TRIF 3-YEAR PLAN

NORTHERN ARIZONA UNIVERSITY

ARIZONA BOARD OF REGENTS

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This plan positions NAU as a national leader in supporting equity and delivering educational value to students and Arizona communities through workforce-driven programming throughout AZ and transformative learning opportunities in impactful research programs.

Executive Summary

Northern Arizona University (NAU) will use TRIF funds to foster integrated and complementary educational and research activities that create exceptional impact and value for our diverse students, leading to the betterment of Arizona's communities. Building on past investments, allocations of TRIF funds in this three-year plan will be distributed across three primary efforts; **Access and Workforce Development (A/WD, ~40%), targeted areas of research excellence (~30%), and a competitive process for seed funding (~30%)** to support and incentivize the development of new and expanded workforce development programs that enable access, as well as, research projects that support the intersections between research and experiential learning opportunities for our diverse student population.

The plan presented here provides continuing support for our A/WD initiative to serve the needs of Arizona residents, particularly the underserved, unemployed and underemployed. Arizona workers, especially those displaced by the Covid-19 disruptions, are urgently seeking flexible and stackable learning pathways that provide new career and advancement opportunities through upskilling and furthering their educations. NAU's action team charged to examine and revise our current portfolio of statewide academic programs, delivery models, and student support services will **ensure that we are meeting the unique labor demand needs of the individual communities surrounding each statewide site and providing support to ensure student success.** NAU's implementation of related actions will be data-driven and well-informed through the collective voices and work of the action team. The commitment of A/WD funding is critical for the success of this effort.

This plan provides ongoing support for our core **Areas of Distinctive Excellence in research** – Pathogen Genomics, Community and Health Equity Research, Forest Health and Environmental Sciences, and Astronomy & Planetary Sciences – by funding research and learning opportunities that are closely connected with our undergraduate and graduate educational programming. Further, targeted investments for **Developing Areas of Research Strength** will complement established programs at partner institutions within the state to address areas of critical need for the future knowledge-based economy such as informatics, cybersecurity, materials and bioengineering. The expected outcome of our investments in Developing Areas of Strength will be growth in research productivity that prioritizes student learning outcomes and connectivity with our academic programs. Past TRIF investments have seeded many outstanding student-focused educational outcomes, as detailed in the individual Program Descriptions, and an explicit focus of this plan is to invest directly in opportunities for students to participate in research and to enroll in research-training programs, with a particular focus on broadening these opportunities for first-generation and students from underserved groups.

A significant component of our plan includes dedicated seed funding, through a competitive basis, for **strategic investments to incentivize innovative workforce development programming and support developing research areas that promote student engagement and learning** through the Seed, Equipment and Infrastructure Investment process. This component of the 3-year TRIF plan is designed to ensure NAU remains nimble and responsive to areas of need in the state as they emerge. Impact on student success, ability to grow and broaden student participation, and capacity to equip students with

skills in demand from priority industries in the state will be the metrics in which this program, as well as all TRIF investments at NAU, will be evaluated.

These investments will improve the health and well-being of Arizonans, help solve regional problems of global relevance, increase regional and statewide economic opportunities, as well as, serve as an essential enabler of workforce development.

University Vision and Philosophy

NAU's goal is to equip students with knowledge and career-ready skills to meet AZ workforce needs and to find innovative scientific and technical solutions to problems facing our community, while providing direct economic benefit to the state through scientific advances, workforce training, and access to higher education for all Arizonans.

NAU is well positioned to expand the delivery of high-quality programming that reaches place-bound students, particularly underserved adult learners, while meeting the evolving workforce demands in Flagstaff and across the State of Arizona. We have developed a workforce and curriculum planning process to ensure program relevance and alignment with the workforce through the data-driven identification of high-growth and emerging academic programs. **By developing and delivering a variety of credentials informed by the real-time labor demand and workforce analysis tied to each of the unique statewide communities that we serve,** this key initiative will significantly increase the number of students with skillsets that meet the evolving workforce needs of existing and emerging employers. A proposed expansion of programs and services will offer a wider range of credentials and new ways of operating in collaboration with community colleges, including transfer pathways and adjunct faculty appointments, building stackable program pathways, and employing universal design practices across programs in 90/30 programs. To meet non-traditional student needs, NAU **will provide personalized student support services** through a University Advising Access Connected Care Team (ACCT) devoted to increasing access and student success.

The impact of NAU research on the education of students is a critically important outcome for our TRIF investments. NAU's mission has always been centered in education, and the **research investments have expanded opportunities for undergraduate and graduate participation in research and** development (undergraduate participation in research has grown nearly 25%, and graduate by more than 100% since 2015). This plan will help us achieve our goal of being a leading minority- and Hispanic Serving Institution by investing directly in opportunities for students to participate in research and to enroll in research-training programs, with a particular focus on broadening these opportunities for first-generation and students from underserved groups.

Central to NAU's three-year plan is the pursuit of grand challenges facing the State of Arizona and the world today that the core strengths of NAU's complimentary research and educational activities are uniquely positioned to address. The Office of the Vice President for Research and Office of the Provost have jointly identified key interdisciplinary programs within each initiative that align our expertise with these grand challenges and position the university effectively with external funding opportunities and industrial needs, summarized below.

- **Access and Workforce Development.** Northern Arizona University has a focused commitment to provide the residents of Arizona with access to high-quality educational pathways that provide career-ready knowledge and skills. **The programs identified below will attract and serve all**

interested learners through the diminishment of enrollment, retention, and completion barriers. Specifically, the deliberate design and alignment of real-time labor demand within the programs and support services will be a critical element to improve our support of historically underserved populations of adult learners and transfer students across the state.

- Workforce Training, Lifelong Learning, and Professional Development
  - The demand for workforce development, lifelong learning, and professional development offerings remains strong across Arizona. In response, **we have identified data-driven demand for launching workforce offerings and development centers, including the Mesa Workforce Development Center.** This specific effort will provide affordable and accessible education and training where people work and live. Additionally, we will **expand our professional development offerings successfully provided by the NAU College of Education and the K12 Center** in support of new and continuing teachers.
- New and Expanded Programming
  - NAU's action team is **charged to examine and revise our current portfolio of statewide academic programs, delivery models, and student support services**. These efforts will provide alignment between the unique labor demand and support needs of the communities and regions surrounding each statewide site. NAU's implementation of related actions will be data-driven and well-informed through the collective voices and work of the action team. Dedicated A/WD funding is critical for the success of this effort.
- Student Service and Support
  - The **creation of the University Advising Access Connected Care Team (ACCT) will build new institutional services devoted to increasing access and student success.** The student service and support efforts provided within ACCT will attract and serve adult learners and transfer students, particularly historically underserved populations with barrier-free educational pathways.
- Instructional and Graphic Design Support for High-quality Programming
  - NAU's instructional and graphic design strategies will continue to be supported through the A/WD funding. This professional design team is a **university-wide coordinated effort supporting faculty development of transformative and equitable educational opportunities** for all learners, including the growing diverse population of adult learners and working professionals.
- Continuing Support for Existing Access and Workforce Development Programs
  - NAU offers more than 60 flexible pathways of undergraduate and graduate programs at statewide sites and online. The continued use of A/WD funds to deliver these cross-disciplinary academic programs is **essential for the sustainability and growth of programs that align with current and projected workforce trends.**

- **Improving Health.** Northern Arizona University's efforts under the *Improving Health* initiative expands Arizona's biosciences economy by building increased research capacity in the biosciences/bioengineering and health research areas. Our research programs in health and the biosciences directly affect Arizonans through hospitals and healthcare institutions, medical technology industries, the identification and tracking of infectious disease in the community and by addressing healthcare disparities for underserved populations (Native American, Hispanic, and rural poor).

