Expanding Research Scope
and Emphasizing Impact:
Repositioning the Enterprise
to meet 2020 Goals
Research—the discovery of new knowledge and its application to the world’s most difficult challenges—is core to a public university’s mission. Northern Arizona University (NAU) is justifiably proud of its research accomplishments and unique contributions to our region and continues to expand the scope and impact of those contributions. I am pleased to present NAU’s Research Enterprise Annual Report for Fiscal Year 2011—a year in which we made significant progress in funding, reporting, and impacts.

During the past fiscal year, the Research Task Force of the Arizona Board of Regents identified key metrics for assessing the university system’s progress toward the ambitious enterprise goals for 2020. All three universities—including Northern Arizona University—are working to increase research expenditures to $2 billion, to double the number of Ph.D. recipients, and to increase the generation of new technologies and innovation. New reporting schedules and content for the Regents emphasize the rate of progress on those enterprise-wide metrics. Here on our own campus, we have updated our web-based outreach and given this Annual Report you are reading a fresh new look while emphasizing the impacts of the university’s research. Through photos and descriptions of some of the research activities of NAU’s most exciting scholars, we hope to give you a taste of the diverse and rich flavors of NAU research and service.

As with most public institutions, finding the financial resources to carry out our research and scholarship is a never-ending challenge. During the past year, our researchers made tremendous progress in adjusting to the state of Arizona’s fiscal contraction by turning their sights to federal funding. Our investigators are clearly seeing increased competitive success—federal research expenditures for Northern Arizona University have increased by more than 30 percent over the past two years. The state of Arizona and the Board of Regents continue to offer some support for research and technology development through the TRIF (or Technology and Research Investment Fund) program; during FY2011, we reviewed and revised business plans for the university’s central TRIF initiatives in sustainability and in the biological sciences.
Northern Arizona University’s research and creative activities result in new knowledge and innovation that

- strengthen the outstanding education provided by the university
- foster the continued learning of faculty, staff, and students and
- benefit the environmental, economic, and cultural vitality of our region and society.

Internally, too, we are finding and allocating significant resources for investment. During the past year, a diverse group of faculty and staff reviewed policies and practices related to indirect cost recovery—the chance to recoup from funding agencies part of the expense required to maintain research infrastructure. As a result of our increased success in indirect cost recovery (more than $7.5 million in FY2011), we now have a pilot program establishing a Research Investment Fund. The Vice President for Research is able to use those substantial dollars to provide matching funds for large proposals, employ staff support for sponsored projects in the most research-active colleges, and even subsidize some important new journal subscriptions for NAU’s Cline Library.

Our final resource is the partnership and collaboration we are able to leverage. Whether it is the university’s Enrollment Management and Student Affairs Division helping us provide support for undergraduate research or our external partners, such as the U.S. Geological Survey, T-Gen North, and Science Foundation Arizona, our colleagues help us extend our reach. In these challenging financial times, it is no longer viable—if it ever was—to go it alone. Our collaborators in the region’s communities, agencies, tribes, and other research entities are among our strongest assets.

Laura Foster Huenneke
Vice President for Research

A New Look for a Better Outlook

Northern Arizona University is a high-research institution (as classified by the Carnegie Foundation for the Advancement of Teaching, 2011) where students and faculty work together to find solutions to local, national, and international issues; make discoveries; and enhance knowledge in all subject areas. The Division of Research aspires to increase its support of the university’s research enterprise each year. As part of this effort, the Office of the Vice President for Research has expanded the evaluation and sharing of research performance data. Deeper analysis and improved distribution of information will lead to discussions and decisions that will ultimately help us reach our vision for NAU’s research enterprise.

What did NAU accomplish this past academic year in research, public service, and instruction? This is what this redeveloped Annual Report attempts to convey. Many metrics have not changed, but there has been a change in the way they are portrayed. Furthermore, new measures have been added, such as data on principal investigators and sponsoring agencies.

Such metrics and measurements matter: each data element helps us understand where NAU has been and where it is going. The display of historical data assists in setting realistic goals, defining proper strategies, and identifying areas of needed improvement as NAU heads into this new decade.

The success of NAU’s research enterprise hinges on the work of students, faculty, and staff researchers. The Annual Report now includes information on activities taking place in each college, spotlighting individuals and their work. This information shows who we are as a university and where our priorities lie. Thank you for taking the time to read about notable research activities, learn more about your colleagues, and take part in moving NAU’s research landscape forward.

What is the “Research Enterprise”?  
The research enterprise at Northern Arizona University refers to all externally-sponsored activities and the systems that support them. These activities include basic and applied research and development as well as public service that benefits groups external to the institution. The research enterprise also supports curriculum development, student services contributing to student wellness and development outside of classes, institutional support for long-range and executive-level planning, student fellowships and scholarships, and campus-maintenance operations.

The Strategic Plan and 2020 Vision

Throughout this Annual Report, you will see references to the strategic plan, which was set in place by President Haeger’s Cabinet, and the 2020 Vision, which was set in place by the Arizona Board of Regents (ABOR), to track NAU’s progress. The 2020 Vision is a framework to improve Arizona’s economy and the quality of life of its residents and is based on four key themes: Education Excellence, Research Excellence, Community Engagement and Workforce Impact, and Productivity. Arizona benefits economically and socially from university research, especially in the areas of industrial research and development, the transfer of technology to the public, and knowledge creation to fuel the private sector.
As the institution with the smallest research portfolio among the state’s three public universities, NAU’s numerical contributions to the research enterprise goals are modest; qualitatively, however, NAU makes invaluable and unique contributions to outcomes for the state’s citizens. Research at an institution such as ours is interwoven with the educational and public service activities that constitute our core university mission. We can demonstrate through these data that NAU performs extremely well despite smaller investments in faculty and research facilities.
The funding Northern Arizona University receives from government, corporate, and nonprofit sponsors allows university faculty, staff, and students to conduct basic and applied research, develop innovative instructional methods, create new intellectual property, participate in regional economic development, and engage in a wide variety of public service initiatives.

Research
NAU faculty, staff, and students focus their research efforts in fields and on issues that have particular significance to our neighbors, our region and our state. From astronomy research in the dark skies of Flagstaff to our annual Undergraduate Research Symposium; from the Partnership for Native American Cancer Prevention to forest health, restoration and management; from the genetics of infectious diseases to the future of water resources in the Colorado River basin: the new knowledge generated by the research enterprise translates into tangible impacts on the health of the state’s citizens, the state’s environment, and the state’s economy. Much of the research conducted at NAU is showcased across the following pages.

In FY2011, award dollars for research increased 10 percent over the previous fiscal year. As usual, most research support came from federal sponsors.

Awards from NAU’s top sponsors supported work to enhance microbial forensics, control bark beetles that damage pine trees, compare diabetes prevalence in Pima Indians living in different environments, investigate the role of titin in active muscles, study uranium damage to DNA, monitor sediment storage through the Colorado River ecosystem, and integrate ecological processes for sustainable military activities.
Public Service

University public service expenditures is one of 33 metrics by which Arizona state universities measure their impact. Northern Arizona University strives to contribute to regional vitality through engagement with—and by providing services to—groups external to the institution, such as K-12 schools, school districts, and Native American tribes.

In FY2011, NAU received $17 million from external sources to conduct public service projects, which was a 56 percent increase over FY2010. During the same period, public service expenditures increased by 1.5 percent. Public service projects included the following activities.

Projects funded in FY2011 through the Institute for Human Development benefited visually impaired individuals, persons with disabilities, and employees who work with young children who are developmentally disabled or delayed. The Forest Service funded projects to develop a Southwest Fire Science Consortium, promote adaptive ecosystem management to reduce wildfire risk, and expose local tribes to ecology and environmental issues.

The Corporation for National and Community Service awarded $1.9 million to the Civic Service Institute for projects that assist in the coordination of substance abuse and violence-prevention policy, integrate residents of the Flagstaff Southside neighborhood with NAU, and provide a stipend and reimbursement to senior volunteers.

About 30 percent of NAU’s public service funding in FY2011 was awarded to conduct activities that focus on Native American communities. Projects involved assisting tribal governments in establishing air-quality management, solid-waste management, and emergency-response programs; a home-visitation program to foster healthier families; services for children with disabilities; and the creation of a Hopi museum exhibit. Most of this funding came from the Environmental Protection Agency (EPA) and First Things First.

