analyze these large, often multi-modal, spatiotemporal datasets. The ability to generate knowledge in near-real time, analyzing massive amounts of data, can help at all stages related to natural hazards. At the planning stage, geoinformatics algorithms can help quantify the risk of constructing a particular facility, or determine where to...
locate sensors to detect signs of an accident or an impending event. Geoinformatics can also be used during an event, to provide real-time knowledge to first responders. Data fusion is a particularly active area of research, where observations from different sensors are processed to give better estimate of a developing event. Finally, geoinformatics can help after the occurrence of disasters to improve upon predictive models that can help protect people properties and the environment.

*Can you give a specific example of how volunteered geographic information fills in the gaps or mediates the weaknesses in remote sensing data and vice versa?*

**GC:** Remote sensing is the de-facto standard to observe and study Earth. However, observations are limited due to revisiting time of satellites and physical constraints dictated by Earth’s atmosphere. Using polar satellites—those that orbit closer to Earth’s surface and are particularly indicated for high resolution observations—it is impossible to acquire a continuous data feed for a particular location. Furthermore, atmospheric opacity may cause observations to contain missing data relative to the surface of Earth. Therefore temporal gaps in the observations are inevitable.

Volunteered Geographical Information (VGI) can be used to augment the satellite observations, and fill the temporal gaps where data was not collected. Merging VGI and remote sensing data is a difficult data fusion problem, where the high-spatial and low-temporal resolution observations from satellites are fused with the low-spatial and high-temporal resolution from VGI.

The difficulty in fusing the data is further exacerbated by the fact we are merging two very different datasets: one objective and based on physical observations from an electronic instrument, and another one subjective and based on the perception of people of a particular event.

*In your career so far, what deliverable or outcome are you most proud of?*

**GC:** Perhaps what I am most proud of is the reconstruction of the non-steady source release from the Fukushima nuclear disaster. I have created with my colleague Pasquale Franzese a new machine-learning-based methodology that uses satellite, in-situ observations and numerical atmospheric modeling to reconstruct the nuclear release. We have published our work, and based on it, I received in 2013 the Medaglia di Rappresentanza from the President of Italy and the Italian Scientists and Scholars of North America Foundation (ISNAAF) award.

*Can you talk more about the use of geoinformatics for the optimization of numerical model forecasts for wind energy power production?*

**GC:** Optimizing weather forecasts for energy production is a very important and exciting research topic which I have recently started investigating as part of my association with the National Center for Atmospheric Research (NCAR) in Boulder, CO. Large uncertainty in model predictions for parameters such as solar irradiance or wind speed can cause a deficit between the demand and supply of energy from solar and wind power plants. It is very important to reduce this uncertainty by improving the models, but also output probabilistic measures associated with the predictions. The analog ensemble methodology developed at NCAR was designed precisely to output probabilistic forecasts that the power company can use to assess the risk of under- or over-producing electricity.

*Is there a relationship between your passion for sailing and your work?*

**GC:** I believe sailing is the most fun activity known to man! I have been sailing ever since I was very young, and especially in recent years I have been active in racing on big and small boats. Whereas I considered sailing a hobby and often an escape, a lot of the concepts that I research and teach about are very handy when racing and cruising.

On some occasions I have run my own atmospheric wind models before major races, and performed sensitivity studies to understand the likeliness of wind shifts in power and direction. However, the most relevant work I did for which I merged my passion of sailing with my research activity is in an article that appeared in 2013 in the *International Journal of Remote Sensing*. I investigated the relationship of Sea Surface Temperature (SST) acquired by different satellites and models with in situ measurements I performed while transporting a boat from Bermuda to the USA. My goal was to determine if it is possible to have better estimation of the location of the Gulf Stream by merging in situ data with satellite observations.

*See CERVONE on page 14*
Steve Norman (Ph.D. ’02) is a research ecologist with the USDA Forest Service Eastern Forest Environmental Threat Assessment Center in Asheville, North Carolina, where he monitors, assesses, and predicts wildfire threats to forests at landscape and national scales.

Norman says childhood experiences in rural Pennsylvania influenced his love of trees and eventual decision to study pyrogeography and climate change. His father was a volunteer firefighter. “I recall riding through areas that had burned hotly in the past. Seeing those burned over areas gave me longing—they made me value what once had been, and what could have been, had more care been taken. I long ago moved beyond thinking of fire in simple terms, but that feeling of landscape nostalgia can never go away, nor can my sense that if people care more about their forests, we will all be better off.”

