NAU NORTHERN ARIZONA UNIVERSITY

Centennial Forest

Annual Operating Plan

July 1, 2024 – June 30, 2025

Includes Report on Activities
July 1, 2022 – December 31, 2023

Prepared by Northern Arizona University and Arizona Department of Forestry and Fire Management

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Executive Summary

Centennial Forest is a partnership between Arizona State Land Department (ASLD), Arizona Department of Forestry and Fire Management (DFFM), and Northern Arizona University (NAU) designating more than 45,000-acres of Arizona higher education state trust lands in the vicinity of Flagstaff, Arizona as the Centennial Forest. The partnership furthers their mutual interest in forest health, maintenance of the natural assets and values of the state-held educational trust lands, reduction of the risk of wildfire, and long-term ecological research by enabling the use of these lands for higher education teaching and research activities and providing for an exchange of resources to collaborate on forest planning and management.

Annual Operating Plans are developed by NAU with participation from DFFM for each fiscal year to 'seek development of the forest plan and implement research and experimentation contemplated within the Centennial Forest Plan' (1999 IGA). The current Centennial Forest Plan dates to 2004 and provides direction for ecological and economically sustainable management, a research and teaching focus, field campus development, and positive contributions to the Flagstaff community. In addition to ecosystem-based management, the plan recognizes the need to manage NAU Centennial Forest for potential revenue production.

NAU plans for fiscal year 2024-2025 include maintaining eight existing long-term research sites (Figure 11, Table 2) and accepting and processing applications and compliance review for newly proposed research projects. Teaching activities are expected to be similar to those of the last several years (Table 3), including experiential learning field labs for silviculture, forest measurements, soils, and other field-based classes; NAU's Park Ranger Training Program; senior capstone projects; Upward Bound work experience; and other education-based community events and field trips. To facilitate additional educational use, the NAU Centennial Forest is currently working on creating a web-based map of previous management activities and research projects. NAU is also in the process of considering additional capital improvements on the Centennial Forest field campus that would leverage existing facilities and agency partnerships to increase capacity for management collaboration, education, and research across NAU and Northern Arizona.

DFFM plans for fiscal year 2024-2025 include continuing planning efforts and beginning implementation on the Jack timber sale, City Wells broadcast burn, West Forks broadcast burn, and 89A Corridor broadcast burn. Additionally, planning will begin on the Pumphouse timber sale. DFFM also plans to review and provide concurrence on new research applications, improve procedures for collaboration processes, host NAU interns, and identify educational opportunities for students to engage with managers.

In summer 2024, NAU Centennial Forest student workers will be engaging with DFFM staff through their Specialized Forestry Program and working to re-establish a Continuous Forest Inventory (CFI) plot network that was originally established by ASLD in the 1970s and last measured in 2010. They will continue work mapping historic fuel treatments and timber harvest activities on the Centennial Forest.

DFFM and NAU are both committed to increased coordination and collaboration between our agencies. The Centennial Forest Advisory Committee will be reconvened by both agencies for the first time since 2020. There will be coordination check-ins between DFFM District and NAU School of Forestry leadership personnel at least monthly and additional opportunities to engage staff and faculty and facilitate collaborative work and communication in service of the Centennial Forest.

Background and Overview of the Centennial Forest

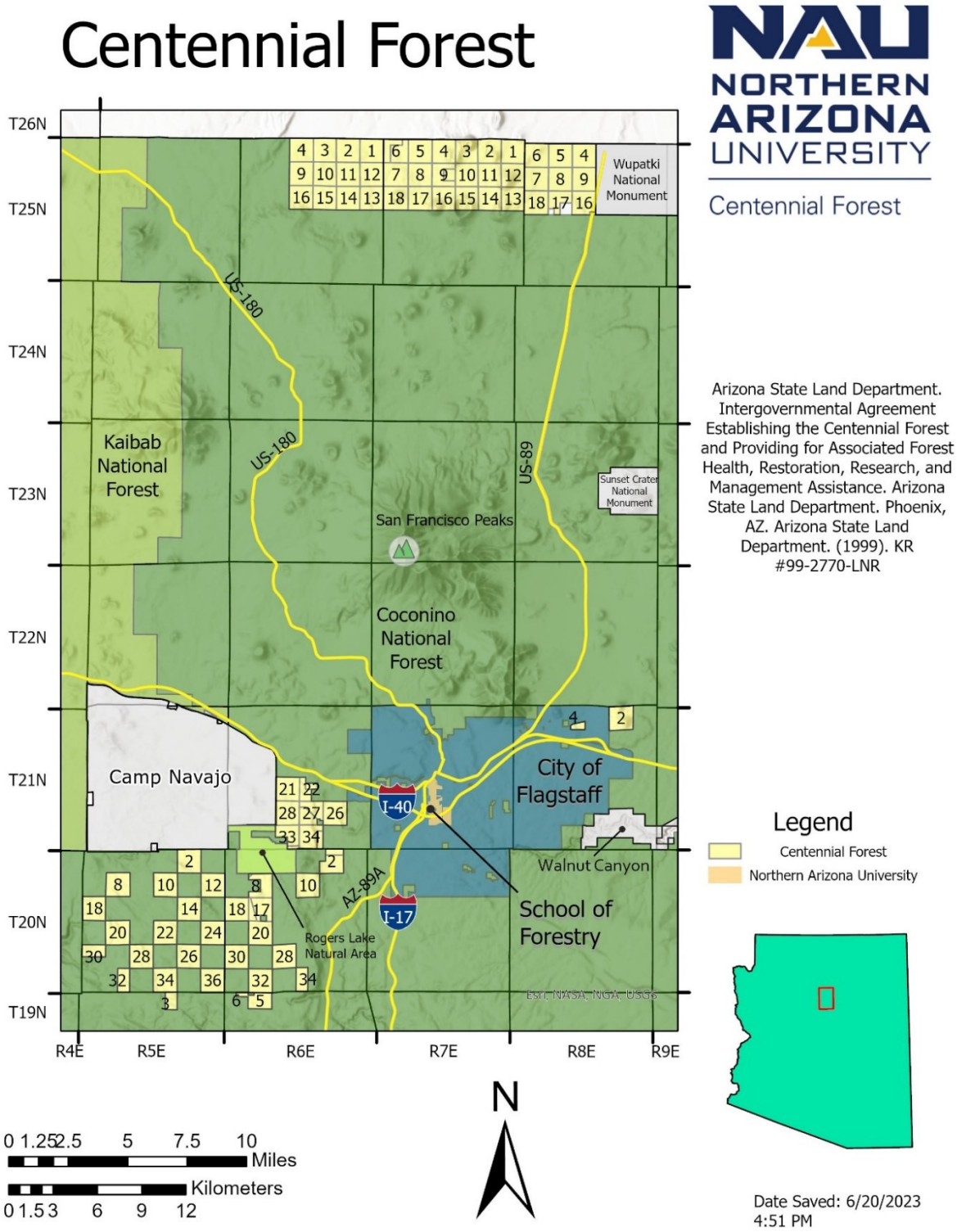


Figure 1: Arizona State trust lands designated as Centennial Forest by Intergovernmental Agreement. Does not show parcels that have been removed from ASLD jurisdiction by subsequent land sales.

A Brief History

The partnership agreement underlying the Centennial Forest is built on a legacy as old as the School of Forestry itself, as portions of the forest have been used for forestry instruction since the school's inception in 1958 (then Arizona State College of Flagstaff School of Forestry). In 1959, a ten-year agreement was made between ASLD and the Arizona Board of Regents allowing the then Arizona State College to use some ASLD land for instructional use and for research activities (Hall and Souder 1997).

As explained by the short booklet, *School of Forestry: Celebrating a half-century of teaching, research, and innovation*,

> In the summer of 1959, Dr. Minor and Applequist instituted a student summer camp which became the prerequisite to upper-division forestry classes. This eight-week session included field work in forest measurements, surveying, silviculture, and dendrology. Student crews inventoried stands, ran land lines, and thinned tenth-acre plots. With help from four faculty members, Dr. Minor supervised most summer camp work in the school forest, then consisting of a 4,000-acre block of state land five miles west of Flagstaff. (School of Forestry, 2008, p. 5)

Figure 2: Dr. Charles O. Minor with students in the field, 1962. NAU Archives.

This 4,000-acre block of state trust land is located immediately east of Camp Navajo, north of Woody Mountain Road, and south of I-40, and is commonly known as the "*Historic School Forest*" (Figure 1).

1999 Intergovernmental Agreement

In 1999 Northern Arizona University (represented by the Arizona Board of Regents) and the Arizona State Land Department entered into an intergovernmental agreement (IGA) for co-management of almost 50,000 acres of educational state trust lands (including the Historic

School Forest) designating the Centennial Forest. The 75-year IGA formalized and expanded NAU's use of these lands for education and research and outlines the mutual interest of ASLD and NAU in achieving four objectives within the Centennial Forest:

1) Forest ecosystem health;
2) Maintenance of the natural assets and values of state-held educational trust lands;
3) Reduction of risk of wildfire; and
4) Long-term ecological research to the benefit of lands throughout Arizona.

This formal relationship provided a framework for collaboration between our agencies and ushered in a period of productive partnership on forest restoration projects for at least ten years following the signing of the IGA (figure 3). During this period, grant funding obtained by NAU was used to treat more than 1,950 acres of fuels reduction work, while ASLD funding was able to treat an additional 1,750 acres (Lawrence, 2010). Much of this restoration work focused on lands located within the Historic School Forest portion of the Centennial Forest as well as lands located within and adjacent to the Centennial Forest field campus, both of which are situated southwest of Flagstaff. With prevailing winds from the southwest, these historic fuel treatment projects continue to provide critical hazard reduction benefits to the City of Flagstaff.

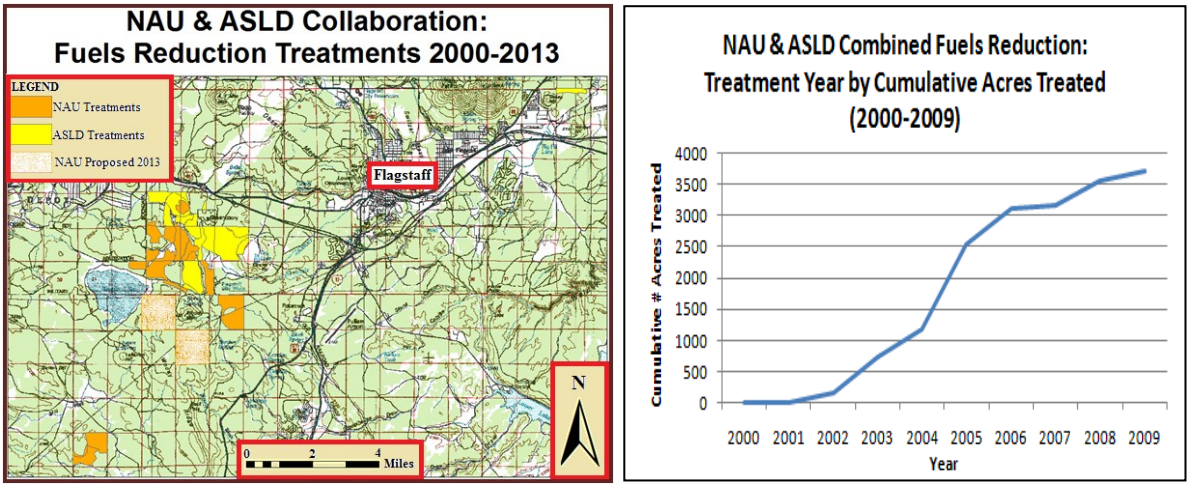


Figure 3: Hazardous fuels reduction treatments of NAU and the ASLD following the signing of the Centennial Forest IGA, from 2000-2009. The orange depicts acreage that NAU initiated, the yellow depicts the acreage that the ASLD took the lead, and the dotted orange is acreage that NAU has funding and is currently proposing treatments for to be completed by 2013. Lawrence, 2010.