Instruction and Other Support

Northern Arizona University’s first strategic goal is to be a learning-centered university. Extramural funding is an important mechanism through which we carry out activities in support of that goal; through grants, NAU develops new curriculum and improves instruction, provides students with financial support and services, and supports general programs of the university.

Instruction projects in FY2011 included establishing a new MS program in Climate Science and Solutions, addressing the shortage of highly qualified speech-language pathologists in Arizona schools, improving the learning space at the Nursing Education Center in St. Michaels (on the Navajo Nation), testing a curriculum in electric energy systems, and continuing the development of history-education programs that employ inquiry learning methods.

To improve retention and education success, NAU annually receives funds to provide services to our students. Native American Student Services and Student Support Services both received support in FY2011 and contributed to these retention-focused programs by providing academic assistance and advising, and through sponsorship of cultural and educational events. The CCAMPIS program also received funding to provide child-care assistance to eligible students, and the School of Nursing received funds to provide cultural connectedness opportunities to Native American students.

The university received more than $2 million in FY2011 for scholarships and fellowships, allowing students to pursue their research and scholarly interests. Nearly $1.5 million of this was awarded through the Noyce Fellows Program, which grants money to pre-service teachers in NAUTeach, a certificate program for training future mathematics and science teachers in Arizona.

Other support in FY2011 enabled NAU to install a 50-meter meteorological tower at Yellow Pine Ranch. A science editor was hired with funds from the Geological Society of America. Extramural funds also supported the Colorado Plateau Cooperative Ecosystem Studies Unit and the Applied Indigenous Studies student assistance programs.
Extramural Sponsorship of NAU Projects

Over the past few years, Northern Arizona University has experienced significant growth in research expenditures supported by federal funds. A strategy to shift our efforts away from competing for state funding has clearly been successful, as federal expenditures by NAU have reached new highs.

More than half of NAU’s grant and contract funding came from federal sources in FY2011. The Department of Homeland Security, the U.S. Forest Service, and the Department of Defense significantly increased their support compared to the previous fiscal year. Strong nonfederal sponsors were the Arizona Department of Economic Security; the Arizona Governor’s Office for Children, Youth, and Families; the University of Arizona; and First Things First.

Of the 143 different external sponsors of NAU activities in FY2011, 29 were first-time sponsors—most notably the Gordon and Betty Moore Foundation, which is funding wildlife conservation projects in the School of Forestry; the Henry M. Jackson Foundation, which is funding the work with Bacillus anthracis; McAllister Investments, which is supporting the Yellow Pine Ranch meteorological tower installation; and NextEra Energy Resources LLC, which is funding the NextEra solar-wind variability study.

The Breakdown of Sponsors

Federal agencies (shown in green) represent 68% of the university’s sponsored funds in FY2011.

<table>
<thead>
<tr>
<th>Sponsor</th>
<th>Dollars Awarded (millions)</th>
<th>No. of Sponsors</th>
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<tr>
<td>Federal agencies</td>
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<td>Other Federal</td>
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<tr>
<td>Environ. Protection Agency</td>
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<td>Private, Industry, Foreign</td>
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<tr>
<td>Local Government</td>
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<tr>
<td>National Science Foundation</td>
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Research Performance

As Northern Arizona University seeks to expand its research activity and impacts, it is crucial to measure, understand, and report the key elements of performance. To this end, we have revised our traditional metrics of research activity.

Proposals

Proposal data presented in past annual reports reflected the number of unique “proposal actions”—transactions processed by the Office of Grant and Contract Services to implement various proposal actions, including continuations of existing awards. The FY2011 and future annual reports will provide information on the number of new proposals—i.e., the count of each first proposal submitted and each competitive renewal submitted for a given project. Dollars proposed now reflects the requested amount for the entire project period, which may be longer than one year.
Research Enterprise Performance and Activity

Awards

Award data presented in previous annual reports reflected a count that included award continuations. Going forward, the Research Enterprise Annual Report will report the number of unique new awards—the count of the first award received and each competitive renewal received for a project. Dollars awarded reflects the entire amount granted in a fiscal year. In a multiyear project the granted amount may be for all years or for a single year, depending on the sponsor.

<table>
<thead>
<tr>
<th>Award Indicator</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
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<tr>
<td>All Awards</td>
<td>426</td>
<td>486</td>
<td>395</td>
<td>410</td>
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<tr>
<td>New Awards</td>
<td>215</td>
<td>253</td>
<td>195</td>
<td>248</td>
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<tr>
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<td>$43M</td>
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Each college makes a unique contribution to research, public service, and instruction at Northern Arizona University. Collectively, the colleges brought in more than $44 million in extramural awards, or 85 percent of the total amount of sponsored funds that the university received in FY2011. Each college contributed in its own way to support a vibrant sustainable community and increase NAU’s research capacity. Increased research space—from 142,000 sq. ft. in 2009 to 170,000 sq. ft. in 2011—will enhance the university’s research productivity and support more cross-disciplinary research.

Expenditures

The measure of expenditures is different from the awards received; funds from an award received in one year may be expended over several fiscal years. Expenditures in previous annual reports included financial aid and federal stimulus funding. This year’s Annual Report excludes those funding types. The chart to the right shows sponsored-project expenditures and the associated recovered indirect costs.

Research expenditures as reported annually to the National Science Foundation (NSF) are the standard metric used to assess research volume in national and state comparisons. This metric is part of the ABOR 2020 Vision, which has a goal of $43.4 million for NAU in 2020—41 percent higher than the university’s FY2011 expenditures of $30.8 million. The chart to the right illustrates that NAU is steadily recovering from the economic dip of 2008.

Northern Arizona University ranked 224 in total research expenditures among all 697 universities reporting to the NSF in 2009. It is therefore quite an achievement that NAU ranks 76th in agricultural science expenditures, 114th in environmental science expenditures, and 129th in biological sciences expenditures. These rankings reflect NAU’S relative strength in forestry, environment and sustainability, and life sciences.

Investigators

Eighty-one faculty members departed Northern Arizona University in FY2011, including 29 tenured and tenure track faculty, according to the August 2011 PAIR cabinet report. With these losses, the pool of individuals who can serve as investigators has become significantly smaller. In FY2011, 33 investigators submitted proposals for the first time. The following chart shows the trend in the number of awarded investigators, including co-investigators, and the number of new awards received from FY2007 through FY2011.
Research carried out by NAU faculty, staff, and students focuses heavily on those fields and issues that matter most to our neighbors, our region, and our students. These scholarly, creative, and technological efforts reflect the university's strategic priorities—environmental and regional stewardship and sustainability, service to tribal students and communities, health and bioscience, and diversity of culture. NAU is at the forefront of integrating research and scholarly activities into the academic experience and overall success of undergraduate students.
Sponsored activity in the College of Arts and Letters (CAL) during FY2011 primarily supported public service and instruction. Flagstaff Unified School District, Cambridge ESOL, and The International Research Foundation granted money to CAL for the first time, supporting the History and English departments and putting them among the top funders for the college. Below are just some of the notable activities undertaken by CAL in FY2011.

Professor Jason BeDuhn, Comparative Cultural Studies, traveled to Dublin, Ireland to reconstruct and translate the text of the “Dublin Kephalia,” an Egyptian manuscript from late Roman times about the ancient Iranian religion. With funding from the National Endowment for the Humanities and the Humanities and the Arts, BeDuhn was able to read previously illegible portions of this very damaged ancient codex. “It turns out that the codex tells of the travels of Mani, the founder of the Manichaean religion, around Iran, Iraq, and Pakistan, in the third century of the Christian Era,” said BeDuhn. The text reveals a pluralistic religious environment of coexistence and competition.

The National Endowment for the Humanities sponsored activity in the College of Arts and Letters (CAL) to train teachers how to lead after-school literature circles, where children and young adults can learn and apply reading and writing skills by discussing a piece of literature in depth. Flagstaff Unified School District, Cambridge ESOL, and The International Research Foundation granted money to CAL for the first time, supporting the History and English departments and putting them among the top funders for the college. Below are just some of the notable activities undertaken by CAL in FY2011.