Geography teachers in high school and at Mansfield University inspired him to apply the process of scientific discovery to answering questions related to those values. “That led to my master’s thesis on how Midwestern forests changed after the wholesale removal of fire, feeding my early sense of fire as a manageable human phenomenon,” he explains.

“When I began working in interior California for my Ph.D. (advised by Alan Taylor), I experienced a very different fire regime: one that thrived on its own at evolutionary time scales; one that was fed by nuances of climate and history in ways that we were just starting to discover. Back in the mid 1990s, the West was just beginning to realize that the return of landscape scale wildfire was inevitable. Our program of research supported this conclusion while addressing the need for putting more fire on the ground to prevent loss. My postdoctoral work in the coast redwoods showed how human aspects of fire regimes follow complex gradients, much like they do here in the Southeast. Having lived in such different places prepared me to think about fire in powerful ways.”

Although as a graduate student he had aspired to teach at a university, Norman says his research and field work introduced “some profound societal and environmental challenges that government service plays a key role in mitigating, if not solving. In Forest Service Research, we play an intermediary role between those that implement work on the ground, the public, and the broader research community.”

“Now, my research unit works with a broad range of collaborators on several projects. One involves science support for the development and implementation of the National Cohesive Wildland Fire Management Strategy, which is a new cross-jurisdictional initiative to sustain fire-adapted landscapes and human communities while making wildfire response more effective. In addition, as part of the ForWarn satellite-based monitoring and assessment team, we’re charged with detecting and tracking the effects of climate variation and disturbances on the forests of the U.S. This big-data coarse-filter project gives everyone...”

See NORMAN on page 13
Devin Yeatman takes a short break after a burnout operation during the September 2012 Mustang Complex, a fire in the Bitterroot Mountains on the Idaho-Montana border. Photo by Josh Tereszkiewicz.

“We need to understand how our changing climate will affect future fire regimes”

During the spring, Devin Yeatman (B.S. ’07) works for The Nature Conservancy as a burn crew supervisor in South Carolina. During the summer, he works for the Department of Interior on the Chena interagency hotshot crew in Alaska.

In South Carolina, Yeatman explains, they typically conduct 20 to 30 controlled burns every spring (January to April), primarily to encourage the propagation of longleaf pine, a fire-dependent species. “The job is pretty dynamic, which I really like. We have work sites all over the state so we stay busy scouting out units, prepping control lines, and burning the properties. I have a few hours of paperwork to do every couple weeks but other than that, I’m able to work outside almost exclusively.”

In contrast, his summer (May to October) gig “focuses exclusively on wildfire suppression. We work in steep, mountainous terrain putting firelines through a variety of fuel types. It is an extremely arduous job where you work 16 hours a day for two weeks at a time before getting any days off, Yeatman explains, “But the travel, camaraderie, and adventure are unparalleled.”

Yeatman recalls what led to his interest in geography and eventually, firefighting. “I was always sucked into my Rand McNally kids road atlas, even when not on family trips. I was able to use my imagination and vicariously live through the maps, picturing what the places were like. As a high schooler, while pondering what I should study in college, I figured ‘hey, I like maps and I like working outside, so why not geography?’ After visiting Penn State, it was a done deal. Penn State had the best program in the country, along with the environment that we all know and love.” Yeatman credits Alan Taylor with first exposing him to the world of wildfire and spurring his interest in that field. “Between the summer dendrochronology internship he runs every year and his two courses in biogeography and forest geography, I was sufficiently motivated and interested in the subject matter to pursue it after graduation.”

During a post-graduation summer internship doing forestry work in central Oregon, Yeatman experienced wildfires that “blew me away,” he says. “Growing up as an East Coaster, I had almost no exposure to wildland fire. It was something completely foreign to me, so cool and new.”

Now both preventing and suppressing wildland fire is his career. Both kinds of work present
Most people instinctively move away from fire. Ph.D. student Catherine Airey is trying to move closer to it.

Specifically, Airey is investigating how fire affected the Sawtooth Mountains in Idaho before Euro-American settlement (around 1850) and how and when this settlement changed the area into what it is today. To do this, she examines fire scars in living trees and dead stumps, “to find out how often fires burned, at what time of year, and during what kind of climate pattern.” Ultimately Airey hopes the knowledge she gains, “will support decision makers in identifying and achieving restoration goals and preparing for climate change while minimizing costly inaction and destructive mistakes.” This work is supported logistically and financially by the Fairfield Ranger District of the Sawtooth National Forest.