In 2004, State Forestry (now the Arizona Department of Forestry and Fire Management) separated from ASLD. DFFM has been designated as the liaison to the Centennial Forest by ASLD. As a part of this designation, DFFM has assumed a majority of the responsibilities assigned to ASLD in the Centennial Forest Agreement including those pertaining to forest management and interactions with the advisory committee, but not including those relating to the lease and sale of State Trust Lands.

Arizona State Trust Lands

ASLD is required to manage the State's Land Trust and to generate maximum revenues for beneficiaries (ASLD, 2023). The primary beneficiary of Centennial Forest lands was originally the University of Arizona (Appendix A), but since 1983, Arizona Board of Regents has managed the University Land Fund to benefit all three state universities, including NAU along with University of Arizona and Arizona State University (Hall and Souder 1997). While university beneficiaries receive very few financial awards from these trust lands, use of these lands by NAU provides tremendous non-monetary benefits to the beneficiaries (Hall and Souder 1997). Noting the outstanding opportunity for outdoor classroom fieldwork and long-term research that furthers forest management objectives of ASLD, the 1999 IGA acknowledges non-monetary benefits of managing these lands for education and research purposes in addition to commercial and noncommercial natural resource values (IGA, 1999).

As such, in 2005, NAU School of Forestry was able to obtain a commercial lease (03-109275-89) on 240-acres of state trust lands located within the larger Centennial Forest at *no cost* for the construction, maintenance, and operation of a forest field campus. This is what we refer to as the "*Centennial Forest Field Campus*" (CFFC; figure 9). Because NAU is one of the Trust Beneficiaries of these lands, a 100% rent credit is provided for this lease agreement which has been paid annually since 2005. See the section on the Centennial Forest Field Campus below for additional details.

Centennial Forest Advisory Committee

The 1999 IGA requires the establishment of the Centennial Forest Advisory Committee by the State Land Commissioner and Dean of the NAU College of Ecosystem Science and Management (now the College of the Environment, Forestry, and Natural Sciences). This committee responsibilities include:

1) To assist in the development of the Centennial Forest Plan biennial reports concerning the management of the Forest prepared by the Parties, exercise general, advisory oversight regarding the health, restoration, and ecosystem management of the Centennial Forest, and to make recommendations concerning the same to ASLD and NAU, and with other interested persons about management of the Forest and development of educational programs based there.
2) To assist in development of Annual Operating Plans.
3) To assist ASLD and NAU in identifying areas of the Centennial Forest in need of restoration and other forest health treatments.
4) To propose amendments to this Agreement to ASLD and NAU.

The Centennial Forest Advisory Committee (CFAC) met every year between 2000-2020. However, NAU School of Forestry's Centennial Forest Manager position was vacant from May 2020 to July 2022 due to the COVID-19 pandemic, resulting in a disruption to this committee. Direct coordination meetings between NAU and DFFM re-initialized in fall 2022, but to date (January 2024), the CFAC has not been reconvened. It is the intention of NAU to reconvene this committee as soon as possible in collaboration with both ASLD and DFFM.

Resource Inventory and Management Plan

NAU is tasked to develop an inventory and assessment of the value of the uses and natural resources of the Centennial Forest which should be updated every ten years (1999 IGA). NAU is also tasked to prepare and submit to ASLD a long-term forest health, restoration, and ecosystem management plan and annual operating plans for the Centennial Forest. Although ASLD is not strictly required to implement this plan, it is in the best interest of the trust to manage these lands in a way that ensures long-term protection of the asset base of these lands, which in this case includes tremendous teaching and research value. This can be achieved through promotion of responsible forest and ecosystem management, expertise that the School of Forestry is highly qualified to provide in collaboration with DFFM (1999 IGA).

A draft Centennial Forest Management Plan was completed in 2002, and a preliminary inventory of the natural resources, values, and activities for portions of the Centennial Forest was completed in 2003 and incorporated into that plan. A subsequent inventory of the financial, educational, and research assets of the Centennial Forest was completed in 2010 by Lee M. Lawrence in the form of a professional paper for his Master of Forestry degree (Lawrence, 2010). An inventory and assessment of Centennial Forest resources has not been completed since 2010, but work toward this effort, including collection of forest inventory data, has been underway since 2021. It is the goal of the current NAU School of Forestry Centennial Forest Manager to deliver a forest inventory as soon as possible to benefit long-term forest management planning and decision-making processes.

Annual Operating Plans

Annual operating plans are submitted to ASLD and DFFM on an annual basis to 'seek development of the forest plan and implement research and experimentation within the plan' (1999 IGA). NAU acknowledges that an annual operating plan has not been in place since the last one was submitted in 2020. This disruption was originally due to vacancy of the School of Forestry Centennial Forest manager following the onset of the COVID-19 pandemic. Due to a series of unfortunate events, it has taken the new manager (in place since July 2022) some time to understand the scope of the program, including the status of existing research sites located on the Centennial Forest.

This submitted operating plan re-establishes Centennial Forest compliance with the 1999 IGA and strives to serve not only as a plan for activities within the forthcoming operating period, but to report on activities and accomplishments that have occurred during the prior period, in this case, since the new manager has been in place, from July 2022-December 2023. The 1999 IGA specifies that the parties should work together on these annual operating plans with input from the Centennial Forest Advisory Committee. It is therefore a goal of the new manager to generate these plans collaboratively with input and shared visioning between Centennial Forest partners, especially NAU and DFFM.

Summary of Accomplishments

Since July 2022, the new Centennial Forest manager, **Jill Beckmann**, has primarily focused on understanding the scope and history of the Centennial Forest program as well as organizing, cleaning, and repairing program resources. Additional progress was made towards a 10-year Centennial Forest inventory. Research and education programs have been maintained and correspondence with DFFM has improved over the last operating period. Relationship building and partnership development is currently NAU's top priority, with a special emphasis on improving relationships with DFFM and ASLD, which is seen as critical before embarking on any major new projects.

Centennial Forest student workers

Savanna Bunn and **Jacob Shelly ('Jake')** were hired to work in the Centennial Forest program in April 2022. While working for the CF, they collected forest inventory data, including tree cores and mobile LiDAR scans for inventoried plots. Jake is a licensed drone operator and experimented using Structure from Motion (SfM) to capture aerial 3D imagery at each plot (figure 4). In late summer 2022, they assisted in inventorying and organizing the storage room and two offices at SoF and the cabin at the CFFC. Savanna and Jake also located and inventoried permanent CFI plots within the proposed Fisher project area ahead of expected operations. During the academic year, both assisted in mounting and sanding cores collected from the forest inventory. Savanna worked in spring 2023 to scan and measure tree cores, work that remains incomplete due to her leaving for a permanent job with the USFS in June 2023.

Jake continued to work for the Centennial Forest through summer 2023 alongside **Elias Watson**, who was hired in December 2022 with funding from Weyerhaeuser. They both worked on several GIS projects, including helping to update and redesign several maps for the Centennial Forest and website. Elias worked hard to track down a bibliography of research publications and products produced from research permitted on the Centennial Forest. He additionally learned how to update the Centennial Forest webpage, where the CF research bibliography is currently displayed. Elias additionally requested renewal applications for long-term research taking place on the Centennial Forest.

Jake's focus has been on building a GIS database of historic treatments. This work has led him to pursue a master's in forestry degree (M.F.) with Graduate Service Assistantship (GSA) funding from the AZ Wildfire Initiative (AZWI). His M.F. project will examine the various public-facing GIS resources hosted by agencies for sharing historic treatment information. He plans to build an online GIS map of cross-boundary treatments and disturbance history that can be used for educational purposes by forestry students and the public alike.

Through summer and fall 2023, Elias worked closely with NAU Facilities Services to repair and clean up storage facilities located on CFFC. This included demolishing a roof that collapsed in the snow in February 2023, throwing away a bunch of old equipment and materials that were no longer of use to the Centennial Forest program (such as solar panels from the flux tower and hundreds of gallons of expired tree paint), and cleaning out a storage container that had mold

damage due to a punctured roof (Figure 6). With occasional assistance from Jake, he did an excellent job of cleaning up 'Area 51' (i.e., the fenced storage facility located on the CFFC). Elias also worked with Facilities Services to get beds and mattresses that were previously used by the Centennial Forest summer camp programs donated to NAU Hat Ranch, who will be operating in summer 2024. As a result of this clean-up effort, Elias and Jake were finally able to get the Centennial Forest's small tractor running again and are now able to store the tractor out of the weather within one of the storage containers (Figure 7).

Finally, with Elias' leadership, NAU was able to purchase a snowplow that can be used to plow the access road to CFFC and Hospodarsky Arena (Figure 5). This was a much-welcomed accomplishment, as access to the field campus was severely limited in winter and spring 2023 due to record-breaking snowfall. The plow is already enabling continued use of the field campus by spring classes and the logging sports team, who relies on the area for practice in the lead-up to the annual conclave event which takes place every spring semester.

Figure 4: Savanna Bunn and Jacob Shelly collect data in summer 2022 for the Centennial Forest inventory update and experiment with drone-based structure from motion.

Figure 5: Plowing the access road to the Centennial Forest field campus in January 2024.

Figure 6: Centennial Forest storage facilities were damaged by heavy snowfall in February 2023.

Figure 7: Post-clean-up success thanks to Centennial Forest workers, Elias Watson and Jacob Shelly (pictured). The tractor has been repaired and is now stored away from the elements in one of the storage containers.

Bulleted List of Accomplishments

NAU accomplishments:

July 2022 – December 2023

Program organization and development:

- Clean out and inventory two offices and one storage closet at NAU School of Forestry
- Re-organize electronic files stored on the NAU Centennial Forest server.
- Organize GIS files and begin building GIS database of Centennial Forest files.
- Create new Centennial Forest maps for website and hallway.
- Create GIS database of historic forest treatments (in progress).

