United States Department of Agriculture
Forest Service

Walnut Creek Center for Education and Research and Southwest Experimental Garden Array

DRAFT Environmental Assessment

Chino Valley Ranger District, Prescott National Forest, Yavapai County, AZ

November 2014

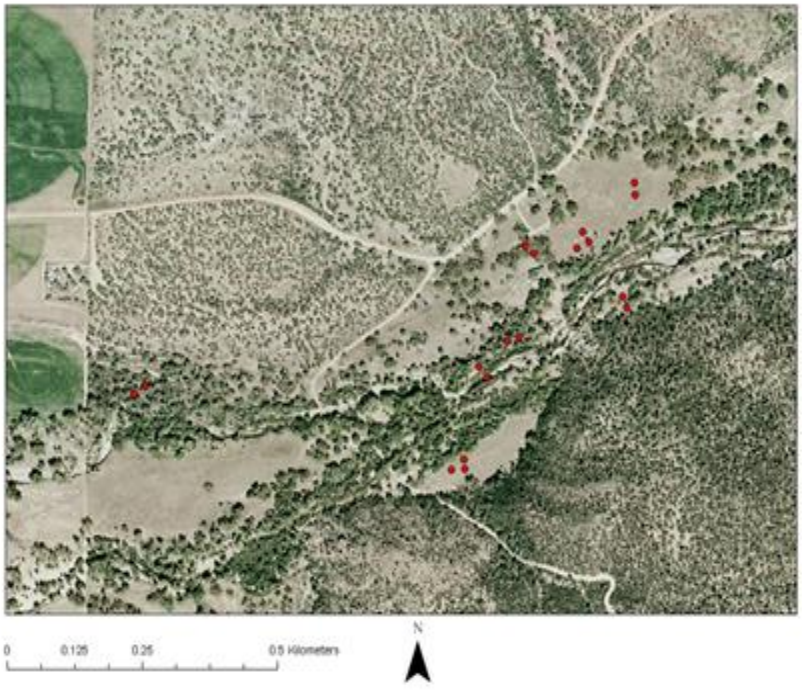

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Image: Arial photo of the project area with vegetation transect locations for the baseline conditions of the site.

[1] An update to the USDA Design Standards (January 2013) included an updated EEO statement that is currently under review. This template will be revised and posted online when the official updated statement is available.

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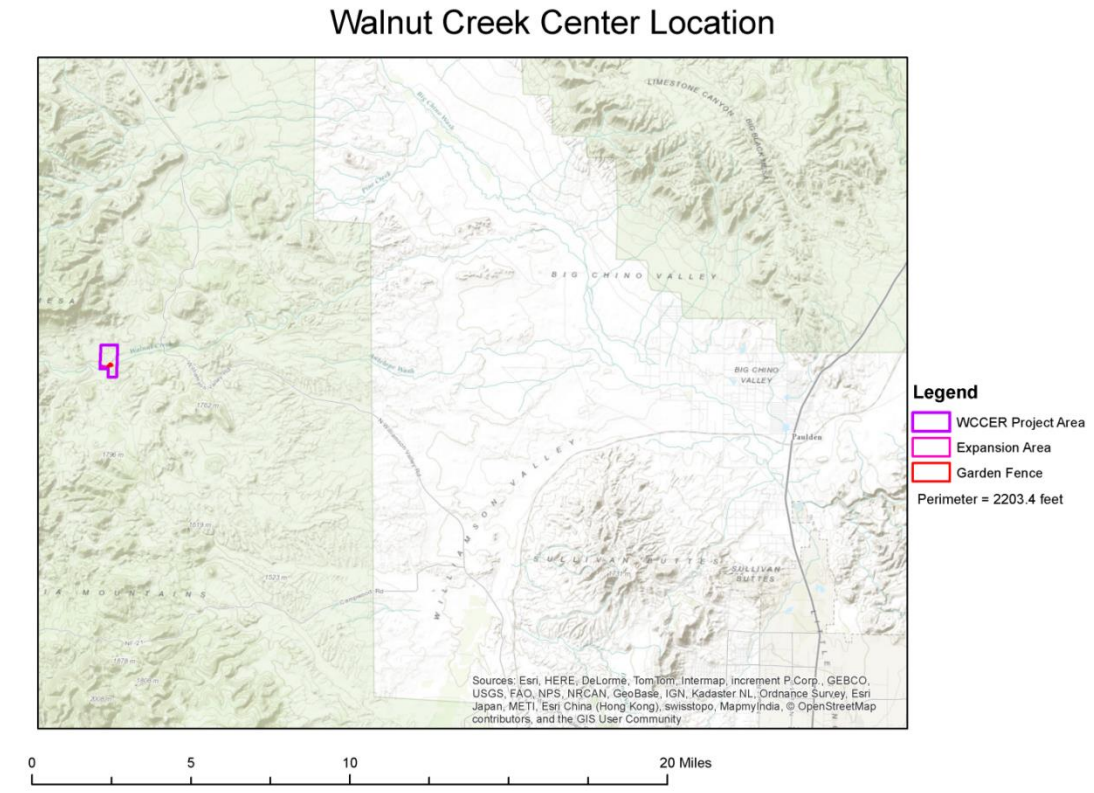