Mansoor Al-Surmi, a PhD graduate in Applied Linguistics, received a fellowship from the International Research Foundation. Al-Surmi’s research explored the linguistic characteristics of a popular TV soap opera to see if it can be used for English as a Foreign Language (EFL) instruction. He hopes the work will assist teachers in the Arab world as they develop materials for EFL instruction.

Douglas Biber, Regents’ Professor of Applied Linguistics, focused his research on empirical linguistic analysis of exam responses on the TOEFL iBT test. His goal was to identify ways in which responses differ across groups and to see which linguistic-discourse features correlate with proficiency level.

Shannon Fitzsimmons-Doolan, a PhD graduate in Applied Linguistics, received a grant from Language Arts and the Humanities and the Arts, Flagstaff Unified School District, Cambridge ESOL, and The International Research Foundation to train teachers how to lead after-school literature circles, where children and young adults can learn and apply reading and writing skills by discussing a piece of literature in depth.

In Diné, the word Nahatah refers to a powerful process of planning and the ability to be a visionary, speak, and follow through. A similar Diné word, Naataanii, means leader. By selecting the acronym NAHA TAH for the Northern Arizona History Academy Teaching American History project, Linda Sargent Wood, Project Director and History Professor, hopes to communicate the vision of the program. “We aim to draw on these [Diné] principles in our project planning and organization, so that we may more successfully elevate strong teacher leaders who, in turn, promote strong student leaders for our communities, nation, and world,” said Sargent Wood. With the support of $1 million from the U.S. Department of Education in 2010, the program offers 4th through 12th grade teachers in Northern Arizona the opportunity to learn new methods and perspectives for teaching history with a “learn, do, teach” philosophy. “Learning, Doing, Teaching History via the Grand Canyon,” the first of five masters’ level, history-education courses, was held in Spring 2011; teachers from northern Arizona came together to develop new investigation-based strategies. During the first Teachers in Action series, teachers learned about historical inquiry with primary sources. Another professional development workshop showed teachers how to implement geographic-information technologies in the classroom.
The lion’s share of extramural funding received by the W. A. Franke College of Business (FCB) in FY2011 came from local and state sponsors and supported public-service activities. Some of these activities are described below.

Ken Lorek, Bilby Endowed Chair, published the article, “Multi-Step-Ahead Quarterly Cash Flow Prediction Models” in Accounting Horizons (25(1)). The article suggests that the single-variable, Brown-Rozeff ARIMA model for quarterly cash-flow projects is more accurate than the premier multivariate model. The Journal of Theoretical Accounting published Lorek’s article “Quarterly Earnings Expectations: An Examination of the Idiosyncratic Case when Time-Series Models Outperform Analysts” in the spring 2011 issue.

Andrew Griffin, Director of Veterans Affairs and Emergency Management, and Associate Professor Chris Lockwood published “Creating Active Learning Applications and Opportunities for an Online Leadership Course” in Academy of Educational Leadership Journal ((14 (3)). The article describes the online leadership course that mimics the face-to-face version of MGT311. Leadership, through active learning and practical leadership application.

The JP Morgan Chase Foundation, a new sponsor of FCB activities in FY2011, supported the 2010 Economic Outlook Conference with a grant of $10,000 to the Center for Business Outreach. This annual conference brings community leaders together to discuss the economic landscape of the coming year. The conference was co-sponsored by Flagstaff Business News.

The Arizona Hospitality Research and Resource Center (AHRCC), directed by Dr. Cheryl Cothran, received funding from the Arizona Office of Tourism (AOT) to provide tourism research services. The partnership for this project has existed since late 2005. With these funds, AHRCC has acquired and maintained materials that are pertinent to the hospitality, tourism, and travel industry in the AOT-AHRRC library. The center continues to prepare tourism-related statistics for AOT on indicators such as expenditures, tourism-related jobs, car rentals, website data, lodging, and airport activities. As part of the agreement, AHRRC also conducts annual surveys and research reports for AOT.

The Arizona Rural Policy Institute (ARPI) was created in 2006 to strengthen the economic development of the region, especially economically distressed communities. The institute received external funding in FY2011 from both the City of Flagstaff and Coconino County. ARPI activities in FY2011 included reporting Coconino County economic trends, compiling information on the 30 legislative districts in Arizona as a redistricting toolkit, and running several economic impact analyses.

Todd Johnson, Computer Information Systems (CIS) lecturer, and Rick Kabalan, a former student IT worker, developed GradeTrack, a web-based application that allows students to keep track of their class assignment scores and their overall class grade during the semester. The chart also allows students to perform what-if analyses to see how potential future assignment grades would lead to a desired final grade. In the fall 2011 semester CIS 120 students used the tool frequently, and they recommended its use for other classes at NAU. The tool is now available for any faculty member to use in his or her courses.

Also in FY2011, the Center for American Indian Economic Development (CAIED) provided trainings and workshops critical to saving and creating jobs in the tribal community. These workshops aimed to preserve and expand existing and potential markets in cash flow management, contracting, and finding new outlets.
Various units within the College of Education (COE), including the Office of the Dean, Educational Leadership (EDL), Educational Psychology, Educational Specialties, and the Arizona K-12 Center, received support in FY2011 to support basic research, instruction, and public service activities. Several of these awards are described below, and many were for ongoing multi-year projects.

With $1,125,000 in funding from the Science Foundation Arizona, COE and CEFNS established the NEXUS Math/Science NAU project. Under the leadership of Daniel L. Kain, then the Dean of COE, and Project Director MaryLynn Quartaroli, this four-year project was completed in FY2011. NEXUS successfully reached out to more than 3,300 Arizona middle and high school students with hands-on outreach programs designed to enhance the students’ mathematical and scientific knowledge and interests. These programs gave the students experience in forensic science and problem-based learning as well as Earth’s atmosphere, solar and wind energy, and other environmental scenarios.

FY2011 marked year five of the second GEAR UP grant from the U.S. Department of Education. Teena Olszewski directs the program, which assists Arizona students from low-income families in successfully transitioning to college. The program has helped increase academic achievement and graduation rates and has improved family knowledge about financial aid options.

The American Indian Cohort Leadership Program combines culturally appropriate curricula, distance learning, and internship training to increase the number of well-trained American Indian principals in reservation-based schools. The program is led by EDL faculty member Joseph Martin and funded by the U.S. Department of Education. By May 2012, a cohort of 25 students is expected to complete the MS program in EDL, which exposes students to the realities of the workplace with the hope of decreasing principal turnover.

During FY2011, the College of Education partnered with the Flagstaff Unified School District for the project “Foundations of Professionalism: Transformative Change through Professional Development.” The goal of this project is to create a professional development outreach program or “learning hub” to help early-childhood educators in Flagstaff. The work is funded by the Helios Education Foundation and coordinated by Gypsy Denzine, COE Dean.

The COE’s Arizona K-12 Center developed and hosted the Arizona Technology Integration Matrix in FY2011 as part of the AZ Teach 21 Online Course. The matrix consists of high-quality videos that assist educators in integrating the Educational Technology Standard for Arizona.

Since 2005, the Arizona School Risk Retention Trust and EDL have collaborated to create curriculum that emphasizes education law, risk management, and the legislative process. In FY2011, the sixth year of the grant, EDL Professor William Wright directed efforts to encourage student interest, publish information, and hold leadership academies on the subject theory.

In Yuma-area schools there have been insufficient numbers of teachers who were prepared to deal with the challenges of rural multicultural and English-Language Learner (ELL) classrooms. A five-year project called Preparing Rural Inclusive Special Educators (PRISE), directed by Professor Patricia Peterson, Educational Specialties, set out to recruit and prepare 45 students from Yuma and La Paz counties to become highly-qualified teachers of ELL students with disabilities. This grant from the U.S. Department of Education covers tuition and books so that participants in three cohorts can earn a Bachelor of Science in Elementary and Special Education at NAU-Yuma. Funds also support the redesign of course materials, travel costs for graduates to attend conferences, and assessment of the effectiveness of project graduates. The program is meeting and exceeding goals: the entire first cohort completed the program, and all PRISE graduates have found employment in Yuma.