Airey’s journey toward fire research began with a B.A. in Biological Sciences from Northwestern and an M.S. in Ecology from Penn State. Along the way she had an internship at Avon Park Air Force Range in Florida that is home to fire-dependent plant and bird species. As Airey notes, “The species thrive there due to [the] frequent fires accidentally ignited by training missions in the past and continued today by an active prescribed burn program.” Eventually she migrated to Yosemite National Park and worked with fire ecologists and managers to reverse the region’s history of fire suppression. The contrast between these two experiences led Airey to her current research, which has its own challenges and difficulties.

“There is urgency because long-unburned forests can become increasingly susceptible to destruction in severe fires,” she says, adding, “With increasing time since fire, it becomes more difficult to interpret how the burned forests once looked and how fire functioned in the ecosystem. It becomes more difficult to reintroduce fire in a desirable way. And none of that begins to address concerns about increasingly severe droughts and weather patterns that are predicted to occur as a result of climate change.”

Despite its reputation, fire can actually be beneficial or even necessary. The Nature Conservancy estimates that about half of terrestrial earth is covered by fire-dependent ecosystems, defined as “ecosystems where most species evolved in the presence of fire, and where fire is an essential process for conserving biodiversity.”

Airey explains that a variety of species, including the majestic sequoia, rely on fire to eliminate competition and burn off surface litter. Others have developed characteristics in response to the flames, such as thick bark, serotinous cones, heat-germinated seeds, and high branches. In addition, many low-lying plants sprout and thrive after fire has cleared the dense underbrush from the surface. Forests that contain this type of diversity need periodic cleansings to maintain the overall health of the ecosystem. This is where fire can come in as an important and necessary tool for preserving the natural balance of our world.

Over the past several years this balance has increasingly been affected by the Wildland-Urban Interface, or WUI. Basically, the WUI is the boundary between nature and the built environment. This boundary is increasingly intruding into forests and other wildlife areas, and the push outward has generated a variety of problems. As Airey notes:

“The Wildland-Urban Interface, WUI, is a big, expensive, and sometimes dangerous problem that is only increasing with development. Protecting homes during wildfires is very costly. People who choose to live in fire prone areas should take steps to equip their residences accordingly. These steps include things like fire resistant roofing materials and properly maintained landscaping that is removed from the house.”

Ultimately the issue of WUI helps illustrate what drew Airey to fire research in the first place, and why it’s so important: “Simply preserving land is not enough to preserve species diversity. It is important to also preserve or mimic the processes that maintained the biodiversity.”

Fire is one of those processes, and by studying it Airey hopes to learn how our past and present can influence our future. Along the way she is trying to learn the best way to manage this dangerous but beautiful force of nature.
The biggest challenges society faces with regard to wildland fire and forest management involve understanding how everything works at the landscape scale and above, Norman says. “It’s at these broader decision scales that conflicts and tradeoffs get in the way of finding collaborative solutions. And the need isn’t so much tackling what we don’t yet know—endlessly addressing those ‘known unknowns’ that science is so good at—or even scoping out those theoretical ‘unknown unknowns.’ Instead, the pressing need is to come up with better ways to negotiate critical ‘known knowns’ among diverse stakeholders. This attention to scale and the need for social and environmental integration is geography at its core.”

**YEATMAN from page 11**

different challenges, in addition to the physical demands. “While working for The Nature Conservancy, the biggest challenge stems from the fact that there’s a lot of responsibility inherent in putting fire on the ground. We need relatively specific windows (humidity, winds, etc.) to burn the various properties and have to constantly adjust to the changes in a dynamic environment. The initial plan is seldom what ends up being used by the end of the day. On the hotshot crew, along with being away from loved ones all summer, probably the biggest challenge is maintaining mental focus and resilience for the long haul (the six-month fire season). When you’re working so hard all the time and beating yourself up, it can be easy to ‘check out’ and stop caring. But you’re part of a team and need to maintain a positive attitude at all times.”

What would make his job easier? Yeatman would like to see researchers working more closely with land managers at all levels of government and in the private arena to develop “stronger, scientifically defensible justifications that increase the proactive management of forests and fuels with prescribed fire and fire surrogates,” he says, adding, “We need increased dendrochronology studies in more varied habitats and geographies so that we can reflect on past interactions of climate and fire. We need to understand how our changing climate will affect future fire regimes.”
UNDERGRADUATE

John Swab won the Freshman Award in the EMS Undergraduate Poster Exhibition and Competition held on December 4, 2013, for his poster “Streetcars: The Start of the Suburbs of Baltimore, Maryland.”