Improving Health investments will directly benefit from NAU's Areas of Distinctive Excellence in Pathogen Genomics and Community Health Research. Further, Improving Health will also benefit from more limited investment into NAU's Developing Area of Strength in Bioengineering/Biotechnology.

- **Water, Energy and Environmental Systems.** Northern Arizona University's programs under the *Water, Energy and Environmental Systems* initiative are based on the understanding that Arizona's natural resource base drives the viability of key economic activities of tourism, farming, ranching, and recreation. *Water, Energy and Environmental Systems* supports rigorous scientific research, sound scientific and technical assistance, and information transfer to landowners, managers, and stakeholders.

  This initative focuses on NAU's Areas of Distinctive Excellence in Forest Health and Land Management and Adapting to a Changing Environment.

- **National Security Systems.** Banking, healthcare, energy, travel, and manufacturing are just some of the industries that require (a) increasingly more secure means of protecting data and thwarting deliberate attempts to disrupt computer networks, (b) ever more sophisticated approaches to safeguarding computing systems operations, and (c) a more cyber-savvy workforce. Further, the precise management of foundational supply chains of energy, food, and water will be a requirement for communities for the foreseeable future. Development of novel purpose-driven functional materials will also deeply influence society of the future as well as burgeoning needs of the industry within the state.

  NAU has made recent hires of prominent researchers in these fields and is positioned to address these challenges with limited investment into the Developing Areas of Strength in Cybersecurity and Innovative Materials, and Supply Chain Management.

- **Space Exploration and Optical Systems.** Northern Arizona University's investment in *Space Exploration and Optical Systems* will leverage the state-of-the-art astronomical resources found in Northern Arizona to prepare a workforce with unique skills that will strengthen Arizona's stature as a worldwide leader in astronomy and planetary science research. Institutions in Arizona employ approximately 2,000 people in this field, with a payroll exceeding $84 million. Under this initiative, NAU post-docs and graduate students will develop cutting-edge skills that will prepare them for high-paying positions in Arizona.

  NAU's Area of Distinctive Excellence within this initiative is Solar System Science and Exoplanets.

The **Seed, Equipment and Infrastructure Investment process** is designed to ensure NAU remains nimble and responsive to areas of need as they emerge. For example, seed funding will be available on a competitive basis to develop workforce training experiences to reach new markets of AZ residents, to facilitate the development of new externally sponsored programs, to purchase and support of specialized instrumentation or for laboratory renovations, and for undergraduate and graduate student research experiences. This intramural process will be jointly administered by the Office of the Vice President for Research and the Office of the Provost. Impact on student success, ability to grow and broaden student participation, and capacity to equip students with skills in demand from priority

industries in the state will be the primary metrics in which this program, as well as all TRIF investments at NAU, will be evaluated.

Expected Outcomes

As a university with a significant focus on undergraduate education, NAU will use TRIF to **increase research participation across our student populations**, particularly among groups that have been historically underrepresented in the STEM disciplines, as well as to tangibly **integrate research and scholarly activity into our educational offerings**. The university's research portfolio, including areas of distinctive excellence and developing areas of strengths, will **strategically increase research expenditures, make significant contributions to knowledge creation, and support meaningful solutions** for regional problems of global relevance. Additionally, NAU will **increase access quality programs for rural and urban communities** resulting in a highly skilled workforce to address the industrial needs across the state.

Marketing/Communication Overview

Sharing the impacts of NAU's workforce-driven programming and transformative educational opportunities in cutting-edge research on students and AZ communities will be a vital part of informing NAU's stakeholders, including the public, state legislature, and ABOR, about the benefits of TRIF and its role in improving quality of life for all Arizonans.

Videos and featured stories in our re-branded marketing efforts will showcase NAU scientists and scholars—and their students— working together to solve regional problems of global relevance. Impacts of our revitalized portfolio of educational programming and student support services will be highlighted to demonstrate that NAU is meeting the unique labor demand needs of the individual communities surrounding each statewide site. Additionally, by creating news stories, press releases, and related marketing content that demonstrate how researchers develop solutions to the grand challenges facing us, NAU will show its audiences how NAU is using TRIF investments to generate tangible benefits that have a positive impact on Arizona's economic viability and make this state a better place to live.

The NAU University Marketing team, led by its Research Communications division, will deliver a consistent message by highlighting research impact, economic drivers, and student and public benefit through stories that showcase the positive impact of TRIF investments, including workforce development through student research opportunities, and projects that raise the reputation of Arizona's researchers in a way that attracts national and international investment to the state. NAU will also join a coordinated effort among the three Arizona universities to develop a strategic marketing plan that focuses on demonstrating the collective value of the TRIF program in research approach reaching its external stakeholders.

University Administration of TRIF

The Office of the Vice President for Research and the Office of the Provost are jointly responsible for implementing the 3-year plan, including disbursement of funds for each initiative. More specifically, the Vice President for Research and the Vice Provost for Online and Innovative Educational Initiatives engage with campus leaders and faculty to guide the achievement of the stated goals for each initiative, and to encourage the development of novel ideas and new interdisciplinary collaborations. These regular engagements also assist with limitations as they are identified and facilitate the annual reporting process on behalf of the university.

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Arizona Board of Regents

Technology and Research Innovation Fund (TRIF) Program Proposal

University:	Northern Arizona University
TRIF Investvest Area:	Access and Workforce Development
Program Name:	Continuing Support for Existing Access and Workforce Development Programs

Problem Statement:

NAU offers a legacy of strong programs that align with the workforce demand across the State of Arizona. The programs serve transfer students, including adult learners, through statewide and online delivery modes. Additionally, the support for the development of real-time labor demand and workforce analysis is aligned with the programming offered. The continuation of these program investments is critical to continue the delivery and support of flexible high-quality programming that meets the needs of the Arizona workforce.

Program Description:

The existing academic programs supported through A/WD TRIF funding cross many disciplines. They are intentionally designed in flexible manners, including but not limited to 90/30-degree completion programs, certificates, and graduate degrees. For the 90/30-degree completion programs, NAU faculty collaborate with our community college partners to design and design programs in Arizona that include well-articulated progression plans for students to follow from entry point through graduation. The following academic discipline areas deliver more than sixty certificate, undergraduate and graduate programs online and at statewide sites through the TRIF A/WD initiative. These programs will continue to be supported with this important funding: Communication Sciences & Disorders Programs, Educational Leadership Programs, Educational Psychology Programs, Educational Specialties Programs, Teaching & Learning Programs, Health Sciences Programs, Nursing Programs

What is the University's Advantage and/or Anticipated Funding Opportunities?

NAU has a significant advantage for serving Arizona transfer students and adult learners through the delivery of workforce-driven programs at our statewide sites. These locations provide place-bound students the much-needed access to high-quality educational pathways, while empower them to maintain their life commitments, particularly jobs, family, and community responsibilities.