Barbara Torre Veltri, Assistant Professor, Department of Teaching and Learning, received the 2012 RCA for Most Significant Scholarly Work for her book Learning on Other People’s Kids: Becoming a Teach for America Teacher.
Much of the sponsored funds awarded to the College of Health and Human Services (CHHS) in FY2011 supported scholarships and outreach to recruit and retain students and faculty from diverse cultural and ethnic backgrounds. These programs and other research activities are featured below.

The Ottens Foundation was very active in supporting programs in Nursing and Dental Hygiene, some of which focused primarily on providing support and services to Native Americans. One of these projects was the American Indian Nursing Program, coordinated by Associate Professor Karine Crow. This program, which gives students a supplemental allowance for travel and housing, benefited 17 students during the 2010-2011 school year.

The Health Resources and Services Administration, the Ottens Foundation, and the Robert Wood Johnson Foundation all sponsored scholarships and fellowships for CHHS students in FY2011. The Scholarship for Disadvantaged Students program supported financially needy students from disadvantaged backgrounds enrolled in Dental Hygiene, Nursing, Physical Therapy, and Speech Pathology programs. The Minority Faculty Fellowship Program funded efforts to increase the number of minority faculty in CHHS. New Careers in Nursing scholarships assisted students in the accelerated nursing program. The Advanced Education Nurse Traineeship Grant also provided financial assistance to nursing students.

The mission of the Rural Health Professions Program is to increase the numbers of students interested in pursuing family nurse practitioner (FNP) certification as well as to improve the quality of rural health experiences. Under the direction of Karen Plager, Nursing Professor, 31 FNP students benefited from the program’s support in FY2011. They received reimbursement for travel expenses to rural clinical sites and to the Flagstaff campus for clinical-related activities, including a two-day, hands-on skills and evidence-based practice workshop. Since the inception of the grant in 2008, the program has been successful in doubling the number of FNP students at NAU.

Assistant Professor Roger Bounds, Health Sciences, studied the effectiveness of different CPR training methods by measuring their chest compression quality. This work compared learning outcomes from four different groups with different lengths of training—with and without real-time video feedback. Bounds found student performance to be similar between short-format courses supported with real-time video feedback and longer courses with traditional instructor feedback. The groups will be followed to determine if retention of skills is also similar.

The Cumulative Illness Rating Scale (CIRS) is a method to measure the degree of total illness burden among patients. Physical Therapy Assistant Professor Meghan Warren compared the accuracy of two non-physicians to one physician when determining the CIRS score for patients. Previously, physicians have been the primary individuals responsible for quantifying illness burden, with reliability coefficients reported between 0.78 and 0.91. In Warren’s study, a physician, a physical therapist, and a student physical therapist calculated CIRS scores from 15 medical records. All raters were consistent with calculating the CIRS score with a reliability coefficient of 0.86. Warren hopes this work will lead to the increased autonomy of physical therapists in clinical work.

Health Sciences Assistant Professor Betty Brown hopes to change the HIV and AIDS care environment. Brown interviewed individuals infected and affected by HIV to gain different perspectives on the disease, determine perceptions of care and support, and guide the information outreach process. Brown’s work will bolster involvement in rural communities to develop sustainable HIV care and prevention plans directed toward the needs of the HIV community. Promoting awareness and supporting good-quality care services is especially important, given recent funding cuts and increased diagnoses of HIV and AIDS in Arizona.

T2DM & Gene-Environment Interactions

Pima Indians living in the U.S. have the highest rates of Type 2 diabetes (T2DM) in the world, but is this the case for Pima Indians living in Mexico? In 1995, a study led by Executive Dean Leslie Schulz found the answer to be “no.” Although diabetes and obesity were more prevalent in Mexican Pimas than non-Pima Mexicans, both Mexican groups had a significantly lower prevalence of these disorders than U.S. Pimas. Even in ethnic groups genetically prone to T2DM and obesity, disease development is determined mostly by environmental factors, including physical activity and diet.

Fifteen years later, with funding from the National Institutes of Health, Schulz followed-up the earlier studies, bringing medical services to the Mexican Pimas and non-Pima Mexicans. These services included a new oral health component with the help of Jennifer Klaus, Assistant Clinical Professor in Dental Hygiene. With the preliminary results in hand, Schulz hopes to determine how the environmental changes over the past 15 years have impacted those who are genetically susceptible to diabetes.
In the College of Engineering, Forestry and Natural Sciences (CEFNS), researchers conduct innovative research that allows students to gain hands-on experience. With $30 million of sponsored support in FY11, CEFNS has seen an 86-percent increase in dollars awarded over the last five years, while dollars requested have doubled during the same time frame.

But it is not all about scientific research at the college; funds awarded for public service activities also increased tremendously over the past year. Notable projects in public service are the Climate Change Science and Solutions project to create innovative education tools for rural communities; the Summer Institute on Environmental Stewardship, which teaches European student leaders about environmental themes in the American Southwest; and the Northern Arizona Environmental Sciences and Literacy Integration project, which offers professional development for elementary school teachers in environmental science and literacy.

**Tom Acker**, Professor of Mechanical Engineering, built upon his work on the “APS (Arizona Public Service) Distributed Wind Study” by further investigating the prediction of wind speed and wind energy output of small wind turbine installations in Doney Park, northeast of Flagstaff. A key factor in evaluating residential wind energy is the quality of the wind source, which can vary substantially in a small area. Acker’s team created a wind map to be used by homeowners interested in purchasing a wind turbine. The team also installed a Skystream Wind Turbine at Cromer Elementary School and assisted APS in evaluating wind turbines for potential installation.

**Thomas Whitham**, Regents’ Professor of Biological Sciences, focuses his research on sustainable plant communities. His recently completed work identified superior genotypes of Fremont cottonwood trees and the areas where they would perform best in terms of tolerance, efficiency, productivity and biodiversity. With a 2011 TRIF grant, Whitham and his team are also genetically fingerprinting tree varieties and creating a Geographic Information System interface for users to find similar climate regions for project-planning purposes. Using this approach for the restoration of riparian environments is critical to ensuring biodiversity in future climates.

There are different methods to reduce excessive speeding in construction zones: stating fines, displaying a driver’s speed, using photo speed ticketing, and so on. Civil and Environmental Engineering Associate Professor **Craig Roberts** and Assistant Professor **Ed Smaglik** saw the need for a comparative analysis to determine which low-cost approach is most effective. They adapted a dynamic message sign to display the potential traffic fine in addition to the vehicle’s speed. Looking at the average speed, 85th percentile, and high-end speeders, the speed-fine feedback was shown to be more effective than just the speed feedback in all cases.

In the summer of 2008, Mount Okmok, located on Umnak Island of Alaska, erupted with unusually little warning. Two years later, Professor **Michael Ort** (Geology, Environmental Sciences and Quaternary Sciences) and graduate student Joel Unema traveled to the island to reconstruct the sequence of the phreatomagmatic eruption—an eruption resulting from magma and water interactions. In collaboration with scientists from the Alaska Volcano Observatory, the team found that the lack of advance warning appears to have been related to an open conduit to the surface; little rock fracturing was required for the magma to reach the surface. Normally, open conduits lead to eruptions with little explosivity, but at Okmok, abundant surface water was flashed to vapor and provided the impetus for the highly explosive five-week-long eruption.

Michael Ort (left) and Joel Unema (right) examine deposits from the 2008 eruption of Okmok volcano.

**Nadine Barlow**, Associate Professor, Dept. of Physics & Astronomy, received the Most Effective Research Mentor award.

**Paul Keim**, Regents’ Professor of Biology, also received an RCA for Most Effective Research Mentor.

**Jut Wynne**, PhD candidate, Dept. of Biological Sciences, received the Most Promising Student Researcher award.

**David Trilling**, Assistant Professor, Dept. of Physics & Astronomy, received the RCA for Most Promising New Scholar.

**Brett Dickson**, Assistant Research Professor (School of Earth Sciences and Environmental Sustainability) and Director of the Laboratory of Landscape Ecology and Conservation Biology, received funds from the Arizona Department of Emergency and Military Affairs to determine the current threat of wildfire at Camp Navajo. His team identified areas where it would be best to implement forest treatments to reduce wildfire threats and they analyzed the effects of the proposed treatments.
Most studies on the health effects of uranium focus on its radiological properties, but Biochemistry Professor Diane Stearns hopes to expand our understanding of uranium toxicity by investigating combined exposures of uranium and UVB light. With funding from the National Institutes of Health, the Stearns lab is measuring the extent to which UV light can chemically activate uranium to produce higher levels and different types of DNA damage and mutations in human skin cells than either agent alone. Results suggest that uranium may act as a carcinogen through chemical as well as radiological mechanisms.