Ariel Alvarez (B.A. ’13) was honored at the fall 2013 EMSAGE Laureates award dinner. She is currently an intern at the National Geographic Society.

GRADUATE

At the 2013 Middle States AAG Annual Meeting in Buffalo, October 18-19, the Penn State team won the Middle States Regional Geography Bowl. The team was composed of grad students Ashlee Adams, Crista Livecchi, Adrienne Tucker, and Jase Bernhardt. Furthermore, Adams, Livecchi, and Bernhardt qualified to represent the region at the World Geography Bowl at the 2014 AAG Annual Meeting in Tampa. Bernhardt also won the award at the conference for Best Student Paper.

Russell Hedberg and his wife Kaitlin announced the birth of their son, Jack Hiland Hedberg, on October 19, 2013.

Aparna Parikh had an article titled “Jane in the Call Center” published in the Critical Planning Journal, UCLA. Additionally, she co-edited the proceedings for a conference titled “The Nature of Spatial Practices” which she had co-organized in spring 2013.

Adrienne Tucker received an American Meteorological Society travel grant to attend the annual meeting of the AMS in January 2014 in Atlanta, Georgia.

Linda Foster’s paper “Development of a workflow prototype utilizing ESRI’s Parcel Fabric” (co-author: Justine Blanford) was accepted in the URISA Journal.

Wei Luo, Peifeng Yin, Qian Di, Frank Hardisty, and Alan M. MacEachren have had a paper accepted by PLOS ONE: “A Geovisual Analytic Approach to Understanding Geo-Social Relationships in the International Trade Network.”

Adrienne Tucker and Jase Bernhardt have been awarded NASA Space Grant Fellowships for the 2013–14 and 2014–15 academic years.

Vincent Ricciardi was one of two recipients of the 2013 M.G. Whiting Student Indigenous Knowledge Research Award.

Jonathan Nelson received a Big Data Social Science IGERT traineeships.

FACULTY AND STAFF

Justine Blanford and colleagues published a paper in PloS Pathogens, “Chemicals, climate and control: Increasing the effectiveness of malaria vector control tools by considering relevant temperatures.”

Cynthia Brewer earned the 2013 Henry Gannett Award from the United States Geological Survey (USGS) for Exceptional Contributions to Topographic Mapping.

Rob Brooks, Alan Taylor, and Todd Bacastow are the principal investigators on a grant renewal with the Pennsylvania Department of Military and Veterans Affairs at Fort Indiantown Gap to assist with the Sustainable Range Program, in the areas of range management, forestry, wildlife, and GIS.

Karen L. Schuckman has been named a 2014 American Society for Photogrammetry and Remote Sensing (ASPRS) Fellow Award winner.

Alan M. MacEachren was named a Fellow of the American Association

Crossing the Gulf Stream in a small boat can be very dangerous, and thus it is very important to have accurate predictions. For the future, I would like to study the possibility of using high-resolution satellite SST observations as an alternative way of navigation in case of GPS failure.

What are your future research plans?

GC: Joining the Department of Geography and Institute for CyberScience at Penn State allows me to continue my line of research while expanding it to new horizons.

I plan to continue working on the development and implementation of geoinformatics algorithms for my two major projects, namely the fusion of remote sensing data and VGI for the study of environmental hazards, and the optimization of numerical models for alternative energy production. For this latter project, I hope to strengthen the collaboration between NCAR and the Department of Geography, hopefully giving opportunities to students to visit NCAR, and take advantage of their impressive computational facilities.

I believe my research is very complementary to that of my colleagues, and I expect to be able to apply some of these algorithms, along with developing new ones, to solve new classes of problems.
Remembering Dr. Frederick L. Wernstedt

As I reflect on the passing of Dr. Frederick L. Wernstedt, I want to note his vital contributions to Penn State’s geography department. Dr. Wernstedt may not have had the high academic profile as his contemporaries, but I believe that his contributions to Penn State’s Department of Geography were just as important. As the Undergraduate Officer, he took on the task of counseling all of us undergraduates. Many of us transferred into the major, uncertain of such a decision. We quite often found ourselves defending our decision to parents and friends. The questions would take form as, “You transferred to what major? Really? What will you do with that? So, you will be a teacher?” Yes, geography was a different kind of choice before the GIS revolution swept aside such concerns. On one occasion, when my father had returned me to University Park after a break in the academic calendar, I suggested that we visit the Deike Building (home of the department before the Walker Building). We walked the floor and by chance Dr. Wernstedt was in his office, working on a map of Mexico. After introductions and general conversation, Dr. Wernstedt said to my father, “Well, your son is in the right major.” That helped with “selling” geography—at least to my parents. Dr. Wernstedt guided us 20 or so undergraduates, gave us confidence, and encouraged us to make the most of the wonderful resources at our disposal in the department, the college, and the broader university. He instinctively knew how to guide us collectively and individually. His efforts to guide and counsel the undergraduates helped build the program and galvanized the loyalty of us undergraduates to Penn State geography.