Is there an Arizona Specific Benefit or Impact?

High-growth labor trends are commonly described as above-average student and labor market demand growth and volume. According to Hanover Research, Arizona student degree completion trends and employment projections indicate there are 11 high-growth fields projected at the bachelor's level. Additionally, there are 14 high-growth fields projected at the master's level. All projected high-growth fields are captured within the existing academic programs supported through A/WD TRIF funding. The continued delivery of these programs is essential for the sustainability and growth of programs that align with current and projected workforce trends.

Investment Detail

	2022	2023	2024	Total
Infrastructure	2,758,788	2,539,588	2,539,588	7,837,964
Basic Research				0
Applied Research				0
Development				0
Total	2,758,788	2,539,588	2,539,588	7,837,964

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses				0
Postdocs Supported				0
Graduate Students	1,235	1,321	1,454	4,010
Undergraduate Students	2,749	2,941	3,235	8,925
Sponsored Project Funding				0
Publications in Academic Peer-Reviewed Journals				0
Startups				0

Arizona Board of Regents

Technology and Research Innovation Fund (TRIF) Program Proposal

University:	Northern Arizona University
TRIF Investvest Area:	Access and Workforce Development
Program Name:	Student Service and Support

Problem Statement:

As US society has increasingly created a narrative of questioning the value of higher education, students and their families have had greater interest in assurances that the university experience and achieving a college degree will lead to social mobility through expanded employment opportunities. This specific population will benefit from a prescriptive degree completion plan that increases access through barrier-free support. Now more than ever, it is critical that all students, including adult learners, receive holistic services and support throughout the student lifecycle, particularly in the areas of purposeful academic and career alignment, participation in internship and externships, transferable career skill development, and strong job seeking skills.

Program Description:

Example of proposed programming:

• University Advising Access Connected Care Team: The creation of the University Advising Access Connected Care Team (ACCT) will build new institutional services devoted to increasing access and student success, with a particular emphasis on non-traditional transfer students and academic programs supporting workforce development. We will directly address the distinct needs of non-traditional and adult learners through a case-management approach, which guides students through institutional policies and processes, serves students outside traditional business hours, and integrates an infrastructure that utilizes data and technology for data-driven decision-making and efficient operations.

What is the University's Advantage and/or Anticipated Funding Opportunities?

ACCT will substantially improve our ability to open access pathways and build capacity in workforce development programs. The North Valley site provides an ideal location convenient for place-bound students within Phoenix, Statewide Sites, and surrounding communities. We will provide on-site services at the North Valley site with a focus on degree attainment in a timely and cost-effective manner. The student support will collaborate across university and community college partners to attract and serve students with barrier-free educational pathways, including the development of a comprehensive structure for accessing prior learning for credit.

Is there an Arizona Specific Benefit or Impact?

In July 2021, Arizona ranked 39th amongst US states in unemployment rates at 6.6% (national average is 5.4%) and 33rd in college attainment rates (30% compared to the national average of 33%). College degrees can result in greater access to higher paying jobs and provide protection against unemployment. But college degrees alone do not provide access to higher paying job opportunities; students also need experiences that build transferable job skills and access to social networks that provide access to such jobs. NAU will advance its commitment to equitable postsecondary value by embedding career development in academic programs, and providing direct support to students to build a strong professional portfolio of transferrable career skills enhanced with internship experiences.

Investment Detail

	2022	2023	2024	Total
Infrastructure	1,277,146	1,219,979	1,082,361	3,579,486
Basic Research				0
Applied Research				0
Development				0
Total	1,277,146	1,219,979	1,082,361	3,579,486

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses				0
Postdocs Supported				0
Graduate Students	481	713	977	2,171
Undergraduate Students	1,070	1,587	2,174	4,831
Sponsored Project Funding				0
Publications in Academic Peer-Reviewed Journals				0
Startups				0

Arizona Board of Regents

Technology and Research Innovation Fund (TRIF) Program Proposal

University:	Northern Arizona University
TRIF Investment Area:	Access and Workforce Development
Program Name:	Instructional and Graphic Design Support for High-quality Programming

Problem Statement:

Providing well-developed faculty professional development programs increases overall organizational satisfaction. Professional instructional design drives engaging learning experiences within faculty coursework. A focus on instructional design is necessary to develop and deliver high-quality, accessbile programs for all learners. Course enrichments for adult learners will provide classroom design that create effective learning experiences. Busy working professionals will be more engaged and retained through professional design practices. Ongoing TRIF funding will support innovative development of new and existing programs, including alternative credentials, learning modules, stackable programming, as well as prior learning assessments and portfolios.

Program Description:

The following instructional and graphic design strategies will be supported through the TRIF A/WD initiative.

• Coordination of a university-wide instructional and graphic design team to develop transformative and equitable educational opportunities for all learners, including the growing diverse population of adult learners and working professionals

• Intentional universal design practices for the creation of instructional materials and utilization of educational technology that enables student success

• Ensuring that workforce training, lifelong learning, and professional development programs are developed with competency-based focus design that articulate to learning outcomes

What is the University's Advantage and/or Anticipated Funding Opportunities?

Designing classroom instruction that utilizes emerging educational technologies to engage and satisfy adult learners will lead to high-quality learning experiences. The ongoing support of the coordinated team of instructional and graphic designers aligns with NAU's vision to create access to high-quality programming by delivering the highest course quality through the professional development of NAU faculty.

Is there an Arizona Specific Benefit or Impact?

NAU serves a diverse population of students through the statewide and online programs. The instructional and graphic designers provide expert learning design, educational graphics and creative design, educational technology services, and training support for all NAU faculty, including online and statewide faculty members. Instructional design principles will support the faculty to deliver engaging content that will lead to effective connections between students, faculty, as well as more involvement from students in their learning.

Investment Detail

	2022	2023	2024	Total
Infrastructure	1,123,554	1,123,553	1,123,553	3,370,660
Basic Research				0
Applied Research				0
Development				0
Total	1,123,554	1,123,553	1,123,553	3,370,660

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses				0
Postdocs Supported				0
Graduate Students	50	100	200	350
Undergraduate Students	100	200	300	600
Sponsored Project Funding				0
Publications in Academic Peer-Reviewed Journals				0
Startups				0

Arizona Board of Regents

Technology and Research Innovation Fund (TRIF) Program Proposal

University:	Northern Arizona University
TRIF Investment Area:	Access and Workforce Development
Program Name:	Workforce Training, Lifelong Learning, and Professional Development

Problem Statement:

Arizona is facing a worker shortage across several sectors, including the service industry, high-skilled technical talent, and manufacturing environments. Arizona sectors with high job losses due to the pandemic include education, sales, and social services, with the current job market privileging bachelor's and master's degree recipients. Arizona's Hispanic or LatinX populations are reported at 31.7%, a significantly higher percentage than the rest of the country. Hispanic, first-generation, non-traditional, and low-income students often seek formal education and/or workforce training to enhance their opportunities. The demand for workforce training, lifelong learning, professional development will remain strong as community members seek alternative educational pathways toward sustainable employment.