In one of the many projects conducted in the Center for Microbial Genetics and Genomics (MGGen), David Wagner, the center’s Associate Director, worked on characterizing the threat of cattle fever in Texas. This project will eventually develop new genotyping assays for ticks and pathogens and use these assays to better understand cattle fever ticks.

Studying dwarf planets, Kuiper Belt objects (KBOs), and centaurs sheds light on the building blocks of the planets in our solar system. Professor Stephen Tegler, Physics and Astronomy, characterizes these outer solar system objects using a combination of telescope observation and lab work. This work (in collaboration with Will Grundy at Lowell Observatory) led to the first quantitative comparison of the icy surface composition of bodies beyond Neptune. Their paper, published in the Astrophysical Journal, was covered in the journal Nature.

Wildlife corridors are needed to maintain wildlife populations, especially on landscapes affected by changes in climate and land use. Professor Paul Beier’s Laboratory of Conservation Biology and Wildlife in the School of Forestry developed a network of corridors across 18 million acres of California deserts. The corridors are designed to be robust to climate change and provide connectivity for bighorn sheep, desert tortoises, and 40 other focal species. Field work and GIS analyses were completed during FY2011. Managers will use the maps and recommendations from these studies to enhance the corridor network in the face of solar energy projects proposed for more than one million acres.

Work carried out by the researchers in the Merriam Powell Center for Environmental Research in FY2011 enforced the center’s mission to explore ecosystem processes and develop strategies for the maintenance of healthy ecosystems. Projects included developing an inventory of caves, arthropods, and other specimens; modeling carbon implications, wildfire emissions, and species growth-climate relationships; supporting the development of the new Climate Science and Solutions Master’s degree program; and other surveying and assessment activities.

White-Nose Syndrome is a devastating disease that has killed more than one million North American bats. With funding from the U.S. Fish and Wildlife Service, Assistant Research Professor Jeffrey Foster of MGGen is expanding knowledge about the disease, which is associated with the fungus G. destructans. He has developed microsatellite markers and whole genome sequencing of the fungus to track movement, transmission, and effects of White-Nose Syndrome on bat populations. These approaches should directly aid in disease management.

Battling Beetles, Saving Forests

Bark beetles have destroyed tens of millions of acres of trees in British Columbia and the Western United States, including forests in Northern Arizona. Drought and human activity have weakened the trees' natural defenses against these grain-of-rice-sized beetles, but a group of researchers in the School of Forestry may have found a way to save our forests.

Assistant Professor Richard Hofstetter has proven that the use of acoustic, species-specific sounds can disrupt mating and tunneling. Altered recordings of the beetles, piped back into infested slices of pine trees, cause beetles to reject each other or fight. Applying the technique on larger samples of pine showed that beetles do not enter the tree at all in response to the uncomfortable sound. The team’s work has led to the development of a device that can help forest managers, as well as private landowners, protect and preserve highly valued trees.
The College of Social and Behavioral Sciences (SBS) brought in $8.3 million in sponsored projects funding during FY2011, of which $6.7 million was awarded for public service projects. The Corporation for National & Community Service, the Department of Economic Security, the U.S. Department of Education, and First Things First were the largest funders of public-service projects in SBS in FY2011.

Nihiyazi Ba’ii’tih means “for our children” in Navajo, a fitting name for the home visitation program directed by Project Coordinator Diane Lenz of the Institute for Human Development (IHD) and staffed by “Home Visitors” who live in the Navajo Nation communities they serve. Using grant funds from Arizona’s First Things First initiative, the program reaches out to at-risk families with children—from newborns to five-year-olds—who reside on the Navajo Nation. Since the program started in September 2010, Home Visitors have assisted 103 families, helping them to understand the role of the family as their child’s first teacher. Home Visitors have also taught families about child development, how to improve parenting skills, and how to access community resources.

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Francis Smiley, Professor of Anthropology, cooperated with the National Park Service to complete the archaeological investigation of the Rainbow Forest Clovis site in Petrified Forest National Park. The site had been deemed the most promising location within the park for buried Paleo-Indian material, but, as a horse pasture for three decades, it was also heavily trampled. The heart of the project was analysis of lithic artifacts—the stone tools and the debris from making stone tools. With a now higher quality and quantity of data, the project has improved our understanding of ancient peoples’ way of life in the American Southwest.

Ethnic Studies Lecturer Mark Montoya presented a paper called “Headless Bodies and Brainless Politicians: The Citizenship Problem in the U.S.-Mexico Borderlands” at the Association for Borderlands Studies annual meeting. Montoya also presented the paper “It Won’t Be Long ’til We Belong: (Im)migrant Social Movements in the U.S.-Mexico Borderlands” and chaired the panel “Race and Ethnicity: Issues in Latino Politics” at the 91st annual meeting of the Southwestern Social Science Association.


The Capacity Building for American Indians Project assists American Indians and Alaskan Natives in preparing and submitting grant applications to federal agencies by organizing national grant writing workshops and other related events. The Project follows up with funded individuals and provides technical assistance to help them successfully implement their grants. The program is directed by Winona Reid of the Institute for Human Development. In FY2011, 13 individuals attended the grant writing workshops and 30 individuals received grant management assistance.
James Wilce's project “Re-Sounding Voices: The Sociocultural Significance of the ‘Lament Revival’ in Contemporary Finland” is an excellent example of global engagement at NAU. Wilce, Professor of Anthropology, worked with Finnish collaborators Anna-Liisa Tenhunen and Heidi Haapoja to investigate the lament revival with a linguistic-anthropological perspective. The laments, or crying songs, serve as a form of self-help therapy. Lament courses have been formed, allowing Wilce to explore the connection between emotion and discourse and to investigate “language socialization.” In contextualizing the Finnish revival, Wilce’s work contributed to American-Finnish ties.

According to the Pima Prevention Partnership, about 95,600 children in Arizona have a parent in jail or prison on any given day. These children are often unidentified and underserved, and their situation poses many potential risk factors. Past literature focuses on interviews with incarcerated parents and agency personnel, excluding the voice of the children. Assistant Professor Rebecca Maniglia, Criminology and Criminal Justice, worked to fill this gap. In the first study of its kind in Northern Arizona, Maniglia interviewed both children and their incarcerated parents in parallel to compare their interpretations and allow children to speak to their own experiences. Coconino County Children of Incarcerated Parents Task Force members are able to use results from this research to immediately benefit children and families who are in this challenging situation.

The Department of Sociology and Social Work established the Laboratory of Applied Social Research (LASR). The group supports the community by offering survey research, data analysis, and program planning and evaluation. In FY2011, LASR completed Community Survey data collection and analysis in connection with the 2012 Regional Plan for the City of Flagstaff. Projects in progress include work for Victim Witness Services and for the Center for International Education.

Southside Communities for All Ages (CFAA) is a partnership between the Southside Community Association and NAU’S Civic Service Institute (CSI). The goal of the partnership is to improve the relationship between NAU and the Southside community and to enhance the quality of life for Southside residents. According to the program’s NAU Liaison Deidre Crawley, one major accomplishment was the “Historic Southside” mural on the Murdoch Community Center, which was chiefly painted by Ethnic Studies Assistant Professor Ricardo Guthrie. The mural is meant to recognize the contributions made by African American community leaders and to depict the history of Flagstaff’s Southside community.

The Impact of Recreation

With 400 miles of designated trails for off-highway vehicles (OHV), the Dry Creek area (located on the Uncompahgre Plateau in Southwest Colorado) is a popular destination for recreation. However, OHV use, like many outdoor recreation activities, can take its toll on the landscape. Professor Pam Foti, Department of Geography, Planning, and Recreation, has focused her scholarly efforts on monitoring recreation impacts related to hiking, biking, and vehicle use on federal wildland areas in the Southwest.

Foti’s work on OHV trail recreation impact assessment in the Dry Creek area, which is a rock crawling site, began in late 2000s. Since then, monitoring has been replicated twice, and impacts have been stabilized at a level appropriate to the site needs, managerial expectations, and recreation activity.