Field Campus maintenance and repair:

- Demolish collapsed roof within 'Area 51.'
- Fill an additional 30-yard dumpster with unused and expired program equipment.
- Repair hole in storage container.
- Clean out mold-infested storage container (due to hole in roof).
- Clean and organize storage containers, including throwing away hundreds of gallons of expired tree marking paint.
- Repair and maintain NAU's small tractor. Store tractor within storage container.
- Get bunk beds and mattresses donated and moved to NAU Hat Ranch.
- Purchase and install snowplow to be used to maintain access to the CFFC in winter.

Research and education:

- Create bibliography of research products and post this to the Centennial Forest website.
- Create new research application and gather renewal applications for long-term projects.
- Gather and validate GIS data and make maps of long-term research projects for 'Values at Risk' project maps and for annual operating plan.
- Host international forestry students from Prague to learn about prescribed burning on the Centennial Forest.
- Host four first-generation college bound Upward Bound students in summer 2023.
- Maintain existing research and education programs, field trips, events, etc., includes student led CFFC inventory and monitoring effort in fall 2023 as part of FOR 449.

Forest inventory work:

- Collect forest inventory data on 44 plots located throughout the Centennial Forest.
- Mount, sand, and begin measuring tree cores associated with these plots.
- Begin relocating and remeasuring historic continuous forest inventory (CFI) plots.

Grants and partnerships:

- Letter of support and successful award of $51,000 from the USFS Resource Advisory Committee (RAC) for Arizona Milkweeds for Monarchs. Funds are being used to hire interns and create pollinator gardens at Rogers Lake Natural Area and Centennial Forest.
    - Conduct initial planting test of milkweeds at Rogers Lake in summer 2023.

- Utilize Weyerhaeuser funding to hire and train Forestry-student and enrolled Navajo tribal member, Elias Watson in field campus maintenance, forestry, and woods-skills.
- Provide support and feedback on Coconino County's Roger's Lake Community Forest Plan, which was a grant deliverable for a USFS Community Forest and Open Space Conservation Program grant that the County received. This grant funded an expansion of Roger's Lake Natural Area and construction of outdoor education facilities.

Partnership coordination:

- Participate in three coordination meetings with DFFM in fall 2022, including meeting with the School of Forestry Advisory Council.
- Respond to a request from DFFM on the location of research sites within the proposed Fisher project area. NAU and ERI flagged sites for equipment avoidance under a tight timeline in fall 2022. NAU also provided limited input on draft project plans, as no formal consultation or collaboration was extended to NAU by DFFM.
- Initiate contact with ASLD on Centennial Forest field campus leasing operations.
- Create list of potential committee members in anticipation of reconvening the Centennial Forest Advisory Committee.
- Belatedly coordinate with DFFM and share maps on values at risk for Crater Sinks Rx.
- Attend and support Cecil fire operations, including providing maps of values at risk.
- Meet with DFFM to identify and share maps of values at risk for City Wells Rx burn.
- Forestry students collected and analyzed forest inventory data at CFFC to inform and evaluate treatment needs. A data summary report was forwarded to DFFM to be used for project planning.

DFFM accomplishments:

July 2022 – December 2023

** Please note that this list of accomplishments may be incomplete prior to July 2023*

Forest management:

- Complete ignitions on Observatory Rx (treating roughly 578 acres on HSF) and Crater Sinks Interagency Rx burn (treating roughly 1500 acres on CF checkerboard) in collaboration with USFS in June 2023.
- Co-managed the Cecil fire for resource benefit with the Coconino National Forest in September 2023 to treat roughly 810 acres of the CF.
- Continued planning efforts on the Jack, Fischer, and Pumphouse Timber Sales.

Partnership coordination:

- Red cards were provided by DFFM to ERI personnel in October 2022 to facilitate experimental prescribed burning activities.
- Participate in three coordination meetings with NAU in fall 2022, including meeting with the School of Forestry Advisory Council.
- Notify NAU and solicit input on upcoming City Wells Rx burn and Cecil fire strategy and operations.
- Initiate 'restart' coordination meeting with NAU and ASLD which occurred in Feb. 2024.

Centennial Forest Field Campus

In 2005, NAU School of Forestry obtained a commercial lease (03-109275-89) on 240-acres of state trust lands located within the larger Centennial Forest (figure 9) for the construction, maintenance, and operation of a forest field campus. Because NAU is one of the Trust Beneficiaries of these lands, a 100% rent credit is provided for this lease agreement which has been paid annually since 2005. An application for 10-year renewal was submitted in 2015. In September 2022, ASLD personnel confirmed that NAU's lease agreement is considered active in a 'holdover' position.

There is currently no infrastructure located on the western portion of the commercial lease. This area was originally intended for Merriam Powell Research Station, but that facility, which contains permanent structures, was instead built nearby on private property at the Arboretum at Flagstaff. The NAU Centennial Forest Field Campus (CFFC) is located within the southern portion (~120 acres) of NAU's commercial lease and includes the following infrastructure.

Infrastructure and uses

The CFFC infrastructure includes two large open-air ramadas suitable for large group gatherings and presentations as well as two pit toilets, an outdoor kitchen/grilling area, and one small cabin (figure 10). There are two water tanks on site as well as a small shed containing a hot water heater (this shed and water heater will be removed in the near future). Previously, field campus infrastructure included several platforms for Adirondack-style wall tents. However, these were removed in 2020. Additionally, the campus includes an actively maintained trail network, a large fire pit and sitting area, and educational signage.

These facilities were previously used to host an outdoor summer camp for children aged 9-16, which ran every year from 2004-2019 (i.e., the Centennial Forest Environmental Education program). This camp served hundreds of young people who have grown to love nature and pursue careers in forestry and natural resources. Like many camps, this program was closed by the COVID-19 pandemic. There are no near-term plans to re-open the camp, as School of Forestry is currently focused on a core mission of enhancing partnerships, community outreach, research, and higher-education goals.

In addition, in the past the field campus was rented out for special events, such as weddings and parties. While the field campus is still available for community events and educational use, there is no direct revenue generated from these uses, which are currently being approved on a case-by-case basis. NAU no longer charges a fee for use of the field campus, largely due to NAU policy that dictates that revenues obtained will not return to the School of Forestry.

On the far east side of the field campus lies a fenced-in storage facility containing five shipping containers and 'Hospodarsky Arena' where the NAU Logging Sports Team conducts practice three times per week during the academic year. The team practice grounds include several dug-in chopping stands, a chaining course, and a climbing pole, as well as two small sheds for housing equipment.

A security fence encompasses approximately 215 acres of state trust land containing the southern portion of NAU's commercial lease where CFFC is located, also bordering two powerline corridors to the north and south of CFFC (figure 10). Locked access gates are located at the west and east ends of the CFFC (figure 9).

Recent uses of the field campus are included in Table 3.

Forest condition

The area in and around the field campus was last commercially thinned in 2006 with funding obtained by NAU. Slash from this sale was piled and burned in 2007. While fire risk remains low at this site, a dense cohort of regeneration has established in the understory (in fall 2023 seedling density was estimated to be between 2,300-7,000 TPA). As such, DFFM has planned and prioritized a prescribed burn, the 'City Wells Rx', which will hopefully be burned in fall 2024. Rick Miller met with Jill Beckmann in September 2023 to discuss infrastructure in need of protection during burn operations (figure 9). NAU School of Forestry is excited to get this work done and has offered to involve forestry students in fire line construction ahead of burn operations.

Monitoring forest development since these treatments were implemented provides tremendous educational value to forestry students, while also providing critical data for asset management and project planning to ASLD/DFFM. Field data were collected in fall 2023 by undergraduate students enrolled in NAU School of Forestry's Fire Monitoring and Modeling class (FOR 449) and sent to DFFM. While excessive regeneration is a problem in 2023, the almost 20-year-old treatment appears to have been highly successful in facilitating large tree development. For the CFFC lease area, historic data shows that basal area in 2004, prior to thinning, was around 74 ft^2/ac with a target residual basal area of 62 ft^2/ac. In fall 2023, forest density was estimated to have increased to around 90 ft^2/ac (figure 8).

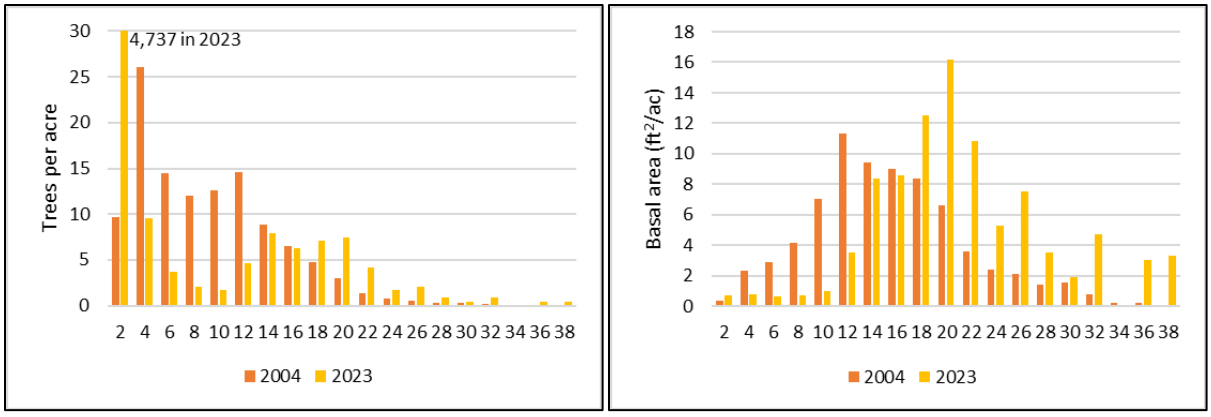


Figure 8: Forest structure by 2-inch diameter class of the Centennial Forest field campus area in 2004 and in 2023. Data does not come from permanent plots; area was resampled in 2023 by forestry students using new plot locations.