Program Description:

Mesa Workforce Development Center: The NAU School of Hotel and Restaurant Management (SHRM) is working with Intermestics Partners and Kind Hospitality to develop a facility that will serve as an education and training hub located at Skybridge Arizona in Mesa, AZ. The leaders of SkyBridge estimate 10,000-12,000 new jobs will be created within the next decade on site, based on the mixed use of the 3.5 million square feet slated for development, and that is just within Phoenix-Mesa Gateway Airport. The Center will prepare students and workers for jobs by providing the necessary skills and credentials through apprenticeships and employer required occupational training in addition to their regular academic instruction. Other proposed workforce training, lifelong learning, and professional development programs include a Microelectronics Workforce Training Program, Industry 4.0 Workforce Training Lab, Financial Planning Certificate, Risk Management and Insurance Certificate, Hospitality Innovative Technology (HIT) Certificate, Organizational Leadership Series, Customer Service Institute, and K-12 Center.

What is the University's Advantage and/or Anticipated Funding Opportunities?

The Mesa Workforce Development Center Skybridge partner, Swift, is already a corporate partner for the W.A. Franke College of Business (FCB) Risk Management and Insurance (RMI) program. The corporation has made a significant donation to the RMI program.

The state of Arizona has been home to many semiconductor and electronics manufacturing companies since 1950's. Recently, TSMC and Intel both announced their investment to build additional semiconductor fabs in Chandler, AZ. The Microelectronics Workforce Training Program will provide the industry with a talented and intelligent university-educated workforce that will innovate, build new products, and adapt to new technologies.

Is there an Arizona Specific Benefit or Impact?

Providing affordable, accessible, and flexible workforce education and training where people work and live is critical to Arizona future. NAU will help develop the talent that employers need to accommodate present and future demand for their products and services.

Investment Detail

	2022	2023	2024	Total
Infrastructure	800,600	740,456	761,350	2,302,406
Basic Research				0
Applied Research				0
Development				0
Total	800,600	740,456	761,350	2,302,406

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses				0
Postdocs Supported				0
Graduate Students	100	200	300	600
Undergraduate Students	165	300	475	940
Sponsored Project Funding				0
Publications in Academic Peer-Reviewed Journals				0
Startups				0

Arizona Board of Regents

Technology and Research Innovation Fund (TRIF) Program Proposal

University:	Northern Arizona University
TRIF Investment Area:	Access and Workforce Development
Program Name:	New and Expanded Programming

Problem Statement:

The Covid-19 pandemic has disrupted the labor market in unprecedented manners across the State of Arizona, including the closings of nonessential businesses, significant demands in healthcare, and sudden shifts to remote work. These disruptions have resulted in displacements of much of the workforce, including but not limited to, service workers, education providers, sales, and social service fields. A significant number of affected workers represent socioeconomically vulnerable diverse populations. Workers are urgently seeking flexible and stackable pathways of education that provide new career and advancement opportunities through upskilling and furthering their educations.

Program Description:

We have organized an action team to provide an inclusive and collaborative review of our current portfolio of academic programs, delivery models, and student services for each of the statewide sites. This action team is further charged to identify the unique labor demand needs of the individual communities surrounding each statewide site and provide recommendations for new and expanded programming in collaboration with the community college partners. Programming recommendations will include workforce development strategies and student services to best serve our current and future students across the State of Arizona. NAU's implementation of related actions will be data-driven and well-informed through the collective voices and work of the action team. The commitment of A/WD funding is critical for the success of this effort. Examples of potential programming: Grow Your Own Program – Teacher Education: The Grow Your Own program will prepare future teachers to make a difference in their communities. CS4ALL Teaching Certificate – Teacher Education: NAU's strong expertise in computer science pedagogy and teacher training make it a natural partner in the state's Computer Science vision.

What is the University's Advantage and/or Anticipated Funding Opportunities?

We are well-positioned to reach urban and rural communities through our established statewide sites. The delivery of new and expanded programs will represent high workforce demand and will also provide much needed access to local communities. Proposed expansion of programs will offer a wider range of credentials and new ways of operating in collaboration with community colleges, including opportunities to partner across staff and faculty, building stackable program pathways, and employing universal design practices across programs in 90/30 programs.

Is there an Arizona Specific Benefit or Impact?

As reported in the 2020 College Completion Report, most of the state public universities' graduates stay in Arizona, find jobs, and contribute to the state's workforce. Providing access to degree attainment in high demand fields for place-bound adult learners will continue to support who would otherwise face undue challenges in pursuing a baccalaureate or graduate degree. Additionally, we will provide upskilling of the workforce communities surrounding our individual statewide sites that will provide pathways for securing a job near their homes and result in the retention of our working residents of Arizona.

Investment Detail

	2022	2023	2024	Total
Infrastructure	219,112	555,624	672,348	1,447,084
Basic Research				0
Applied Research				0
Development				0
Total	219,112	555,624	672,348	1,447,084

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses				0
Postdocs Supported				0
Graduate Students	20	60	120	200
Undergraduate Students	30	60	120	210
Sponsored Project Funding				0
Publications in Academic Peer-Reviewed Journals				0
Startups				0

Arizona Board of Regents

Technology and Research Innovation Fund (TRIF) Program Proposal

University:	Northern Arizona University
TRIF Investvest Area:	Improving Health
Program Name:	Pathogen Genomics

Problem Statement:

The Challenge: Rapidly characterize outbreaks of pathogens to inform and enable community response. The COVID-19 pandemic illustrated that rapid detection of microbial pathogens is critical to an informed community response. Although the pandemic illuminated the need for screening in the eyes of many Americans, rapid and reliable detection strategies are also crucial for doctors to prescribe appropriate antibiotic regimens and to identify emerging biothreats. In Arizona, environmental monitoring of pathogens found in soil or animal hosts (e.g. Valley fever, West Nile virus) is necessary to inform appropriate community responses. New detection and mitigation strategies will be a national priority and the need for skilled professionals to collect and interpret this data has never been more important.

Program Description:

Northern Arizona University's program in Pathogen Genomics research is primarily carried out through the world-renowned Pathogen and Microbiome Institute (PMI), with complementary research in this area in the Department of Biological Sciences and School of Informatics, Computing & Cyber Systems. Major focus areas include the evolution, ecology, and epidemiology of human and animal pathogens spanning those involved in hospital-acquired infections, to anthrax, plague, biological warfare agents, to virulent viral pathogens such as COVID-19. Research strengths encompass microbiology, high throughput genetics and genomics analysis, bioinformatics and drug development. Cutting-edge research efforts are also contributing to our understanding of the human microbiome through identification and characterization of the communities of microorganisms of the human gut, sinuses, and skin, for example, which are associated with human health and disease.

What is the University's Advantage and/or Anticipated Funding Opportunities?

NAU is uniquely equipped to address this challenge due to its core strength in microbial genetics, genomics and microbiome sciences, and its history of training undergraduate researchers to support the health-care and biotechnology industries. Anchored by PMI, which includes a state of the art BSL3 laboratory and vivarium, NAU will continue to maintain robust relationships with external clients at the DHS and DoD. Recent investment into PMI has enabled it to grow its portfolio to include expertise in virology and computational sciences. On average, Pathogen Genomics researchers have trained over forty undergraduate researchers annually over the previous five-year period and continue to provide exemplary training in the fundamentals of genomic research. These students go on to outstanding next steps after NAU, including medical school and top graduate programs.