The primary goal of recreation impact assessment is to learn about physical impacts that are directly related to recreational use. Impact studies provide on-site information to site managers to help them determine the fine balance between recreation use and resource protection. The ultimate goal of Foti’s research is to provide resource information to assist site managers in making those difficult decisions related to site use and visitor activities.
The units that support NAU’s research enterprise advance the scope and impact of research and scholarly work across campus. We encourage and support creativity, innovation, and excellence by protecting intellectual property and facilitating technology transfer; providing funding assistance, proposal development, and award acceptance; overseeing regulatory compliance and research subjects’ protection; and offering creative and technical services to researchers.
A number of technical and administrative units provide direct support to the individuals who carry out the university’s research mission. In FY2011, these units continued to focus on improving service to the campus community by streamlining, reorganizing, and increasing transparency.

The Office of the Vice President for Research

The Office of the Vice President for Research (OVPR) provides the leadership and strategic vision necessary to ensure the growth and success of the research enterprise and to fulfill NAU’s role as a major research university. Providing resources—directly and indirectly—to support the work of the faculty, students and staff who carry out the university’s research mission is a major function of the OVPR. In FY2011, the OVPR provided more than $300,000 in financial support for research, scholarly and creative activities of tenured and tenure-eligible faculty through the Faculty Grants Program (FGP). Formerly called the Intramural Grants Program, the FGP is intended to support a faculty member’s professional goals and interests and is an important source of support for new faculty and faculty working in disciplines where extramural support is not regularly available.

The research and scholarly work conducted at NAU is important not only to the university but to the region and state, and it is important to recognize in some tangible way those individuals whose contributions stand out. To this end, the OVPR held the third annual Research and Creativity Awards (RCAs) in FY2011 to recognize the scholarly achievements of NAU faculty and students. Recipients of the RCAs, along with NAU’s faculty and staff inventors, were honored at a formal reception and award ceremony in September as part of the annual Research Open House. RCA awardee information can be found on pages 11, 13, 16 and 22 of this Report.

One of the strongest synergies between faculty scholarship and high quality instruction is the university’s commitment to undergraduate research. While most research experiences provided to students are rooted in externally funded programs secured and led by faculty members, the OVPR contributes financial support in the form of Hooper Undergraduate Research Awards and Hooper Sustainability Awards. This year we were able to provide the additional support of an Undergraduate Research Coordinator, funded in partnership with Enrollment Management and Student Affairs. The Coordinator helps individual programs in publicizing opportunities, recruiting students, and connecting research programs and students with university support. We anticipate that the assistance will ease the burden on faculty, and will eventually lead to improved visibility and financial support for undergraduate research.

Science Foundation Arizona

One of the NAU’s key partners, Science Foundation Arizona (SFAz), continued to distribute funding to the university in FY2011 through a fourth cohort of SFAz Graduate Research Fellows. The purpose of the program is to strengthen the three research universities in Arizona by providing access to the top-tier prospective scientist and engineers and deepening the pool of jobs in Arizona in the fields of engineering and technology.

Continued support under the Bisgrove Scholars Program funded two postdoctoral research positions in environmental sustainability. This program is meant to attract early career scientists and engineering to Arizona to focus on complex, multidisciplinary research problems at the state universities. The state’s first Bisgrove Postdoctoral Scholar is Dr. Ophelia Wang, joining the university’s Laboratory of Landscape Ecology and Conservation Biology. Dr. Wang graduated from universities in Costa Rica, Panama, and Taiwan before receiving her Ph.D. in Geography and the Environment at the University of Texas. Dr. Wang was awarded the NSF Doctoral Dissertation Research Improvement Grant for her dissertation.

Technology and Research Initiative Fund

Support from the state’s Technology and Research Initiative Fund (TRIF) flows through Arizona Board of Regents to the university. The OVPR provided more than $2.2 million of TRIF funding for projects and initiatives to advance research, science and forest health.

The Growing Biotechnology Initiative (GBI) enables translation of outstanding interdisciplinary research and development into applications that address critical health, technology, and education issues in the Arizona economy. GBI researchers evaluated the potential for bioremediation at a Tucson groundwater contamination site, using a stable isotope probing method to differentiate microbial organisms based on their response to chemical exposure. Other work included the synthesis of azapeptide compounds for investigation as antiviral and antibacterial agents.

Over the past five years, the Environmental Research, Development and Education for the New Economy (ERDENE) program has stimulated innovation and partnership in sustainable solutions for the state’s economy and environment. Some of the important projects funded through ERDENE in FY11 included development of a low-cost system to treat surface water utilizing a wind-powered slow sand filter, and progress towards development of a model system utilizing amphibian behavior assays to monitor biologically relevant pollutants in water supplies.
approaches to reduce the threat of unnatural fire and restore the health of forests. One of the projects ERI assisted with is a wildland urban interface project of thinning and restoration called Eagar South. When a fire travelled from untreated forest to the Eager South area, the fire behavior changed and the fire progression slowed.

Office of Grant and Contract Services

The Office of Grant and Contract Services (OGCS) facilitates proposal development, award acceptance, and non-financial post-award activities associated with the administration of grants and contracts. During FY2011 OGCS introduced new tools to enhance service to faculty and staff, including new software for grants administration, a revamped website, and the Funding Opportunities LISTSERV.

OGCS worked concurrently to introduce Cayuse 424 for proposal preparation and to prepare for the system-wide implementation of PeopleSoft Financials for post-award financial administration of grants and contracts. Cayuse 424 is expected to significantly reduce system errors and associated burdens on faculty and staff in preparing proposals through Grants.gov. The new web-based software has enabled a shift from paper-based to electronic routing and approval of most proposal and award actions, thus enabling “anywhere” access to proposal submission or award administration. Cayuse 424 provides a permanent, secure, common record of proposals for faculty, staff, and administrators. The stored data will also form the basis for the “push” to PeopleSoft Financials in July 2012, providing—for the first time—an electronic link between pre- and post-award financial actions.

The OGCS website was redesigned in FY2011 to enhance user friendliness. The revamped website provides quick access to a wide variety of resources, documents and services.

OGCS also created a new listserv in FY2011—Fundopps-L, a monthly notice of current and up-coming extramural funding opportunities. Interested faculty and staff can subscribe to this listserv on the OGCS website.

IDEA Lab at the Bilby Research Center

IDEA Lab offers support services to researchers across campus in the areas of imaging (photography and videography), design (illustration and websites), editing, and administrative support services. FY2011 was a very busy year for the group. Tony DeLuz, Scientific Illustrator, created hand-painted renderings for the grand reopening of the Hotel and Restaurant Management-East building and built displays for the Native American Cultural Center. Web Designer Patrick McDonald and Photographers Ryan Belnap and Dan Boone collaborated with Archaeology Professor Chris Downum on projects that will redefine how the public experiences archeological treasures: an on-line virtual museum for several key archaeological collections in the region and an archaeology section for the Learning Center for the American Southwest website.

The videography team has finalized a documentary about community and ecosystem genetics, which can revolutionize how we reclaim land, protect biodiversity, and adjust to a shifting climate. Titled A Thousand Invisible Cords: From Genes to Ecosystems, it will be shown on PBS stations nationwide during FY2012. The Imaging Lab team, in collaboration with Comparative Cultural Studies scholar Jason BeDuhn, developed new multispectral techniques for capturing ancient images and text on a fourth-century papyrus. This papyrus is shedding light on religious and cultural interactions in the Middle East. IDEA Lab staff also collaborated with Grand Canyon National Park to create a much-needed backcountry guide to the park.

Regulatory Compliance

The Office of Regulatory Compliance (ORC) was formed in 2006 to serve as a compliance resource and to ensure a safe and healthy working and learning environment. The ORC manages all biological, chemical, and radiation programs and coordinates the campus’ Loss Prevention Program. Many departments oversee programs designed to protect resources, such as fire safety, occupational safety, workers compensation, property security, and insurance and liability protection. ORC coordinates these efforts into one overall Loss Prevention Program. During FY2011, the ORC planned for a year-long program to clean up the Flagstaff Mountain campus of unwanted chemicals. The office gathered funds to collect several tons of chemicals for proper disposal during FY2012.
The Division of Research

Biological Safety

The NAU Biological Safety Office (Biosafety) recognizes, evaluates, educates and advises those involved in biohazardous research about biohazardous agents and appropriate microbiological practices and laboratory techniques to control the associated risks. The office also provides technical advice to campus researchers about safety, security, and operating procedures.