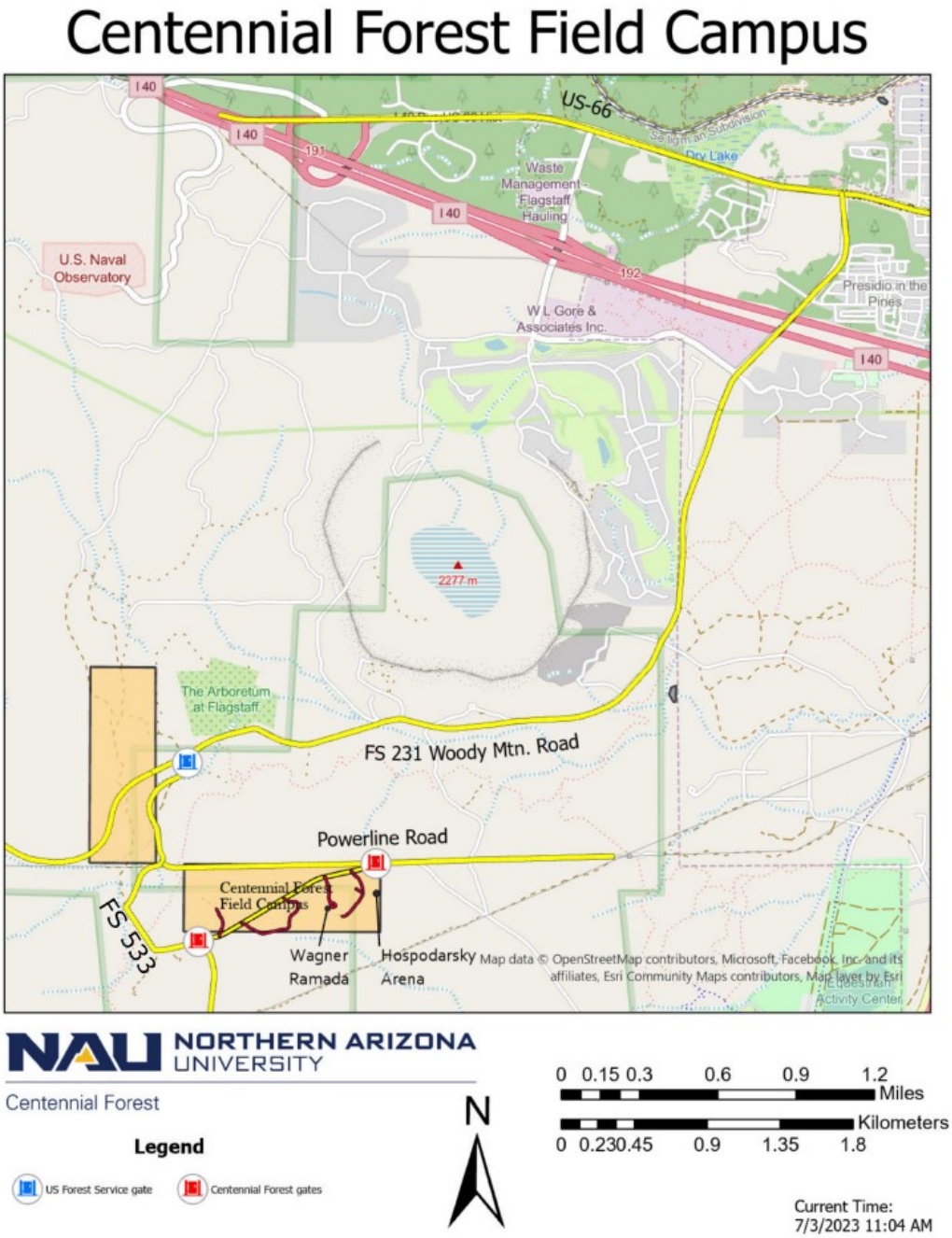
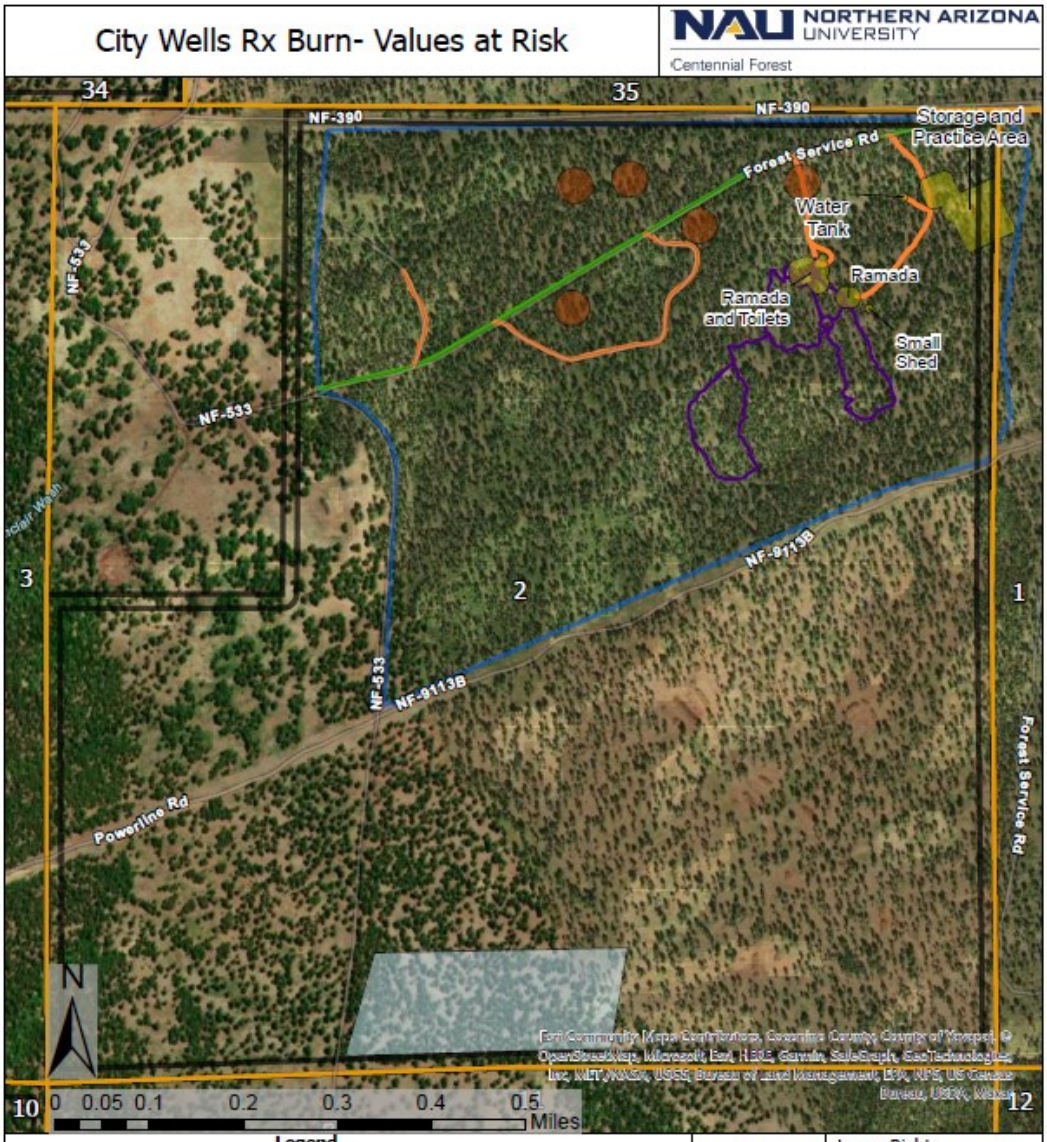


Figure 9: Location of NAU's 240-acre Centennial Forest field campus. ASLD commercial lease number 03-109275. The lease agreement covers all areas shaded orange. Centennial Forest field campus (existing infrastructure and current use) is located in the southern unit of the lease area.



Name	Contact	TxNeeds
CFFC Infrastructure	Jill Beckmann (Jill.Beckmann@nau.edu)	Exclude Rx Fire.
Abella Study - Fenced Exclosures + 100 ft	Scott R. Abella (scott.abella@unlv.edu)	Rx Fire okay.
Resin Study	Rich Hofstetter (Rich.Hofstetter@nau.edu)	Exclude Rx Fire.

Figure 10: Values at Risk located on the Centennial Forest Field Campus, including the location of all roads, trails, and infrastructure. Map was made to coordinate plans for the City Wells Rx Burn.

Research

Per the 1999 IGA, one of the primary objectives of the Centennial Forest is to facilitate 'long-term ecological research, the results of which may be applied to lands throughout Arizona'. Since the IGA was signed, hundreds of research publications and products have been produced from research that has taken place on the Centennial Forest. A research bibliography was recently added to the Centennial Forest webpage. Additionally, a detailed list of previous publications are now hosted publicly within the Centennial Forest Zotero Library, which can be viewed here.

Since July 2022, only one new short-term research project was approved. This project was approved without consultation, as it did not have potential to impact state trust resources, nor require any infrastructure or protection from regular management activities (Table 1). This was an application submitted by Dr. Drew Peltier to core 6-10 ponderosa pine and Gamble oak trees on the Historic School Forest to study the eco-physiological drivers of the mixing of old reserve carbon in tree sapwood.

There are currently eight active long-term research projects in place on the Centennial Forest (Figure 11; Table 2). These all have been in place for more than 15 years, and one is more than 100 years old!

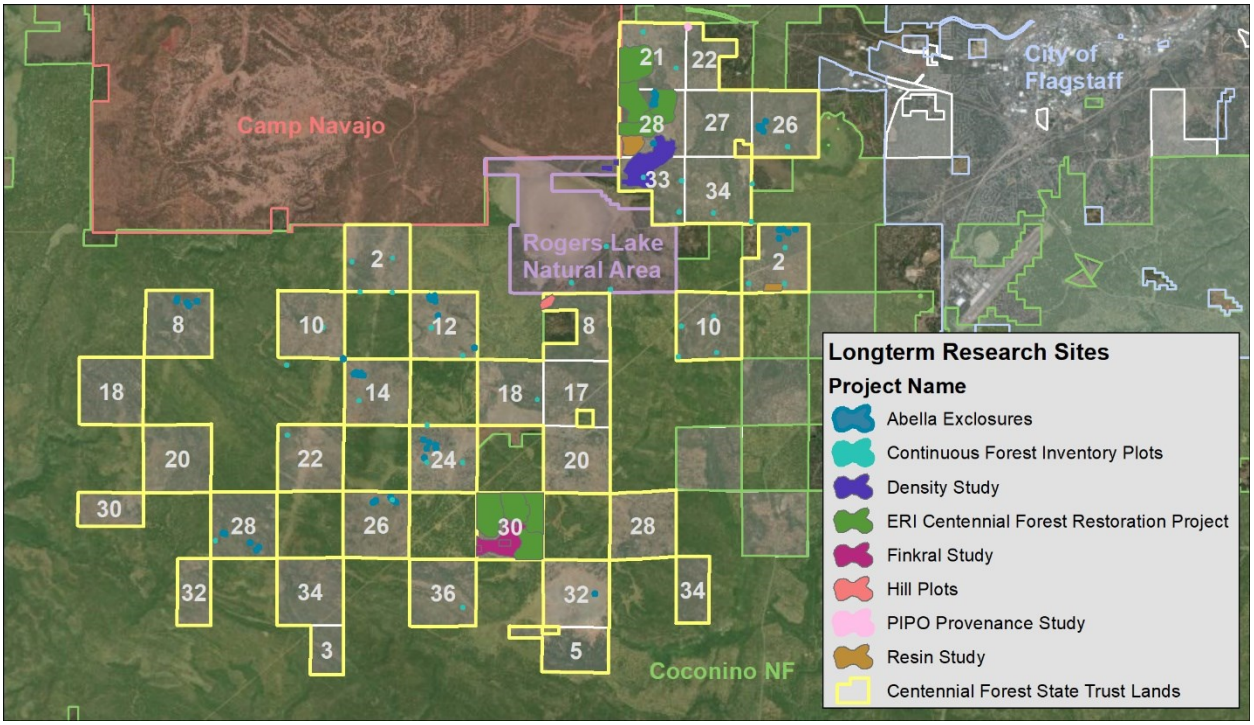


Figure 11: Location of all existing and active long-term research sites on the Centennial Forest. See Table 2 for details.