Is there an Arizona Specific Benefit or Impact?

Pathogen Genomics researchers specialize in infectious disease that affect Arizona and the Southwest. Their expertise was instrumental to the community response to COVID-19 and they play important roles in continued monitoring efforts. The program has proven to be effective in training students for jobs in translational genetics and medicine. In addition to researching pathogens with a significant presence in the state, NAU launched the COVID-19 Testing Service Center to grow the SARS-CoV-2 virus and test new drugs against it, giving Arizona an edge in responding to the crisis. NAU's TRIF investments will ensure researchers continue to make discoveries and invent new technologies that have an immediate and long-lasting impact on the health and well-being of the population of Arizona.

Investment Detail

	2022			Total
Infrastructure	180,000	180,000	180,000	540,000
Basic Research	359,788	385,467	459,800	1,205,055
Applied Research	185,000	185,000	185,000	555,000
Development	0	0	0	0
Total	724,788	750,467	824,800	2,300,055

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	0	0	0	0
Postdocs Supported	4	5	6	15
Graduate Students	17	22	24	63
Undergraduate Students	50	52	55	157
Sponsored Project Funding	6,000,300	6,493,946	6,890,261	19,384,507
Publications in Academic Peer-Reviewed Journals	52	57	62	171
Startups	0	0	0	0

Arizona Board of Regents

Technology and Research Innovation Fund (TRIF) Program Proposal

University:	Northern Arizona University
TRIF Investvest Area:	Improving Health
Program Name:	Biotechnology and Bioengineering

Problem Statement:

The Challenge: Developing new technologies to address critical medical needs of Arizona and the nation. The need for innovative solutions to medical problems is ever-present in society. Arizona has significant areas of medical need common to our civilian and veteran populations. As a single example, the NIH has dedicated programs to spur the development of tools and rehabilitation strategies to prevent ambulatory decline in aging populations, and the DoD has a need for similar technologies to aid human performance of service members and recovery of injured veterans. Technologies that respond to current and emergent needs of civilians that are also positioned to serve the needs of deployed military and injured veterans represent highly attractive investment areas for the state.

Program Description:

The Bioengineering and Biotechnology initiative is supported by a recently established PhD program in Bioengineering and by researchers in diverse departments, including Biological Sciences, Applied Physics & Materials Sciences, Chemistry, Health Sciences, Athletic Training, and Mechanical Engineering, which form collaborative interdisciplinary groups to carry out basic and applied research in areas including personal bionics and wearable robotics, rehabilitation, hearing improvement, development of materials and devices for biocompatible implants, sensors, wound healing agents, and other medical devices. NAU researchers are positioned well to partner with faculty at other in-state institutions to further develop research programs and provide experiential learning opportunities for our students in this broader area.

What is the University's Advantage and/or Anticipated Funding Opportunities?

As the home of the medical devices division of industry pioneer W.L. Gore, Flagstaff is a center of innovation within the state for bioengineering and medical devices. Previous program investment enabled NAU to contribute to these fields while concurrently training students to meet the workforce needs of these industries. NAU will draw from expertise in the departments of Biological Sciences, Chemistry, Mechanical Engineering, and Applied Physics & Materials Sciences to pursue external funding opportunities in Defense as well as NIH. Skills of NAU researchers participating in this program complement larger programs at our partner institutions in the state, and collaborative projects among universities are likely to yield further positive outcomes and expanded research opportunities for our students, in turn providing graduates strong fundamental skills for employment in the biotechnology or medical devices industries.

Is there an Arizona Specific Benefit or Impact?

Wearable technology, sensors, precision medicine, and medical device development are a focus of the Bioengineering and Biotechnology program, and NAU will continue to develop intellectual property and licensable technology in these areas. Ongoing work has fostered SBIR/STTR grants and start-up companies based on NAU technology, and further investment will expand these opportunities. Arizona in general and Flagstaff in particular is home to many industries that require skilled workers in medical devices and translational biotechnology research. Investments in bioengineering and biotechnology are catalyzing discoveries that improve lives, foster economic growth and provide cutting-edge training for a diverse population of students who will join Arizona's workforce.

Investment Detail

	2022	2023	2024	Total
Infrastructure	416,500	512,500	0	929,000
Basic Research	263,704	128,489	153,267	545,460
Applied Research	117,450	0	0	117,450
Development	0	0	0	0
Total	797,654	640,989	153,267	1,591,910

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	416,500	512,500	0	929,000
Postdocs Supported	3	4	6	13
Graduate Students	18	19	22	59
Undergraduate Students	30	35	40	105
Sponsored Project Funding	1,502,864	1,552,940	1,587,303	4,643,107
Publications in Academic Peer-Reviewed Journals	22	24	26	72
Startups	0	0	1	1

Arizona Board of Regents

Technology and Research Innovation Fund (TRIF) Program Proposal

University:	Northern Arizona University
TRIF Investvest Area:	Improving Health
Program Name:	Community Health Research

Problem Statement:

The Challenge: Reducing health disparities in rural and underserved populations. Many prevalent diseases in America disproportionately affect minority and underserved/rural populations, and this trend is often magnified in the southwest. In Arizona, the mortality rates associated with diabetes are nearly eight-fold higher than the state average for Native American communities and two-fold higher for Hispanic/Latino populations. A 2020 CDC report also found that Native Americans have higher incident rates of many cancers compared to non-Hispanic White people (www.cdc.gov/cancer/dcpc/ research/articles/cancer-AIAN-US.htm). The factors that contribute to health inequity are multifaceted and require a coordinated and interdisciplinary response.

Program Description:

The Community Health Research program will further develop NAU's nationally recognized capacity to produce translational health research and discoveries in community-based healthcare research, precision and personalized medicine, infectious disease control, and partnership-based clinical research for the diverse populations of Arizona and beyond. The program supports a wide range of research into chronic health conditions such as cardiac disease, obesity, dental health, communicative disabilities, , cancer, health informatics, and wellness training research, among others. Faculty across departments in the College of Health & Human Services, the College of Engineering, Informatics & Applied Sciences, the College of the Environment, Forestry & Natural Sciences, and the College of Social & Behavioral Sciences work in collaborative, interdisciplinary groups to transform evidence-based bioscience and health care applications to improve lives and foster economic growth in Arizona and beyond.

What is the University's Advantage and/or Anticipated Funding Opportunities?

Previous investment into this program has paid dividends via the establishment of the Center for Health Equity Research (CHER) and the Southwest Heath Equity Research Collaborative (SHERC); moreover, NAU has a longstanding focus on basic science impacting cancer health disparities, community health and student training through the Partnership for Native American Cancer Prevention (NACP), which is a partnership with the University of Arizona Cancer Center (UACC) funded by the National Cancer Institute. Achieving health equity, eliminating disparities, and improving population health is a of the goal of the Health People 2030 initiative set forth by the Department of Health and Human Services. Together, Community Health researchers equip Native American, Hispanic and other diverse students with high impact multidisciplinary training that prepares them for a wide variety of solutions-oriented jobs in critical areas of need.

Is there an Arizona Specific Benefit or Impact?