In FY2011, Biosafety successfully completed the Centers for Disease Control and Prevention and Department of Homeland Security Audit of the Center for Microbial Genetics and Genomics. Maintaining the health and safety of the university’s laboratory workers as well as the NAU and Flagstaff communities is imperative.

Biosafety instituted a comprehensive laboratory audit program to provide guidance on safe lab practices, including chemical storage, personal protective equipment, and emergency procedures. Some of the other services that the Biosafety Unit oversees include the Bloodborne Pathogens Exposure Control Program and the removal and disposal of biohazard waste.

Biosafety staff represents the NAU Research Division on the university’s Emergency Management Advisory Group (EMAG), which participates in training and tabletop exercises to be prepared in the event of an emergency situation on campus. During FY2011, EMAG conducted two successful exercises—an “active-shooter scenario” and a “wildfire-in-close-proximity scenario.” The NAU Research Division’s role is to anticipate how the incident will impact the laboratories and researchers—i.e., How would an extended loss of power affect equipment critical to research projects? How can the research projects be shut down safely during a building or campus evacuation?

Human Subjects Protection

Any research that focuses on human participation must be evaluated and approved by NAU’s Institutional Review Board (IRB). This past year, the director implemented a Quality Assurance/Quality Improvement (QA/QI) Initiative that has never before been offered. The initiative ensures that researchers are following human subjects protection procedures. Through this initiative, IRB personnel can assist researchers by discussing ongoing projects, going over human subjects protection, answering questions, and providing advice. This initiative has proven to be worthwhile and valuable for NAU researchers and the IRB.

To increase awareness and better guide researchers, the coordinators of each research compliance center (i.e., the IRB, the Institutional Animal Care and Use Committee, and the Institutional Biosafety Committee), started serving on each other’s boards. This has given them a broader perspective on compliance issues, increased synergy, and facilitated the exchange of information.

The three groups also collaborated on developing a brochure that comprehensively explains each of the areas of regulatory compliance. With the assistance of Vice President for Research Laura Huenneke, they developed a PowerPoint presentation on the various regulatory compliance units. This presentation can be used by any member of the Office of the Vice President for Research.

The number of files that the IRB reviews has increased steadily over the past five years. In FY2011, the IRB reviewed 260 new research protocols submitted by students, faculty, staff, and researchers from departments representing all of the NAU’s colleges, including many locations beyond the Flagstaff Mountain campus.

Restoring Wildfire-Ravaged Landscapes

All eight greenhouses in the Research Greenhouse Complex received a much-needed face-lift last year, with new roofing and glazing to let more sunlight in and improve the conditions for plant research. The greenhouses are used by researchers in forestry, biology, and other disciplines to test theories about genetically modified organisms, climate change, genetic adaptation, and soil microbes. The greenhouse is also a partner in a statewide effort to create a seed bank for locally adapted ponderosa pines, which has proven its worth this past year. While the largest fire in Arizona history, the Wallow Fire, was still burning in eastern Arizona and western New Mexico, the greenhouse staff was starting seedlings from pine seeds they had collected from this region two years earlier. These seedlings will help restore this important and beautiful landscape.
Undergraduate Research

**Award Programs**

Engaging undergraduate students in authentic and meaningful experiences in scholarly, creative, or research activities outside the classroom is a university priority. NAU offers multiple opportunities for undergraduate students to receive support for these activities across the disciplines. The Office of the Vice President for Research manages three awards programs supporting undergraduate (and graduate) student research: the Hooper Undergraduate Research Award (HURA), the Hooper Sustainability Award, and the Student Travel Award.

**Hooper Undergraduate Research Award**

The Hooper Undergraduate Research Award (HURA) program offers students the opportunity to undertake projects of their own design in partnership with a faculty mentor. In FY2011, 19 students from four colleges and eight departments received HURA support, totaling $65,651; the average award was $3,455. Projects included “Recruitment of Pinyon Pine in the Face of Drought and Climate Change,” “Paleoenological Reconstruction of the Coconino Sandstone Depositional Environment,” and “Biomass and Carbon Stocking for Treated and Untreated Stands in a Mixed Conifer Forest.”

**Hooper Sustainability Award**

Through the generous support of gifts made to the NAU Foundation, undergraduate and graduate students submit proposals to carry out projects that emphasize outcomes and are focused on sustainability issues in Northern Arizona. Seven students, representing two colleges and four departments, worked on the five projects funded in FY2011. These awards totaled $7,450.

In FY2011, the Office of the Vice President for Research added an Undergraduate Research Coordinator to its team to provide centralized coordination and support for undergraduate research programs campus-wide. MaryLynn Quartaroli, Ed.D., previously the Project Director of the NEXUS Math/Science NAU project, has a long history with NAU and understands the importance of learning through hands-on experiences. Quartaroli works with the Undergraduate Research Steering Committee to support faculty and staff who direct the many offerings for students. The OVPR appreciates the support of the university’s Enrollment Management and Student Affairs division in this activity.

**Student Travel**

Traveling to professional meetings or conferences away from NAU engages students at higher levels in their disciplines. The Student Travel Award program provides undergraduate and graduate students with some financial support to present their research, creative, or other scholarly work and to participate in academic competitions at state, regional, national, or international conferences.

**Other Opportunities**

Individual faculty members across campus provide other mentoring and support for undergraduate researchers. During FY2011, 370 individual students in four of the six NAU colleges enrolled in an Undergraduate Research course. Students in the College of Engineering, Forestry, and Natural Sciences and the College of Social and Behavioral Science accounted for 56 percent and 41 percent of the total, respectively.

During FY2011, one forestry and three biology students participated in the Integrative Graduate Education and Research Traineeship (IGERT) program funded by the National Science Foundation (NSF). They worked on cutting-edge research projects related to the “genes to environment” theme.

**Undergraduate Research Mentoring**, funded by NSF, supports outstanding underrepresented undergraduates so that they can gain hands-on research experience in the sciences and benefit from mentoring and a two-credit research ethics and presentation course. In the 2010-11 academic year, eight students with majors in biology, environmental sciences, and forestry participated. Research topics were equally varied—from synthetic chemistry to ecology.
The **Center for Microbial Genetics and Genomics** typically adds up to four new undergraduates every year as paid research assistants; during FY2011, there were 17 research undergraduate students on the MGGen payroll.

The **John and Sophie Ottens Native American Research Scholarship** provided funding—$2,000 each to eight Native American freshmen, sophomores, and transfer students—to do introductory research in fields related to the natural and health sciences. The students majored in chemistry, nursing, dental hygiene, health sciences, environmental sciences, biochemistry, environmental engineering, and applied indigenous studies.

NAU faculty hosted four **Research Experiences for Undergraduates (REU)** summer programs, which were funded by the NSF: mathematics, astronomy, *Shima’ nahasdz’a’i bee’ liina’* (Mother Earth Gives Life) in environmental science, and *Hojooba’ bee’ la’ hooniil* (Social Psychophysiology of Compassion). Undergraduates from across the nation, including NAU students, participated. In collaboration with the Mother Earth Gives Life REU, the **Summer Transitional Enrichment Program** offered tribal and community college students the opportunity to collaborate with a faculty mentor and other students to get hands-on research experience.

The **Partnership for Native American Cancer Prevention** at NAU trained 44 undergraduate students in FY2011. Eighteen of these received support to work in year-round research labs. A second group of seven trainees were paid a stipend to participate in the Summer Transitional Enrichment Program: These students were community college students who spent 10 weeks during the summer doing intensive research. Another 19 students were introduced to research careers and concepts in an introductory five-week summer program that focused on piquing students’ interests in research and biomedical careers during the Health STAR program.

The **Initiative Maximizing Student Diversity** (IMSD) program, supported by the National Institutes of Health, seeks to improve retention, academic achievement, and graduate-school enrollment of underrepresented minority students in biomedical research fields. Students participate in research activities in faculty mentors’ labs and enroll in classes targeted to build applicable knowledge and a skills base. During FY2011, seven biology and chemistry students participated in the IMSD program.