Table 1: New research projects approved since July 1, 2022.

Principal Investigator	**Duration**	**Title**	**Objectives**	**Description**	**Infrastructure / Impact / Activity**	**Compatible Management Activities**
Drew Peltier – NAU dmp334@nau.edu	2023 Date of activity: 10/4/2023	Eco-physiological drivers of the mixing of old reserve carbon in tree sapwood.	How deeply do trees mix new reserve carbon? Where is the oldest reserve carbon located within diverse tree species? Management implications include an improved understanding of which types of trees (Large and fast growing? Old and slow growing?) contain the oldest carbon reserves. There is evidence trees with older carbon reserves are more resilient to climate change stressors like periodic drought.	We are synthesizing old and newly collected data on the age of carbon reserves in tree sapwood. What does this mean? Carbon reserves are stored photosynthate, essentially energy reserves that can be remobilized in response to stress or disturbance. In large trees, these reserves can be decades old, but we don't know how common this is across species, as only ~40-50 trees have been measured in the world. We would like to add ponderosa pine and Gambel oak to this list, as these species have never been measured, and are widespread in the Southwest.	Remove 12mm increment cores, sapwood only, and 5.15mm increment cores to pith from 3-5 ponderosa pine and 3-5 Gambel oak. location: 35.1888979, -111.7571253	Broadcast Burning: Yes Pre-commercial Thinning: Yes Commercial Tree Thinning: Yes Linear fuels treatments and fire line construction: Yes Wildfire: NA No protection measures needed

Principal Investigator	Duration	Title	Objectives	Description	Infrastructure / Impact / Activity	Compatible Management Activities
Kyle Rodman, Research Scientist – ERI Kyle.rodman@nau.edu	2024-2026	Removing barriers to prescribed burning through improved decision support for burn-related tree mortality objectives.	1) investigate how climate influences post-fire mortality in small trees; 2) develop fire resistance guidelines for small trees; 3) investigate how fire resistance changes with phenology to influence post-fire tree mortality; and 4) develop predictive mortality models that incorporate drought and season of burn in fire effects decision support systems. Part of a larger, US West-wide project. We will incorporate new data into FOFEM and BehavePlus to better account for season of burn and drought stress and develop manager-oriented guidelines for prescribed burning in young stands and areas with small trees, across a range of western US forest landscapes.	Tree mortality-related concerns can be a major barrier to prescribed burning implementation. No existing research or mortality models include data on small trees (<4 in DBH, with little data on trees 4-8 in DBH). This knowledge gap makes it difficult to develop burn plans to meet objectives related to forest structure and fire hazard, such as reducing ladder fuels and likelihood of high-severity fire and retaining desirable small trees for future recruitment. Very little information exists about how burn season/phenology and drought affect tree resistance to fire, which can limit prescribed burning due to concerns about killing too many trees.	Track mortality of ~300 small trees in the Turkey Hills RX fire project area for up to two years. Each tree will be tagged using aluminum nails or wire, as well as pre-stamped aluminum tags, without soil disturbance or other modifications to the site. After plot installation and establishment, we will conduct two additional surveys approximately 1 and 2 years after initial surveys, for a total project duration of two years (i.e., concluding summer 2026). location: T 21N, R 8E, Section 2 within the April 2024 Turkey Hill Rx burn footprint	Broadcast Burning: No Pre-commercial Thinning: No Commercial Tree Thinning: Yes, provided that this is in trees > 10 inches in diameter, this should not affect our study. Linear fuels treatments and fire line construction: Yes, So long as these do not remove tagged trees, we see no issues. In an emergency fire event where firelines are needed, we are OK with tagged trees being removed though. Wildfire: Undesirable Any management activities that do not injure or kill tagged trees are probably fine, but additional fire or removal of tagged trees within the two-year study period would be undesirable.

Principal Investigator	Duration	Title	Objectives	Description	Infrastructure / Impact / Activity	Compatible Management Activities
Amy Wolkowinsky, Associate Director, ECOSAIL Lab, NAU Amy.Wolkowinsky@nau.edu	2024-2026 Installation in July 2024. Funded through June 2026.	The Arizona Tree Stress Explorer and Alert System	To monitor tree water stress at the individual-tree scale in near-real time across all of Arizona. This system will enable ADFFM to respond proactively to forest stress events, be they drought- or bark-beetle induced. This study will validate a statistical model that is being designed to enable tree stress detection beyond the two-year study/validation period.	The proposed system relies on the changing optical properties of leaves when a tree is stressed. When leaves start to dry out, their optical properties change, which is observable via satellites, based on sunlight reflecting off those leaves. To provide an early warning system for tree health, the optical properties of all adult statured trees across Arizona will be monitored. The model will be validated by a network of Potentiometer based point dendrometers and FloraPulse microtensiometers, some of which will be located on Centennial Forest.	14 potential locations in the Centennial Forest. No more than 10 locations will be selected. At each location dendrometers will be installed in five (5) trees (one per tree) of varying sizes approximately at breast height. Microtensiometer installation will be assessed during dendrometer installation. Spectrophotometer measurements and data downloading will be conducted every 2-3 months by 1-2 people for the duration of the project. All instruments used in this study are quiet and do not make noise. Location: We will provide a map with sensor locations and table with GPS coordinates following installation.	Broadcast Burning: No Pre-commercial Thinning: See below Commercial Tree Thinning: No Linear fuels treatments and fire line construction: See below Wildfire: Undesirable Once we install sensors, we need to monitor those trees for the next two years. Removal of those trees – whether by burning or thinning – is not compatible with data collection for this project. Management actions that do not affect our sensors are compatible. Smoke will not affect the sensors; although scorching could potentially damage. If DFFM schedules burns within our study areas, we can put in fire lines as necessary

Table 2: Existing active long-term research projects.

Principal Investigator	**Duration**	**Title**	**Objectives**	**Description**	**Infrastructure / Impact / Activity**	**Compatible Management Activities**
Scott Abella – Assistant Professor, UNLV scott.abella@unlv.edu	2003 – 2028+ renewal submitted pubs to date: 11	Vegetation responses and changes in soil quality indicators following ecological restoration of ponderosa pine forests across three soil parent materials in Northern Arizona "Abella Exclosures"	Study understory vegetation community changes and selected physicochemical soil quality indicators to improve understanding of the relationship of understory vegetation response and the below-ground ecosystem response to ecological restoration of ponderosa pine forests in Northern Arizona.	This project evaluates plant community and soil responses to restoration thinning of ponderosa pine, grazing, and aqueous smoke application on three soil parent materials (limestone, benmorite, and basalt) across diverse sites in the Centennial Forest. Since its inception in 2003, the project has produced 11 peer-reviewed publications.	There are 51, 20 m × 25 m (0.05 ha) randomly located experimental plots, each containing a 3.16 m× 3.16 m (10 m^2) and 2m tall grazing exclosure. Plots are marked with small rebars (about 4 inches aboveground) at each of the four plot corners of the 20 m x 25 m plots and the small exclosures (10 m2) are present at the center of each plot. These are long-term sites in place since 2003, scattered across the CF (see map).	Broadcast Burning: Yes Pre-commercial Thinning: Yes Commercial Tree Thinning: Yes Linear fuels treatments and fire line construction: Ideally the plots themselves would not have fire line dug through them, but fine if line is dug around them Wildfire: neutral – if wildfire occurs then it would be incorporated as part of the study Thin and Burn OK, do not disturb exclosure fencing if possible.

Principal Investigator	Duration	Title	Objectives	Description	Infrastructure / Impact / Activity	Compatible Management Activities
Richard Hofstetter – Professor, NAU Forestry Rich.Hofstetter@nau.edu	2003 – 2028+ maintain until 2029 at least renewal submitted pubs to date: 33	Mechanistic understanding of the impacts of thinning ponderosa pine (Pinus ponderosa) on pine bark beetles (Curculionidae: Scolytinae) and tree defenses "Density Study"	The purpose of this project is to provide regionally appropriate data that supports or refutes the conventional wisdom that stand density regulation is the most effective strategy to prevent pine bark beetle damage to southwestern ponderosa pine forests. The objective of our research is to examine changes in tree characteristics related to stand thinning that would impact bark beetle success and performance, such as resin flow and phloem thickness across a range of thinning treatments in ponderosa pine forest stands.	This project started in 2006. This site consists of a range of BA treatments. We have already monitored short-term changes in tree defense and growth parameters but wish to continue for a minimum of 10 more years (2019-2029). In 2019, additional hand thinning occurred to continue the basal area treatments. Changes in the magnitude of stand susceptibility to bark beetles as a function of tree vigor post silvicultural activities shows temporal variability. The observational studies will continue to provide a clear indication as to which elements of stand thinning are important to bark beetles.	The site contains twenty 1-hectare plots that were thinned to one of five treatments (60, 80, 100, 120, 150 BA) in 2006. Every 5 years, we collect resin (i.e., tree sap) from a subset of trees (~10 trees) from the center of each plot. We remove ponderosa that are attacked and killed by bark beetles – this involves the use of a chain saw. This material is brought back to the School of Forestry lab to determine whether insects killed the tree and what insects colonized the tree. Typically, 1-5 trees are cut each year at the site. T21N R6E S28 and 33	Broadcast Burning: Yes Pre-commercial Thinning: No Commercial Tree Thinning: No Linear fuels treatments and fire line construction: Yes Wildfire: desirable No cut both in experimental blocks and surrounding control areas (contained within the surrounding roads)

Principal Investigator	Duration	Title	Objectives	Description	Infrastructure / Impact / Activity	Compatible Management Activities
Richard Hofstetter – Professor, NAU Forestry Rich.Hofstetter@nau.edu	2008 – 2028+ planned for 30+ years renewal submitted pubs to date: 40	Relationship between tree resin chemistry and bark beetle activity study "Resin Study"	Our objectives are to determine if population genetic structure in the western pine beetle varies with respect to host tree phytochemical phenotype in nature, and to determine if Dendroctonus beetles locally adapt to host phytochemistry in way that meaningfully impacts host acceptance rates, attack success, fitness, and fecundity. In addition, we will use these sites for the long-term monitoring of tree performance and phenotypic frequencies following completion of these studies, and bark and woodboring beetle population abundances.	During summer 2008 we established two 1 ha plots (Site 1 and Site 2) for collecting tree (dbh, height, phloem thickness) and oleoresin data (resin flow rates, relative and absolute monoterpene composition). In 2008, 10 trees from each site were selected for a bark beetle-manipulation study and were cut down in 2009. Since 2009, the trees have been continually monitored for beetle activity. If a tree died, it was cut down and sections of the trunk were brought back to the lab to determine the insect composition and potential cause of tree death. Zero to five trees have been cut each year on these sites.	In summer 2008, approximately 250 trees at each 1 ha site were tagged and resin samples taken from each. Study trees have metal tags near base of trunk on north side of the tree. No other infrastructure is on the sites. The trees are continually monitored for beetle activity. If a tree dies, it is cut down to determine potential cause of tree death. *Site 1:* SW of Fisher Tank, 35.1683, -111.7686 *Site 2:* S of CFFC, 35.1376, -111.7314	Broadcast Burning: Yes Pre-commercial Thinning: No Commercial Tree Thinning: No Linear fuels treatments and fire line construction: Yes Wildfire: undesirable We would prefer the site not to be thinned. A control burn is ok as long as the fire is not too hot to cause damage to canopies.