Investment into the Community Health Research program serves address health disparities in underserved populations throughout the state and trains diverse students for careers in health-related occupations. Program researchers and their mentees are spearheading interdisciplinary and culturally informed efforts to find community-driven solutions to address health inequities wherever they exist. By building valuable partnerships with local and regional healthcare providers, research institutions and tribal communities, program researchers are making important developments in community and behavioral health sciences, which are particularly valuable for rural Arizona communities that do not have the same access to public health resources as do individuals in Phoenix or Tucson.

Investment Detail

	2022	2023	2024	Total
Infrastructure	60,000	60,000	0	120,000
Basic Research	359,788	385,467	459,800	1,205,055
Applied Research	0	0	0	0
Development	0	0	0	0
Total	419,788	445,467	459,800	1,325,055

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	0	0	0	0
Postdocs Supported	4	5	7	16
Graduate Students	22	27	28	77
Undergraduate Students	15	18	22	55
Sponsored Project Funding	3,539,802	3,381,061	3,217,860	10,138,723
Publications in Academic Peer-Reviewed Journals	40	44	48	132
Startups	0	0	0	0

Arizona Board of Regents

Technology and Research Innovation Fund (TRIF) Program Proposal

University:	Northern Arizona University
TRIF Investvest Area:	National Security Systems
Program Name:	Cybersecurity and Innovative Materials

Problem Statement:

The Challenge: Preventing cybercrime through the development of hacker-resistant security measures and novel materials. As of December 2020, global economic losses from cybercrime were estimated to be over a trillion dollars, and over half of companies that experienced a cyberincident admitted to having no plan to respond to or prevent a future incident. The most pressing challenge is the need for cybersecurity that cannot be easily defeated. Novel approaches include embedded encryption in hardware, innovation in secure quantum computing, nanotechnology and robust microelectronics. The development of innovative materials to address these concerns also has practical applications spanning national security, the production of clean energy and water, and microelectronics.

Program Description:

The Cybersecurity and Innovative Materials program addresses key challenges for secure computing and the development of microelectronics. Cybersecurity for information and communications systems, reconfigurable computing, remote sensing, and the internet are areas of major concern for industry operations, institutional protection of data, computer-to-computer communications, and other related applications. Every technology-oriented industry requires increasingly sophisticated approaches to computing systems operations, computing applications, and data protection. In addition to the need for cybersecure materials, the society of tomorrow will increasingly rely on bioelectronics and biosensors, quantum computing, nanotechnology, and those for novel energy storage. All of these will require fundamental research and translatable discoveries to forge these foundations for society. We see this growing need as a core national security priority in the coming decade, as is the effective training of participants in the computing systems and microelectronic industry workforce.

What is the University's Advantage and/or Anticipated Funding Opportunities?

The university will leverage expertise in the School of Informatics, Computing & Cyber Systems, Mechanical Engineering and Applied Physics & Material Science to develop technology modules that will enable new forms of protection across the landscape of cybersecurity needs. Furthermore, NAU researchers will leverage strengths in materials science across multiple academic units as well as the Center for Materials Interfaces in Research and Applications (¡MIRA!), to develop and combine several new technologies, including innovations in microelectronics and the design of computer hardware, to improve the ability of computers to fend off cyberattacks. ¡MIRA! is a materials science center with research foci on quantum materials, active matter and nanoclusters, materials for national security and maintains a mission for expanding opportunities for students from underserved groups in applied materials research.

Is there an Arizona Specific Benefit or Impact?

National security and the economic vitality of the United States depends on a stable, safe and resilient cyberspace. The cybersecurity and defense industries have long been one of the most important employers for the state, and coupled with the rapid expansion of job opportunities in semiconductors and microelectronic materials there is expected to be an immediate and pervasive need for skilled workers across these fields in the state of Arizona. Program researchers will provide important experiential opportunities for undergraduate and graduate students, thus in these disciplines to help meet the growing need for these important and rapidly growing Arizona industries.

Investment Detail

	2022	2023	2024	Total
Infrastructure	309,731	125,000	0	434,731
Basic Research	119,929	128,489	153,267	401,685
Applied Research	71,888	0	0	71,888
Development	71,887	0	0	71,887
Total	573,435	253,489	153,267	980,191

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	309,731	125,000	0	434,731
Postdocs Supported	6	8	8	22
Graduate Students	25	30	35	90
Undergraduate Students	30	35	40	105
Sponsored Project Funding	1,992,141	2,227,355	2,389,619	6,609,115
Publications in Academic Peer-Reviewed Journals	20	22	25	67
Startups	0	0	2	2

Arizona Board of Regents

Technology and Research Innovation Fund (TRIF) Program Proposal

University:	Northern Arizona University
TRIF Investvest Area:	National Security Systems
Program Name:	Supply Chain Management

Problem Statement:

The Challenge: Empower communities with tools to enable adaptation to unexpected events. Communities thrive when they have ready access to food, energy and water, but when disruptions to their supply occurs (through natural disasters, wildfires, extreme weather events, or even a global pandemic) the lives and livelihood of its citizens may be jeopardized. The ability to accurately model and visualize the supply chain and commodity transit pathways in real-time can provide powerful information for decision-makers and emergency managers in the resilient management of their food, energy and water systems for disaster relief and recovery. Knowledge of potential limitations to commodity distribution can help communities and states plan for and effectuate recovery as rapidly as possible.

Program Description:

The Supply Chain Management program researchers work with very large datasets in partnership with economic forecasting data and analysis of social and behavioral trends in affected communities, to enable construction of models to develop effective responses to unexpected events. Effective community responses to catastrophic events is a priority global need that serves to protect people's lives and livelihoods. Supply chain analysis will aid development of intelligently planned and sustainable smart cities, smart buildings and smart cars. Implementation of the program relies on interdisciplinary expertise from a suite of academic units, including the School of Informatics, Computing & Cyber Systems, School of Earth & Sustainability, College of Health & Human Services, College of Social & Behavioral Sciences, and the W.E. Franke College of Business. The strong focus on interdisciplinarity fosters technical innovations, economic development, and workforce training.

What is the University's Advantage and/or Anticipated Funding Opportunities?

NAU researchers are developing a nationally scalable protocol for public participation in research that leverages data science and visualization tools, and we anticipate this program will effectively complement work at our partner institutions in the state. FEWSION, which uses comprehensive data sets to map out domestic supply chains and resources, aims to develop a framework for deploying adaptation strategies for interdependent power, water, and transportation systems. The tool analyzes and extracts new information from public datasets describing the production, consumption, and flow of food, energy, and water. This program represents an attractive path for students seeking careers in data analytics or information sciences. We anticipate opportunities for student engagement to increase as the program develops, and collaboration with researchers at programs in other statewide institutions will be pursued.

Is there an Arizona Specific Benefit or Impact?

The pandemic has shown that effective management of supply chains is essential. When disruptions to the supply of food, energy or water occurs, people's lives and livelihood are at risk. Investment into the Supply Chain Management program will enable NAU researchers to develop unique algorithms from publicly-available datasets to describe the production, consumption, and flow of food, energy, and water. These tools will provide invaluable information to city planners, economic planners and emergency managers inside and outside of Arizona. Further, training of undergraduate, graduate and postdoctoral scientists in advanced data analytics will provide effective workers to meet the need of industry in the state.