—Mark Kissel (B.S. ’77)

for the Advancement of Science (AAAS).

Petra Tschakert traveled to North Lakimpur, India, to take part in a consultation workshop on flexible flood management in December 2013. The workshop was part of the Himalayan Climate Change Adaptation Programme (HICAP).

After six years in the Department of Geography office, Kary Isett takes on a new administrative support assistant position at the Dutton Institute, working with the GeoINT and iMPS-HLS programs.

Jennifer Balch was awarded a NASA grant from the Terrestrial Ecology program. The grant is titled: “Understanding Climate and Land Use Drivers of Invasive-Grass Fueled Fires Across the Western U.S.”

Erica Smithwick and Petra Tschakert were elected to serve on the Faculty Senate.

Guido Cervone was awarded a grant from the Office of Naval Research for his research project: Filling Gaps in Remote Sensing Data Using Social Media During CBRNE Emergencies.

Karen Cox joined the department as the bookkeeper.

Karl Zimmerer organized an interdisciplinary symposium on agrobiodiversity and sustainability at the 2014 annual meeting of the AAAS held in Chicago, Illinois.

Barbara Luther, the department’s new undergraduate assistant, begins on March 3, 2014.

ALUMNI

Adria Liszka Reutzel (B.S. ’00) welcomed to a baby boy, William Joseph, into her family on June 11, 2013.

Frank Boscoe (Ph.D. ’00) had his first book published, “Geographic Health Data: Fundamental Techniques for Analysis.” He has a dual appointment with the New York State Cancer Registry and the Department of Epidemiology and Biostatistics and the University at Albany.

Amy Trauger (M.S. ’01) and Jennifer Fluri (M.S. ’01, Ph.D. ’05) co-authored an article in the February 2014 issue of the Professional Geographer. “Getting Beyond the ‘God Trick’: Toward Service Research.”

Steven Lachman (Ph.D.’03) was elected as a State College district judge on Tuesday, November 5, 2013.

Geoff Hatchard (M.S. ’03) started a new job with Apple, working on their Maps programs, in Cupertino, California.

Michael R. Glass (Ph.D. ’07) edited a book with Reuben Rose-Redwood (M.S. ’02, Ph.D. ’06) for Routledge. Performativity, Politics, and the Production of Social Space was released late December 2013. In addition, Lise Nelson contributed one of the chapters: “Engaging Butler: Subjects, Cerment, and the Ongoing Limits of Performativity.”
We are infinitely grateful
to the many wonderful alumni and friends of the department who support our mission and our students through their gifts, endowments, and named funds such as:

BALMAT FAMILY SCHOLARSHIP IN GEOGRAPHY
To support outstanding undergraduate sophomores, juniors, and seniors.

BALMAT HONORS SCHOLARS FUND
To provide monies for the honors program in the department.

ERICKSON FUND IN GEOGRAPHY
To enrich the College of Earth and Mineral Sciences by providing monies to enhance the academic quality and general welfare of students, faculty and staff of the department.

JEFF GOCKLEY MEMORIAL AWARD
To support an undergraduate student in the area of geographic information science.

PETER R. GOULD MEMORIAL FUND
To support the Peter R. Gould Center for Geography Education and Outreach.

C. GREGORY KNIGHT ENDOWMENT IN GEOGRAPHY
To support research, faculty and student travel, equipment, and lectures.

E. WILLARD AND RUBY S. MILLER GEOGRAPHY GRADUATE STUDENT FUND
To encourage graduate study in the department by providing fellowships to outstanding graduate students.

G. D. RICHARDSON AND KATHY LASAUCE UNDERGRADUATE SCHOLARSHIP IN GEOGRAPHY IN THE COLLEGE OF EARTH AND MINERAL SCIENCES
To provide recognition and financial assistance to outstanding undergraduate students enrolled in the department.

If you would like to learn more or make a gift, visit www.geog.psu.edu/about-us/giving-penn-state-geography to see the complete list of endowments and named funds.

Thank you!