Principal Investigator	Duration	Title	Objectives	Description	Infrastructure / Impact / Activity	Compatible Management Activities
Thomas Kolb – Professor, NAU Forestry Tom.Kolb@nau.edu	1988 – 2028+ planned until 2030 renewal submitted	Ponderosa Pine Historic Provenance Test "PIPO Provence Study"	To assess the performance of different seed sources of ponderosa pine. The primary value of the site is demonstration and teaching.	The test was established in the 1980s and consists of rows of planted trees in an old field. The trees have tags that identify their provenance. The trees should be allowed to grow naturally. The measurements are non-destructive and consist of occasional assessment of tree height and diameter.	Approximately 200 trees planted in rows. T21N R6E S22 NW NW	Broadcast Burning: No Pre-commercial Thinning: No Commercial Tree Thinning: No Linear fuels treatments and fire line construction: No Wildfire: undesirable No cutting or burning.
Margaret Moore – Professor, NAU ForestryMargaret.Moore@nau.eduJon Bakker - Research Specialist, ERI and NAUJonathan.Bakker@nau.edu	1912-2036+ long-term renewal submitted pubs to date: 35+	Hill Plots	To remeasure and analyze a unique permanent plot to examine changes in the forest understory and overstory over the last 90 years. The long timescale of data from this plot will help describe the range of natural variability for understory vegetation.	In 1912, R.R. Hill established a series of plots (mapped quadrats) at 5 sites in the Coconino National Forest. One of these sites, referred to as the 'Rogers Lake' site, is located on land that is now managed by the Centennial Forest.	A 0.6 ha grazing exclosure was established at this site, and half of the mapped quadrats are located inside of this exclosure. The remaining mapped quadrats were located within 200 m of the exclosure. The fence around the grazing exclosure has been recently maintained and is in excellent shape. NW1/4 Sec 8, T20N, R6E	Broadcast Burning: No Pre-commercial Thinning: No Commercial Tree Thinning: No Linear fuels treatments and fire line construction: No Wildfire: undesirable We would like to protect the site from thinning (PTC or commercial), livestock grazing, or prescribed fire or wildfire.

Principal Investigator	Duration	Title	Objectives	Description	Infrastructure / Impact / Activity	Compatible Management Activities
Dave Huffman – Director of R&D, ERI david.huffman@nau.edu	2001-2029+ long-term renewal submitted pubs to date: 3	ERI Centennial Forest Restoration Project Original project name: "Stand Treatment Impacts on Forest Health (STIFH)"	Objectives are to study the effects of restoration treatments on structure, composition, ecosystem function, and disturbance in southwestern dry forest ecosystems. One of several studies included in a larger investigation, called the Long-term Ecological Assessment and Restoration Network (LEARN). At each LEARN site, forest restoration treatments are paired with untreated control units to intensively study ecological responses. Results of this study will have broad implications for fire prevention, forest restoration, and uneven-aged management in ponderosa pine forests in the Southwest.	A restoration treatment (evidence-based thinning and application of prescribed fire) was applied to four approx. 100 acre stands – two stands at the Fisher site and two at the Rock site. The proposed treatment was a combination fire prevention/stand improvement thinning with elements of forest restoration and uneven-aged management. This type of treatment does not differ markedly from standard ASLD treatments, which under ASLD policy are, "…designed with emphasis on all-aged stands and big trees." Data were collected before thinning and last measured in 2019 (16 yrs post-thin and 8 yrs since the last Rx burn [for 3 of 4 treatment blocks]).	All plot centers are marked with a piece of rebar and an aluminum tag showing unit and plot number. Rebar pieces are buried with approximately two inches exposed above the soil surface. Endpoints of vegetation and fuels sampling transects are also marked with rebar. All overstory trees (≥ 1.37 m height) are numbered and tagged at 1.37 m above the ground with aluminum tags. One large tree near each plot center is tagged for reference with azimuth and distance to plot center. See map. There are four stands at the Fisher Site (T21N, R6E, Sec. 21&28), and four stands at the Rock Site (T20N, R6E, Sec. 30)	Broadcast Burning: Yes (when planned ahead for treatment units); No (for controls) Pre-commercial Thinning: No Commercial Tree Thinning: No Linear fuels treatments and fire line construction: Yes, see above (broadcast burning) Wildfire: undesirable

Principal Investigator	Duration	Title	Objectives	Description	Infrastructure / Impact / Activity	Compatible Management Activities
Kristen Waring – Professor, NAU Forestry kristen.waring@nau.edu	2008 - 2028+ long-term renewal submitted pubs to date: 1	Short- and long-term economic productivity of restoration treatments and other silvicultural prescriptions in ponderosa pine stands in northern Arizona. "Finkral study"	This research examines the profitability of timber harvesting in ponderosa pine stands in northern Arizona under different silvicultural prescriptions. Costs associated with timber harvesting and revenues generated from the sale of timber were to be compared across five different treatments. Longer-term objectives are to monitor the biological growth rates of residual stands and the corresponding economic value growth.	Applied silvicultural prescriptions include: Control: No Treatment; Thinning in all strata with diameter cap; Free form thinning without diameter cap; Seed tree with reserves; The Ecological Restoration Institute's 'full restoration' treatment. This site serves as a long-term silvicultural research and teaching area to showcase different prescriptions and is an important teaching tool. Structures found here are not common elsewhere in northern Arizona.	140 acres divided into 4 blocks of 5, 5-acre units. Ten randomly located, 1/10 ac fixed plots monumented with rebar and rock cairns. No additional treatments beyond the original implementation in 2008 are planned at this time. Boundaries were re-marked in ~2020 and may need additional marking before 2028. S1/2, S30, T20N, R6E	Broadcast Burning: No Pre-commercial Thinning: No Commercial Tree Thinning: No Linear fuels treatments and fire line construction: No Wildfire: undesirable Broadcast burning possible if collaborative such that data can be collected prior to burning with ample planning time and some funding.

Principal Investigator	Duration	Title	Objectives	Description	Infrastructure / Impact / Activity	Compatible Management Activities
Jill Beckmann – Professor of Practice, NAU Forestry jill.beckmann@nau.edu	1978 - 2029+ long-term renewal submitted A professional report on assets of the CF was presented in 2010.	Centennial Forest Continuous Forest Inventory Plots "CFI plots"	We can assume that the original purpose of this project was to assess growth, yield, and timber value within the Centennial Forest. These data can continue to inform sound stewardship and conservation of resources located on the Centennial Forest by documenting growth rates, informing economic analysis of short-term and long-term values and resources of the forest.	There were originally 176 continuous forest inventory plots installed beginning in 1977-78 (established by ASLD). Most were remeasured 2-3 times in the 80s and 90s. A few were revisited in 2003. The last year of measurement was 2010, in which 61 of the original plots were able to be located and measured.	Tenth-acre plots are marked with a single rebar at plot center and trees are tagged with metal tags facing plot center. Original direction to plots were difficult to follow, and many of the original plots are not locatable. UTM coordinates were marked in 2010. Where possible, we are updating these with submeter GPS. These are long-term sites in place since the 1970s, scattered across the CF (see map).	Broadcast Burning: Yes Pre-commercial Thinning: Yes Commercial Tree Thinning: Yes Linear fuels treatments and fire line construction: Yes Wildfire: ok Avoid ground disturbance of the rebar, but no other accommodations should be made. These plots should be treated and managed the same as adjacent areas.

Educational Activities and Community Events

The Centennial Forest educational state trust lands provide tremendous educational opportunities for Arizonans and have been used for forestry and environmental education at least since 1959, when the School of Forestry was first established. While the previously popular Centennial Forest Environmental Education summer programs are no longer taking place, thousands of educational student hours continue to be logged annually. These include use from Forestry, Parks and Recreation Management, and Environmental Science classes, as well as special programs such as NAU Outdoors, the Honors Program, Inclusion and Multicultural Student Services, Applied Indigenous Studies, NAU Upward Bound, and the Center for International Education.

Additionally, the Centennial Forest Field Campus remains available for use at no cost by forestry-related, NAU, and higher education-focused community events and gatherings. Because no revenue is currently being generated from use of the field campus, all events are currently approved by the NAU Centennial Forest manager on a case-by-case basis. Table 3 contains a list of known educational activities and community events that have taken place on the Centennial Forest (all units) since July 2022.

To facilitate additional educational use, the Centennial Forest manager is currently working on creating a web-based map of previous management activities and research projects. The goal of this application would be to make it easy for NAU instructors, agency-based forestry-related courses, and other environmental educators to readily identify outdoor learning opportunities, such as past treatments and other natural disturbances (wildfires, tornados, etc.). The hope is that by prominently displaying these opportunities on NAU's website, educators will find it easier to seize these opportunities and plan activities around these locations.

Figure 12: Upward Bound students pull invasive weeds at the Centennial Forest field campus in June 2023 and compete for the 'longest root' (Dalmatian toadflax).

Table 3: Educational activities and community events that occurred between July 1, 2022 – December 31, 2023.

Contact / Instructor	Entity, Course	Location	Date(s)	Learning Objectives or Purpose
David Danker, Northern Arizona SAF Chapter Chair	Northern Arizona Chapter of Society of American Foresters	Centennial Forest field campus, Wagner Ramada	8/13/2022	Annual local SAF chapter social event including barbeque at Wagner Ramada
Heidi Toth, NAU Communications	Good Morning Arizona	Historic School Forest	8/17/2022	NAU Centennial Forest, with Jacob Shelly and Savanna Bunn, was featured on Good Morning Arizona for a back-to-school story on fire-related forestry research involving students
Jill Beckmann, NAU School of Forestry	NAU Logging Sports Team	Hospodarsky Arena, Centennial Forest field campus	**2022 & 2023:** Every Mon, Wed, Fri afternoon while school is in session	Logging Sports Team practice
Jill Beckmann, NAU School of Forestry	NAU Forestry, Silviculture II (FOR 412)	Finkral Study site, Section 30	9/19/2022	Visualize and compare 4 different uneven-aged silvicultural prescriptions: Seed Tree w Reserves, Ecological Restoration, Free Thin w diameter cap, Free Thin w/o diameter cap, (and control/no thin)
Jill Beckmann, NAU School of Forestry	NAU Forestry, Silviculture II (FOR 412)	ERI Centennial Forest Restoration Project area (aka STIFH), Historic School Forest	10/10/2022	Visualize and collect data from a stand that has been managed with multi-aged silviculture using group selection and a BDq-based silvicultural prescription. Later determine the q-ratio from the collected data.
Jill Beckmann, NAU School of Forestry	NAU Forestry Advisory Council and Arizona Department of Forest and Fire Management	Centennial Forest field campus and the 4,000-acre Historic School Forest	10/13/2022	Field Tour and Coordination meeting between NAU School of Forestry Advisory Council and DFFM
Greg Galloway, Program Coordinator	NAU Park Ranger Training Program	Centennial Forest field campus	**2022:** 9/10; 9/24; 10/15; 10/24-29; 11/12 **2023:** 2/25; 3/4; 3/25; 4/1; 4/4-7; 4/15 (Spring 2023 canceled due to snow - alternative site used)	Park Ranger Training Program field skills, land navigation, team movement tactics and scenario-based training