Investment Detail

	2022	2023	2024	Total
Infrastructure	0	0	0	0
Basic Research	119,929	128,489	153,267	401,685
Applied Research	0	0	0	0
Development	0	0	0	0
Total	119,929	128,489	153,267	401,685

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	0	0	0	0
Postdocs Supported	0	2	3	5
Graduate Students	2	6	9	17
Undergraduate Students	3	10	13	26
Sponsored Project Funding	1,559,548	1,456,649	1,355,663	4,371,860
Publications in Academic Peer-Reviewed Journals	18	20	22	60
Startups	0	0	0	0

Arizona Board of Regents

Technology and Research Innovation Fund (TRIF) Program Proposal

University:	Northern Arizona University
TRIF Investvest Area:	Space Exploration and Optical Sciences
Program Name:	Solar System Science and Exoplanets

Problem Statement:

The Challenge: To understand the composition of objects in our solar system, and to pursue a spacecraft mission to explore an asteroid. The origins of the Solar system and its unexplored bodies remain among the most significant questions for space scientists. Research is performed through high-powered telescopy, in which signatures are assessed through measurement and analysis of large data sets. Data obtained from instrumentation delivered to the site of observation via a planned spaceflight is also necessary. Cutting-edge equipment must be made that is limited in size and weight, is robust and resilient, and is constructed in an economical fashion. Deployed instrumentation can acquire data inaccessible through telescope images and is critical to understand the composition of these bodies.

Program Description:

TRIF funding has enabled recruitment of leading-edge faculty to NAU's Department of Astronomy and Planetary Sciences with experience on collaborative spacecraft missions, and program researchers aim to lead a spacecraft mission to an asteroid through the NASA SIMPLEx program. Currently, researchers and their students direct the daily tasks of the NASA Curiosity Rover on the surface of Mars from campus and have developed deployable instruments for other missions to the red planet. Researchers specializing in exoplanets have access to powerful telescopes, as well as unique equipment capable of replicating and measuring phenomena in the environments of these distant planets. NAU researchers will engage with our partner institutions in the state, and with the aerospace industry in Arizona. In addition to yielding valuable scientific information, this project will also provide industry contacts and unique training opportunities for undergraduate and graduate researchers, strongly serving current needs of this cornerstone industry in Arizona.

What is the University's Advantage and/or Anticipated Funding Opportunities?

Northern Arizona was the site of a transformative finding in planetary science when Pluto was discovered at Lowell Observatory, and NAU is positioned to build on this rich tradition. Previous investment grew the department of Astronomy & Planetary Science, created a top-tier doctoral program, and enabled important discoveries, such as the evidence of Farfarout, which was recently confirmed as the most distant object in the Solar System by the International Astronomical Union. NAU researchers access important telescopes and have developed valuable collaborations (Lowell Observatory, USGS) to pursue new funding opportunities at NASA, the DoD, and ithe NSF. Finally, program researchers are collaborating with other areas of university strength to understand seasonal variations of biosignatures using remote sensing, both on Earth and potentially those detectable on astrobiological targets of interest.

Is there an Arizona Specific Benefit or Impact?

According to the Arizona Commerce Authority, the state is home to over 1300 manufacturers and suppliers of the aerospace industry and employs over 58,000 workers. Astronomy and planetary sciences is also an important employer for the state, which houses numerous internationally recognized research facilities and observatories. Investment into the Solar Systems Sciences and Exoplanets program will allow researchers and students to engage with our partner institutions in the state, and with the aerospace industry in Arizona. In addition to the scientific information this program is poised to provide, it will also facilitate industry contacts and unique learning opportunities for undergraduate and graduate researchers, strongly serving current needs of this industry in Arizona.

Investment Detail

	2022	2023	2024	Total
Infrastructure	0	0	0	0
Basic Research	689,788	715,467	789,800	2,195,055
Applied Research	0	0	0	0
Development	0	0	0	0
Total	689,788	715,467	789,800	2,195,055

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	0	0	0	0
Postdocs Supported	0	1	1	2
Graduate Students	7	8	10	25
Undergraduate Students	10	13	16	39
Sponsored Project Funding	3,465,529	3,919,541	4,297,490	11,682,560
Publications in Academic Peer-Reviewed Journals	40	44	48	132
Startups	0	0	0	0

Arizona Board of Regents

Technology and Research Innovation Fund (TRIF) Program Proposal

University:	Northern Arizona University
TRIF Investvest Area:	Water, Energy and Environmental Systems
Program Name:	Forest Health and Land Management

Problem Statement:

The Challenge: Development of a sustainable management strategy to improve forest health and lessen the risk of catastrophic wildfire. Forests in the western U.S. provide invaluable resources and services to the nation. In addition to the financial benefit they provide, healthy forests also contribute to people's quality of life. Forests provide clean air and water, contribute to biodiversity, recreational opportunities, and scenic landscapes. Unmanaged forests, on the other hand, are at risk of catastrophic wildfires and post-fire flooding that damage landscapes and livelihoods. An interdisciplinary and coordinated approach to develop and promote the best science to inform management is required to accomplish forest restoration and watershed protection is needed inside and outside of Arizona.

Program Description:

Under the Forest Health and Land Management initiative, NAU invests in researchers in the Ecological Restoration Institute (ERI), along with faculty in the School of Forestry, School of Earth & Sustainability, and School of Informatics, Computing & Cyber Systems. ERI seeks solutions to the costly environmental problems of degraded forest health and unnatural wildfire. Losses of city and county revenue from decreased tourism, short-term job losses, damage to water supplies, and the devastation experienced by those who live through catastrophic wildfire are just some of the economic impacts that ERI's work seeks to alleviate. Additionally, investments in the program support the development and use of remote sensing technology to monitor forest health, wildfire recovery, and the effect of environmental change on wildlife populations. Past TRIF investments in these units have enabled NAU to provide training in restoration science, including fieldwork experiences, to hundreds of graduate and undergraduate students.

What is the University's Advantage and/or Anticipated Funding Opportunities?

Centered in the largest ponderosa pine forest in North America, and with the only School of Forestry in the state, NAU is uniquely positioned to pursue this challenge. NAU's ERI plays a primary role in forest restoration initiatives across the west and is the lead member of the multi-university Southwest Ecological Restoration Institute (SWERI). Ongoing research and restoration work performed in NAU's highly regarded School of Forestry supports active management and conservation of our natural resources in concurrence with the revival of the forest products industry in Arizona. In the 1950's, the Arizona State Land Department dedicated 4000 acres of forest in Northern Arizona as an "outdoor laboratory" for NAU. Building on this history, the 50,000 acre Centennial Forest was established in 2000, offering a premier location for research and workforce training for students in Forestry undergraduate and graduate programs.

Is there an Arizona Specific Benefit or Impact?

Arizona has over 18 million acres of forested land within its boundaries, and unmaintained and unhealthy forests are at risk of catastrophic wildfire and flooding. The development of land restoration practices minimizes the risk of wildfires, and lessens the economic impact of these natural disasters. In addition to the introduction of responsible land management and resource conservation practices that protect residents throughout the west, researchers are collaborating with governmental stakeholders and developing industry partnerships to revive the forest products industry, thus improving the economic outlook for rural communities statewide. Finally, this program will provide training in restoration science, including fieldwork experiences, to many graduate and undergraduate students.