The **NAU/NASA Space Grant Undergraduate Research Internship Program** is designed to provide activities in universities that increase the understanding, assessment, and utilization of space resources and to expand the educational, scientific, and research base of all space-related fields. In April 2011, 14 NAU students participated. FY2011 was the first year that a student from Coconino Community College (CCC) participated in the program; the program hopes to be able to support another CCC student in the future. Students from biology, physics & astronomy, exercise science, engineering, and history participated during this fiscal year; they all presented their research at the annual, statewide space-grant symposium at Arizona State University in April.

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**Undergraduate Spotlight: Allison Baker**

One of the NAU/NASA Space Grant interns, **Allison Baker** (photographed at an ASU symposium), took first place in NAU’s Undergraduate Research and Design Symposium poster competition in April 2011. She won for her poster, “The Effects of Carbon Dioxide Enrichment on Mutualistic Soil Fungi.”

Although Baker intended to major in speech pathology, she explains that Assistant Professor Catherine Gehring, her introductory biology professor at NAU, “ignited my passion for science” and sparked her interest in mycorrhizal fungi in particular. She approached Dr. Gehring, and started doing field work and assisting on projects after her freshman year. Over the years, Baker has become more involved and more independent, eventually designing and implementing her own project, and receiving funding for her research. She settled on a major in biology with a botany emphasis.

Baker attributes much of her intellectual growth and time-management and problem-solving skills to her involvement in undergraduate research. “It gives you a huge sense of responsibility. It’s allowed me to take what I learn in my classes and actually apply it. I think that’s a fundamental step in taking education to the next level...forcing yourself to ask questions and to be wrong. If you’re able to determine why your thinking is wrong, that’s great!”

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Associate Professor **Matthew Gage**, Biochemistry, recruited students to work in his lab on research projects that focused on understanding protein structure/function relationships. Four undergraduates who worked in the lab during FY2011 presented posters at the Annual Protein Society meeting. Gage states, “These undergraduates do hands-on, cutting-edge research in my lab, which provides them with unique opportunities that they would not receive at other institutions.”
Northern Arizona University supports the commercialization of outcomes generated through research and other scholarly activities performed by faculty, staff, and students. In FY2011, the university, NAU Ventures and NACET (Northern Arizona Center for Entrepreneurship and Technology) began a cooperative effort to catalyze the discovery and innovation process on campus, to translate NAU intellectual property into products and services with commercial potential and to identify private companies, entrepreneurs and investors interested in funding such endeavors.

**Notable Activity**

In 2011, Northern Arizona University developed a technology transfer “in-reach” program—a plan to meet with every principal investigator currently performing funded research on campus. In doing so, the Office of the Vice President for Research not only keeps current on the research programs of NAU faculty, but can also educate NAU researchers about potential commercial applications of their work. This in-reach program began generating invention disclosures in FY12.

During FY2011, Northern Arizona University received a grant from the Arizona Governor’s Office of Economic Recovery (GOER) to strengthen its partnership with NACET; NACET received an identical grant from GOER. With these funds, NAU and NACET established a student incubator program, called LaunchBox. Student teams will be launching their businesses with support from the incubator during FY2012. NAU’s GOER funding was also used to purchase accessories for a digital microscope housed at NACET (available for use by NAU faculty and research staff) as well as support for faculty research projects having a high potential to generate licensable technologies and/or start-up companies.

Funds from the GOER grant were also used to purchase a comprehensive technology transfer data management system, Wellspring Worldwide’s Sophia™, which will allow individual inventors to access information about the status of patent applications and licensing efforts and enable the university’s tech transfer partners—NACET and NAU Ventures—to have real-time access to the most up-to-date information about the university’s entire portfolio.

In FY2011 NAU and NACET jointly sponsored a “Power of Angel Investing” series seminar through the Angel Capital Education Foundation. This seminar provided a comprehensive overview of the angel-investing process to faculty, students, and members of the Northern Arizona entrepreneurial community.

In FY2011, NAU entered into its first international inter-institutional agreement with the University of Victoria, British Columbia, to manage intellectual property arising from collaborative research entitled, “Thyroid Assays across Indicator and Sentinel Species.”

**Technology Transfer Metrics**

As more and more NAU faculty members become comfortable with commercialization as an effective mechanism for disseminating their work, the numbers (and quality) of invention disclosures have climbed. However, it takes anywhere from five to eight years for a non-provisional (20-year) patent to issue. Because of this, the number of patents issued in a given year is actually a metric that reflects the quality of discoveries made in years past. While ABOR does own a number of patents for discoveries made by NAU employees in the 1990s and early 2000s, only over the last few years has the university made a deliberate and organized effort to generate intellectual property as a way of disseminating the results of research conducted by NAU faculty, staff and students. However, the university is enthusiastic about the future of its technology transfer program; there were a number of patents pending in FY2011 and several very promising discoveries were made. In a few years, NAU will reap the benefits (in the form of patents issued) of these discoveries. Similarly, numbers of, and revenues from, licensing university technologies do not yet reflect the increased emphasis on technology transfer at NAU. However, the university generated more licensing revenue in FY2011 than in any previous year since 2006, and enterprise goals set for the coming years reflect our expectation that as our technology transfer program matures, the outcomes generated—especially patents issued and licenses executed—will increase accordingly.

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Inventor Spotlights

From Muscle Actuators to Advanced Prosthetics

Muscles can adapt to changes in the environment without any intervention from the brain. Unfortunately, prostheses don’t work this way, and users of even the best devices are left moving in ways that look and feel artificial. Kïsa Nishikawa, Regents’ Professor of Biology, has developed a winding filament hypothesis and has created a bench model of an actuator that attempts to explain and mimic the behavior of muscle in response to applied forces. Nishikawa believes that the Titin protein winding around thin filaments is the driver behind the spring-like properties of muscles. This work is expected to lead to advances in the design and functioning of prosthetics.

Visually Representing Video Content Connections

In conjunction with researchers at the University of Vermont and the University of South Florida, Professor Paul Flikkema (Electrical Engineering) has developed a means for organizing multi-media information to optimize user value. A mix of graphical elements shows connections based on video clip content, allowing users to navigate through and understand the relationships between ideas, methods, and concepts of the videos. Additionally, the graphical representation evolves based on user activity and feedback. A potential application of this technology is an online (web-based) multi-media portal for educational material.

Rapid Results from a Hand-held Diagnostic Device

Water resources throughout the world are becoming contaminated with human-produced compounds that mimic the actions of naturally occurring hormones which can be harmful to the environment. The evaluation of this contamination is limited by the cost, complexity and sensitivity of existing assay formats. NAU researchers Catherine Propper (Biology), Timothy Vail (Chemistry), Niranjan Venkatraman (Electrical Engineering), and John Tester (Mechanical Engineering) have developed an inexpensive, rapid, easy-to-use lateral flow system comprised of a multi-assay cartridge holder and a hand-held, embedded opto-electronic reader. The advantages of this system over other traditional water testing include the ability to gain near real-time results from multiple tests that are nearly as sensitive and less expensive than traditional laboratory systems. Beyond water testing, this technology may also be suitable for applications in emergency medicine, disaster relief, veterinary care, pharmaceutical evaluation, drug testing, or portable clinical diagnostics for developing countries.

Working Against You, the Healthy Way

Regents’ Professor Stan Lindstedt and colleagues may have invented the perfect exercise device—one that doesn’t require the user to “do the work” so much as it “does the work to the user.” The Eccentron™ is a device that looks very much like a recombinant exercise bicycle but is quite the opposite—it requires the user to perform an eccentric (or ‘negative’) exercise, which involves using muscles to resist force rather than to produce it (think pushing bicycle pedals to stop them from rotating rather than pushing the pedals to make them rotate). The Eccentron™ is well-suited for the physical-rehabilitation market because it provides a highly effective workout opportunity for the elderly, the exercise-intolerant, and those with cardio-respiratory limitations. It is also well-suited for the general fitness market; the U.S. Ski Team has been using Eccentron™ as part of their summer preparation program, and they find it extremely advantageous. The athletes say that the ability to generate force independently with each leg allows them to better focus on specific muscles. In FY2011, NAU licensed the Eccentron™ to BTE Technologies, who plans to begin shipping product in FY2012.