Contact / Instructor	Entity, Course	Location	Date(s)	Learning Objectives or Purpose
Eli Jensen, Ironwood Forestry	Ironwood Forestry	Centennial Forest field campus, Wagner Ramada	6/3/2023	Family Forestry Field Day for Ironwood Forestry crew members and family
Alicia Azpeleta-Tarancon and Jill Beckmann, NAU School of Forestry	NAU Upward Bound	Centennial Forest field campus	2023: 6/8; 6/15; 6/20; 6/22; 6/27	Four female high school students pulled noxious weeds and learned about plant families and native vegetation as part of their work requirement for Upward Bound, a summer program for potential first-generation college students.
Richard Hofstetter, NAU School of Forestry	NAU Center for International Education	Observatory Rx burn area, Historic School Forest	7/26/2023	Host international students from the Department of Forestry and Wood Sciences, Czech University, Prague Czechia. Visit a recently burned stand and discuss fire prescriptions, severity, and effects on various components of overstory and understory vegetation.
Jill Beckmann, NAU School of Forestry	Centennial Forest	Centennial Forest field campus	8/18/2023	Meet with Rick Miller to identify values at risk and discuss plans for upcoming City Wells Rx burn
Jill Beckmann, NAU School of Forestry	Centennial Forest	Centennial Forest field campus	8/25/2023	Meet with Rich Van Demark to discuss possible disposal methods for NAU logging sports woody debris.
Jill Beckmann, NAU School of Forestry	NAU Forestry, Fire Monitoring and Modeling (FOR 449)	Centennial Forest field campus	9/1/2023; 9/29/2023	Conduct pilot study and then collect pre-Rx fire monitoring data (24 plots). Learn how to create a sound monitoring design; collect data; subsequently use these data to model expected effects of Rx fire and other possible treatments on forest structure and fire hazard
Adeline Jones, NAU Logging Sports Team	Great Alaskan Lumberjack Show	Hospodarsky Arena, Centennial Forest field campus	11/7/2023	Great Alaskan Lumberjack Show training and recruitment event
Richard Hofstetter, NAU School of Forestry	Centennial Forest, NAU Forestry School, Forest Entomology and Forest Pathology courses	Observatory Rx burn area, Historic School Forest	every Fall semester (Pathology course) and Spring semester (Entomology course) since 2005	Uses wood and tree samples for educational lectures and active live labs for courses. Materials include infested bolts, bark beetle trap collections, ponderosa tree pathogens such as mistletoe, etc.

Contact / Instructor	Entity, Course	Location	Date(s)	Learning Objectives or Purpose
Alark Saxena, NAU School of Forestry	NAU School of Forestry, Capstone (FOR 480C)	Primarily work in-classroom with case studies based on the Centennial Forest	every Spring semester	Centennial Forest related senior capstone projects in 2023 and 2024 include: *Design a Management plan for Centennial Forest for long term research and wildfire mitigation.* *Pros and cons of using prescribed versus managed wildfire on the Centennial Forest*

Partnerships and Funding

Progress has been made by Centennial Forest partners on a few new and on-going projects within the operating period (since July 2022).

Weyerhaeuser grant

Funding ($25,000) was received by NAU in 2019 to support Native Americans pursuing a career in Forestry but was not able to be implemented due to the COVID-19 pandemic. In December 2022, Elias Watson, B.S.F. student (and now graduate) of NAU Forestry and an enrolled member of the Navajo Nation, was hired to carry out the work of the proposed Weyerhaeuser Conservation Corp. In addition to helping with numerous field campus maintenance activities, including trail clearing, sign rehabilitation, trash clean up, and repairs (including chainsaws and tractor), Elias worked to improve the Centennial Forest website, organized research permit information, and created new maps for online and hallway display.

USFS RAC grant with Milkweeds for Monarchs

NAU School of Forestry Centennial Forest submitted a grant in collaboration with non-profit organization Arizona Milkweeds for Monarchs to experiment and establish pollinator habitat in two areas: Roger's Lake Natural Area and Centennial Forest burned areas by installing 4000 native plans and installing educational signage.

Roger's Lake Community Forest Plan

NAU provided feedback and support for Coconino County's Roger's Lake Forest Plan, a grant deliverable for a USFS grant they received through the Community Forest and Open Space Conservation Program. This grant funded an expansion of Roger's Lake Natural Area by purchasing a portion of the Miller property and construction of outdoor education facilities.

DFFM Wildfire Mitigation

DFFM has staffing and funding available to implement fuels reduction projects across multiple land ownerships for fire prevention, critical infrastructure protection, and forest and watershed restoration.

NAU School of Forestry

The Centennial Forest Manager position is currently a half-time faculty position (Assistant Professor of Practice), supported by a combination of Bureau of Forestry Research and state funding from the School of Forestry. A limited annual operating budget of $30,000 helps to fund all other program needs at NAU, including field campus maintenance and repairs, vehicle use, equipment, supplies, and part-time student employees.

Management Success

Cecil Fire Management – successful coordination between DFFM and NAU

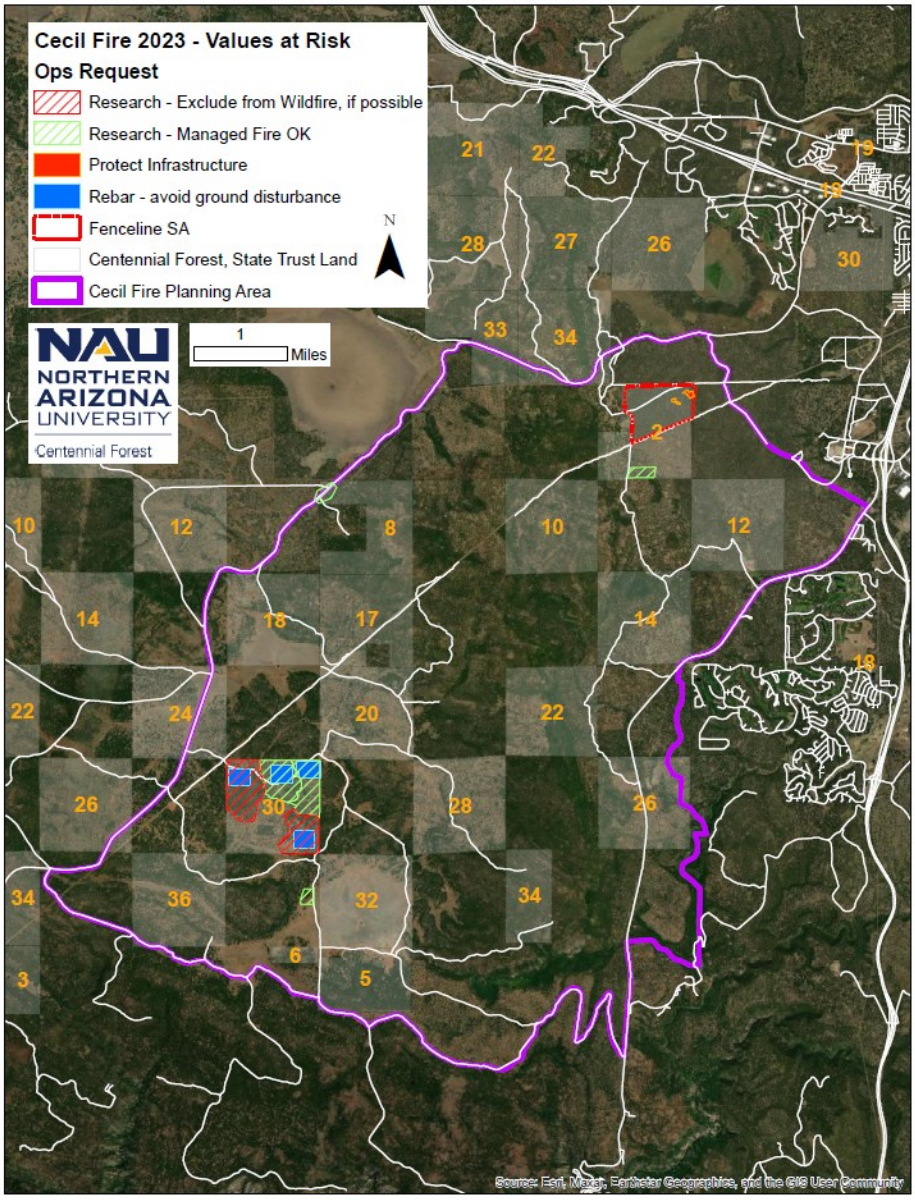


Figure 13: Centennial Forest Values at Risk within the Cecil Fire (Sept 2023) Planning area.

Strategic Priorities for 2024-2025 Operating Period

NAU and DFFM plan to collaboratively pursue the following work priorities during the next operating period:

1. Improve relations between all IGA parties: ASLD, NAU, and DFFM.
    - NAU and DFFM will develop a process for each organization to develop a fiscal year annual operating plan before annual CFAC committee meetings in spring.
    - Monthly coordination call between the Centennial Forest Manager and DFFM District Forester.
    - Convene at least one annual meeting that includes participation from DFFM and NAU leadership.
    - Streamline the process for consultation and approval of proposed research projects occurring on the Centennial Forest.
    - Renewal applications and information (including GIS files and mitigations measures) for long-term research projects will be maintained by DFFM and NAU personnel who are planning and implementing projects on the Centennial Forest.
    - Develop a process for collaboration between DFFM and NAU on planning and implementing forest emergency and non-emergency management actions and operations for the Centennial Forest.
    - Convene informal events between local DFFM staff and NAU School of Forestry to generate ideas and foster direct working relationships and collaboration.
2. Reconvene the Centennial Forest Advisory Committee
    - Committee will be co-convened by DFFM and NAU including input on membership, agenda topics, and prioritizing work on the Centennial Forest.
    - Professional facilitation services will be utilized for CFAC meetings.
3. Increase collaboration for management occurring on Centennial Forest.
    - DFFM and NAU will collaborate on how treatments can maintain research and teaching values in addition to ecosystem health and reduction of wildfire risk.
4. Complete work on GIS map of educational opportunities (past treatments and disturbances) for the Centennial Forest website. Provide input data to Arizona Forestry Information Tracking System (FITS) for project planning purposes.
5. Complete a LiDAR-based interpolated forest inventory for checkerboard portion of the Centennial Forest based on 2022 and 2024 field data.
6. Evaluate the existing CF Forest Plan and consider revision and updates

NAU plans to pursue the following additional work priorities during the next operating period:

1. Continue field campus operations, maintenance, and improvements:
    - Facilitate field campus use by NAU classes, ASLD and DFFM personnel, and higher-education and community forestry related groups.
    - Continued maintenance of the Centennial Forest field campus including invasive species removal, upkeep of existing trail system, and plowing access roads during snow.