Investment Detail

	2022	2023	2024	Total
Infrastructure	1,205,000	625,000	500,000	2,330,000
Basic Research	359,788	385,467	459,800	1,205,055
Applied Research	0	0	0	0
Development	0	0	0	0
Total	1,564,788	1,010,467	959,800	3,535,055

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	100,000	0	0	100,000
Postdocs Supported	2	2	2	6
Graduate Students	8	10	12	30
Undergraduate Students	15	18	22	55
Sponsored Project Funding	3,626,718	3,817,599	3,962,319	11,406,636
Publications in Academic Peer-Reviewed Journals	40	44	48	132
Startups	0	0	0	0

Arizona Board of Regents

Technology and Research Innovation Fund (TRIF) Program Proposal

University:	Northern Arizona University
TRIF Investvest Area:	Water, Energy and Environmental Systems
Program Name:	Adapting to a Changing Environment

Problem Statement:

The Challenge: Predict the impact of a changing environment on soils, the atmosphere, ecosystems, and natural populations. Changes in our environment and climate have resulted in alteration of many aspects of the world today, including the strength and duration of weather events and changes in the average temperature and precipitation relative to historical patterns. As the environment changes, life on Earth changes with it. A deep understanding of how the flora and fauna on Earth are impacted by these changes (including wildlife ecosystems, forests, and even soils) will be required for society to effectively adapt as our environment changes around us.

Program Description:

Under the Adapting to a Changing Environment program, NAU makes investments in two Research Centers: The Center for Ecosystem Science and Society (Ecoss) and the Center for Advancing Western Landscapes (CAWL). Researchers in Ecoss investigate the interactions of biological communities—from single cells to the entire globe—with the environment, with a particular eye for how they both respond to and influence environmental change. Ecoss provides opportunities for the training of future scientists and actively engages the public in the discoveries made by the center. CAWL has advanced cross-disciplinary environmental research and training at NAU with a focus on the Colorado Plateau. The center has taken the initiative to provide science-based leadership to address conservation and environmental challenges in the West. Additional complementary research in the Adapting to a Changing Environment program occurs through faculty-led initiatives from the School of Earth & Sustainability, Department of Biological Sciences, School of Forestry, School of Informatics, Computing, & Cyber Systems and the Sustainable Communities program.

What is the University's Advantage and/or Anticipated Funding Opportunities?

With recognized leaders in environmental science and ecology, and with synergy from skills in remote sensing and computational modeling, NAU is uniquely positioned to train the next generation of scientists to tackle problems in these areas. NAU has multidimensional strength in this program, including faculty who incorporate field-based, molecular genetic and bioinformatic approaches to understanding how changing climate impacts life on earth. The integration of sensor technology with informatics allows researchers to conduct longitudinal studies to assess ecosystem and forest health. Together with research in forestry and ecology, this work informs sustainable development goals and management practices. Program researchers mentor students across degree programs that take full advantage of NAU's unique place-based strength of being situated in the natural laboratory of the Colorado Plateau.

Is there an Arizona Specific Benefit or Impact?

Changing land management practices and climate variation are altering Earth's landscapes, but scientists don't have a complete picture of their impact on ecosystems. Program researchers use unique instruments, facilities, and field-based experiences to study the interactions of biological communities and determine how they respond to and influence environmental change. This information helps forge solutions to environmental challenges and aids land-management efforts across the globe. The program provides outstanding educational opportunities and research engagement for undergraduate and graduate students, preparing them for careers with natural resource management agencies, research laboratories, and environmental consulting firms, among other in-demand career pathways.

Investment Detail

	2022	2023	2024	Total
Infrastructure	593,844	350,000	350,000	1,293,844
Basic Research	359,788	573,967	459,800	1,393,555
Applied Research	0	0	0	0
Development	0	0	0	0
Total	953,632	923,967	809,800	2,687,399

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	0	270,000	270,000	540,000
Postdocs Supported	8	9	10	27
Graduate Students	44	47	50	141
Undergraduate Students	35	38	40	113
Sponsored Project Funding	4,237,633	4,164,990	4,073,196	12,475,819
Publications in Academic Peer-Reviewed Journals	80	88	96	264
Startups	0	0	0	0

Arizona Board of Regents

Technology and Research Innovation Fund (TRIF) Program Proposal

University:	Northern Arizona University
TRIF Investvest Area:	TBD
Program Name:	Seed, Equipment and Infrastructure Investment

Problem Statement:

The Challenge: Provide resources to departments/centers, faculty and students to ensure the University remains responsive to current needs of the state. The ability of an institution to succeed in research, student training and workforce development requires support in a variety of ways. Students benefit from the mentorship of expert researchers through paid fellowships or project grants. Early/Mid-career faculty require support to host students and seed funding to help acquire key data to help find external funding. Departments can develop through strategic planning funds to support faculty working in areas that benefit the university's mission. Investment into research infrastructure ensures the university pursues cutting edge-work and effectively trains students to meet the evolving needs of employers.

Program Description:

The Seed, Equipment and Infrastructure Investments (SEII) program provides a competitive mechanism for NAU researchers, students and/or interdisciplinary teams to request internal support for equipment, infrastructure, seed funding, or strategic planning for new programs to train students in emerging areas of workforce need. Requests will be solicited from eligible investigators doing research in a TRIF-supported initiative, and will be evaluated by internal and external referees on their scientific excellence, impact on student training and workforce development, and alignment with broader strategic goals of the university. We anticipate that researchers participating in programs recognized as Areas of Distinctive Excellence for NAU will be very competitive for support through the SEII program, as will researchers who, in collaboration with others, aim to explore how their own research can integrate with and benefit from these recognized areas of expertise. Improving student outcomes and expanding access to research traineeships or research workforce development are a major focus of the request.

What is the University's Advantage and/or Anticipated Funding Opportunities?

NAU prides itself as an institution that is dedicated to student access and success, and empowers our students to succeed both in the classroom and the research laboratory. Through this novel program, the university will be able to foster new research opportunities in a manner that is inclusive of the diverse research strengths of research on campus, as well as to help ensure the robustness of our research enterprise and its ability to remain responsive to the evolving workforce needs in our community. Providing exceptional student training and experiential learning opportunities has always been a core mission of NAU and this program will allow us to significantly expand the number of students we serve, and broaden the demographic of students who participate in research.

Is there an Arizona Specific Benefit or Impact?

The Seed, Equipment and Infrastructure Investments program serves to help the research enterprise at NAU operate optimally, which in turn continues to aid the state's economic growth through providing rigorously trained individuals to support workforce needs in high-demand areas throughout Arizona in all TRIF supported initiatives.

Investment Detail

	2022	2023	2024	Total
Infrastructure	TBD	TBD	TBD	TBD
Basic Research	TBD	TBD	TBD	TBD
Applied Research	TBD	TBD	TBD	TBD
Development	TBD	TBD	TBD	TBD
Total	3,950,000	4,925,000	5,490,000	14,365,000

Performance Measures

	2022	2023	2024	Total
Faculty Startup Package Expenses	0	125,000	525,000	650,000
Postdocs Supported	0	2	3	5
Graduate Students	8	10	12	30
Undergraduate Students	50	60	70	180
Sponsored Project Funding	0	0	0	0
Publications in Academic Peer-Reviewed Journals	0	0	0	0
Startups	0	0	0	0