- Reorganize and tidy logging sports grounds in anticipation of hosting scrimmage event with Colorado State University in fall 2024.
- Consider additional capital improvements on the field campus that can leverage existing facilities and agency partnerships to enhance student field experiences and increase capacity for management collaboration, education, and research across NAU and Northern Arizona.

2. Enhance experiential learning education opportunities for forestry students:
   - Remeasure FOR 449 plots on the Centennial Forest field campus after City Wells prescribed fire ignitions are complete (may not be completed until fall 2025).
   - Contribute Centennial Forest related projects to the Senior Capstone course.
   - Continue educational use of Centennial Forest including use by various forestry classes and the NAU Law Enforcement Training Program.
   - Work towards bringing the 'Centennial Welcome' for incoming freshmen students back to the Centennial Forest field campus in some form.

3. Facilitate research activities on the Centennial Forest:
   - Maintain eight existing long-term research sites.
   - Accept applications and conduct compliance review for newly proposed research projects.
   - Create improved database and web map of previous research projects for the Centennial Forest website.

4. Forest Inventory and Management Planning:
   - Continue to remeasure long-term continuous forest inventory (CFI) plots on the Centennial Forest, which were first installed in the 1970s and last measured in 2010.
   - Consider re-establishing historic CFI plots that cannot be located to rebuild the complete CFI plot network.
   - Design an accelerated M.F. project for an anticipated graduation date of Spring 2026 that will contribute to a forthcoming revision of the Centennial Forest management plan in collaboration with DFFM.

DFFM plans to pursue the following work priorities during the next operating period:

1. Implement the City Wells Prescribed Fire
2. Plan and implement the West Forks Prescribed Fire
3. Plan and implement the 89A Corridor Prescribed Fire
4. Plan and implement the Jack Timber Sale
5. Plan of the Pumphouse Timber Sale
6. Review and provide concurrence on new research applications
7. Identify educational opportunities for students to engage with managers
8. Host NAU interns and evaluate potential for additional internship opportunities

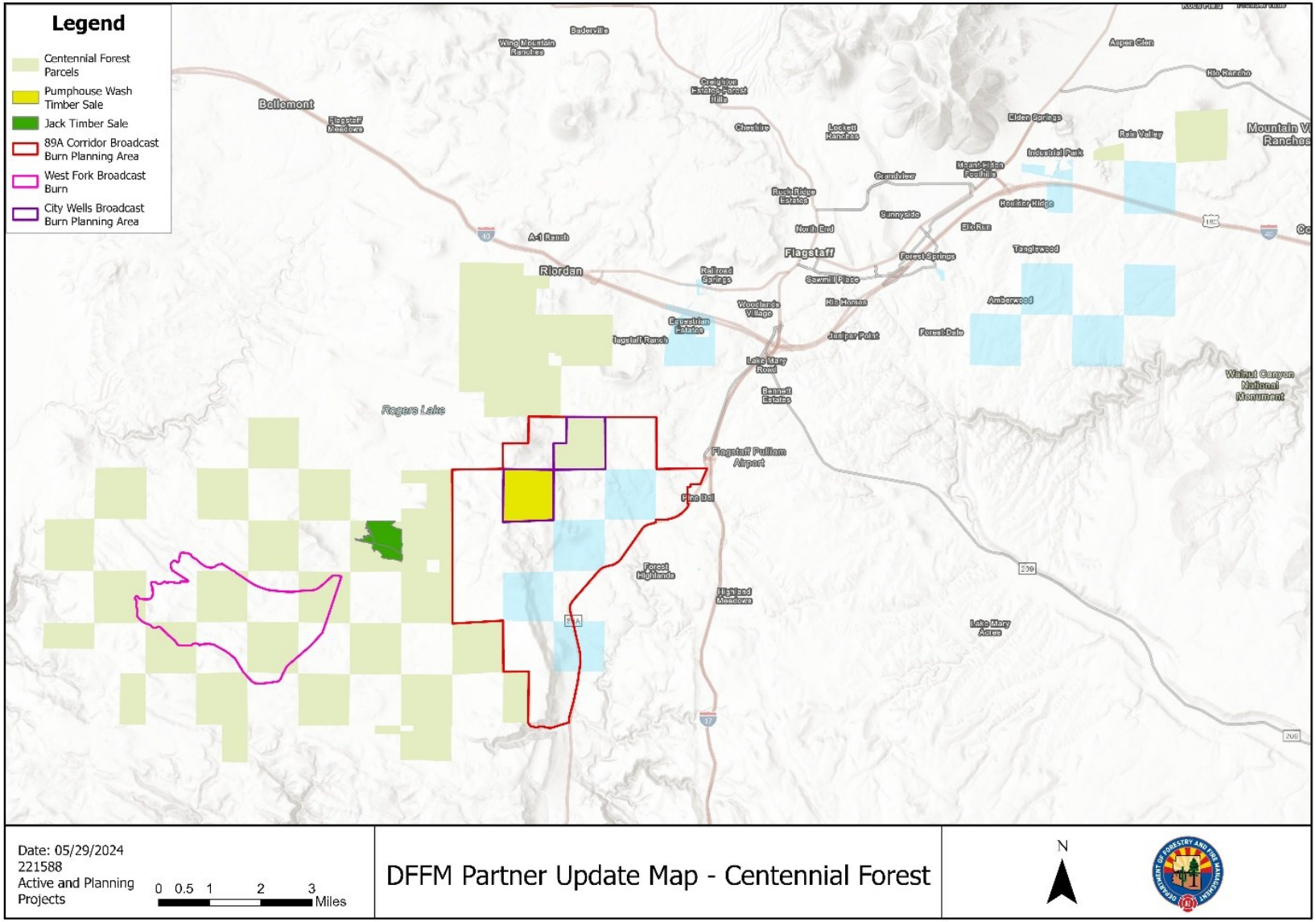


Figure 14: DFFM plans for forest management activities on the Centennial Forest for FY 2024-25

How 1999 IGA Parties Can Work Together

Some additional ways that the parties of the 1999 IGA can work together include the following:

1. Collaboratively propose and develop research needs and projects that can be applied to the Centennial Forest. These may be based on management questions DFFM may be trying to resolve to inform short- or long-term management decisions.
2. Collaboratively develop teaching resources, opportunities, and events for NAU students on the Centennial Forest. This may include participation in or observation of forest operations, field skills, equipment safety, career training, internships, etc.
3. Collaborate on the CF action plan.
4. Use input from CF action plan for the updated DFFM Forest Action Plan
5. Incorporate student data collection into projects (similar to fuels data collected for the City Wells Rx Burn).
6. Have students develop draft project plans and apply the best one. Could also include marking or similar activities to support projects and student development.
7. Develop a collaborative project on the NAU field camp / commercial lease.
8. Create a shared geospatial system (stand delineation and management, research sites, etc.).
9. Use the CF inventory to help inform treatment needs and long-term planning.
10. HFI grant or similar pass through to support tree removal at field camp via hand crew or similar?

Appendix A: Trust Beneficiaries

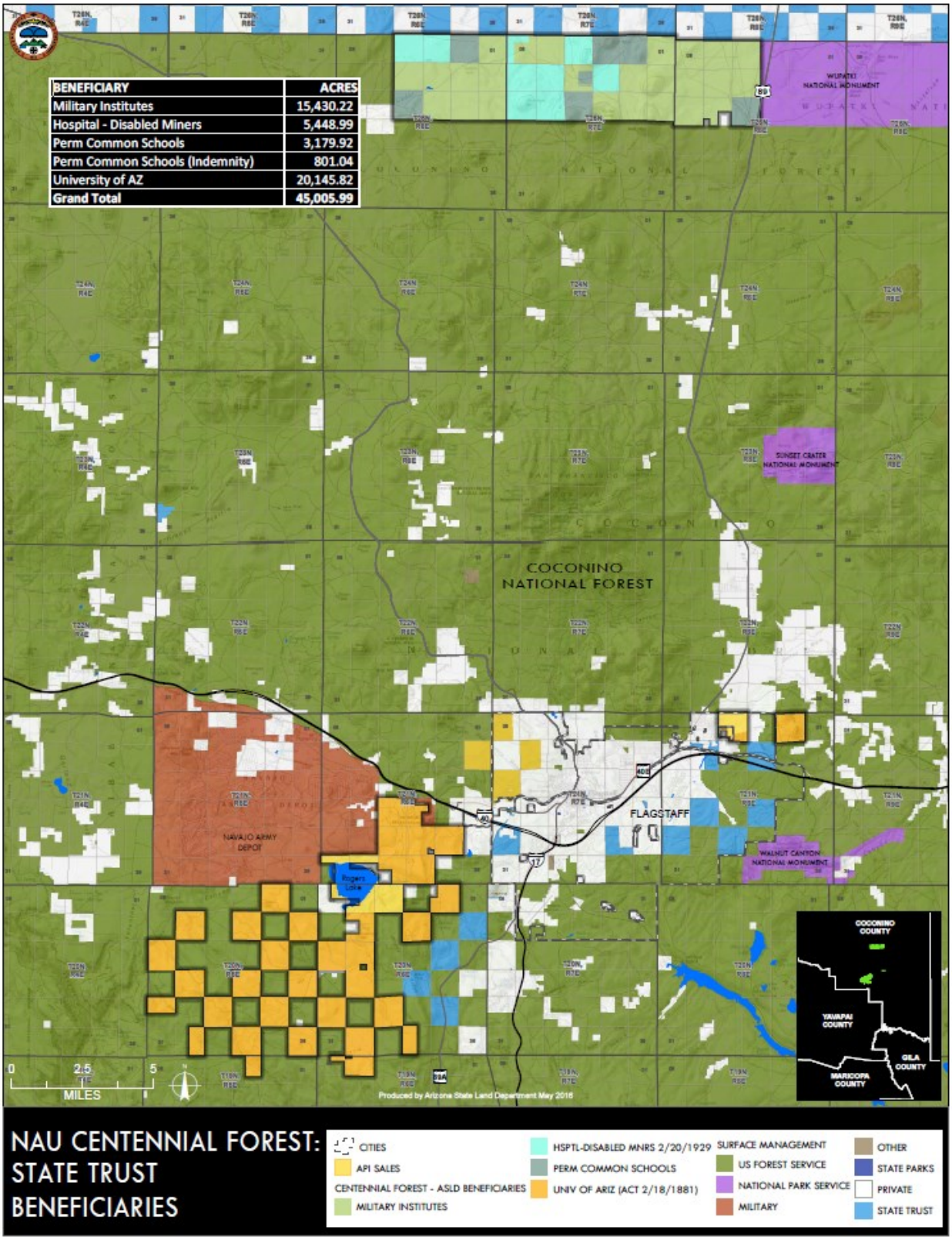


Figure 15: Trust Beneficiaries of AZ State Trust Lands around Flagstaff, including Centennial Forest.