Introduction

Chino Valley Ranger District

The Walnut Creek Center for Education and Research (WCCER), a partnership of Prescott College, Northern Arizona University (NAU), and The Arboretum at Flagstaff, proposes a suite of three activities centered around the Historic Walnut Creek Ranger Station on the northwest section of the Prescott National Forest (PNF). One component is the continued operation of the Walnut Creek Ranger Station Administrative site (~5 acres, including buildings and infrastructure) as a WCCER partnership field station. The second component is the use of the surrounding 275 acre section for low impact research and teaching to include such activities as surveying, sampling, marking, and collecting of soils (<1 cu. m), plants, and invertebrates. The third component is the use of up to 10 acres for a research site for the Southwest Experimental Garden Array (SEGA) for the study of plant genetics and climate change. The purpose of the research to be supported by this site is to understand climate change impacts on native ecosystems and use knowledge of genetics and community interactions to mitigate those effects. This research site will be one in a network covering an elevation gradient across northern Arizona to enable testing of the impacts of varied temperature conditions on plants and associated communities.

We (NAU and the Prescott National Forest) prepared this environmental assessment (EA) to determine whether implementation of WCCER and SEGA activities may significantly affect the quality of the human environment and thereby require the preparation of an environmental impact statement. By preparing this EA, we are fulfilling agency policy and direction to comply with the National Environmental Policy Act (NEPA). For more details of the proposed action, see the Proposed Action and Alternatives section of this document.

Proposed Project Location

The Walnut Creek Center for Education and Research operates a field station that conducts research and research training in the mountains of central Arizona approximately 55 km northwest of Prescott. The WCCER is a vital partnership of the three partners in central and northern Arizona with interests in environmental education and research. The facility is operated by Prescott College (administrative lead partner), The Arboretum at Flagstaff, and Northern Arizona University, under permit from the Prescott National Forest.

Location and General Infrastructure

The Walnut Creek Center is located at 34.9224°N, -112.8447°W (Figure 2), at an elevation of 1560 m. The leasehold encompasses 113 ha. Two perennial streams, Walnut Creek and Apache Creek, flow through the property. Vegetation on the site includes a unique interior riparian deciduous forest with adjacent interior chaparral and pinyon-juniper communities. A fairly well developed cottonwood/willow gallery forest and scrub willow community is found adjacent to the active stream channels. Because of the diversity of available resources, habitats and moisture, the field station promotes a diversity of seasonal, resident and visiting wildlife species (Abbott and Glomski, 2000).

Structures at WCCER include a 1614 square foot manager's residence, a 2770 square foot multipurpose research building (Figure 1), a generator building and five other outbuildings. Water at the site comes from a well that pumps to a 5,000 gallon water storage tank. Sewage is handled by a septic tank and

Figure 1. Historic Ranger Station barn used as a multipurpose education and research building at Walnut Creek.

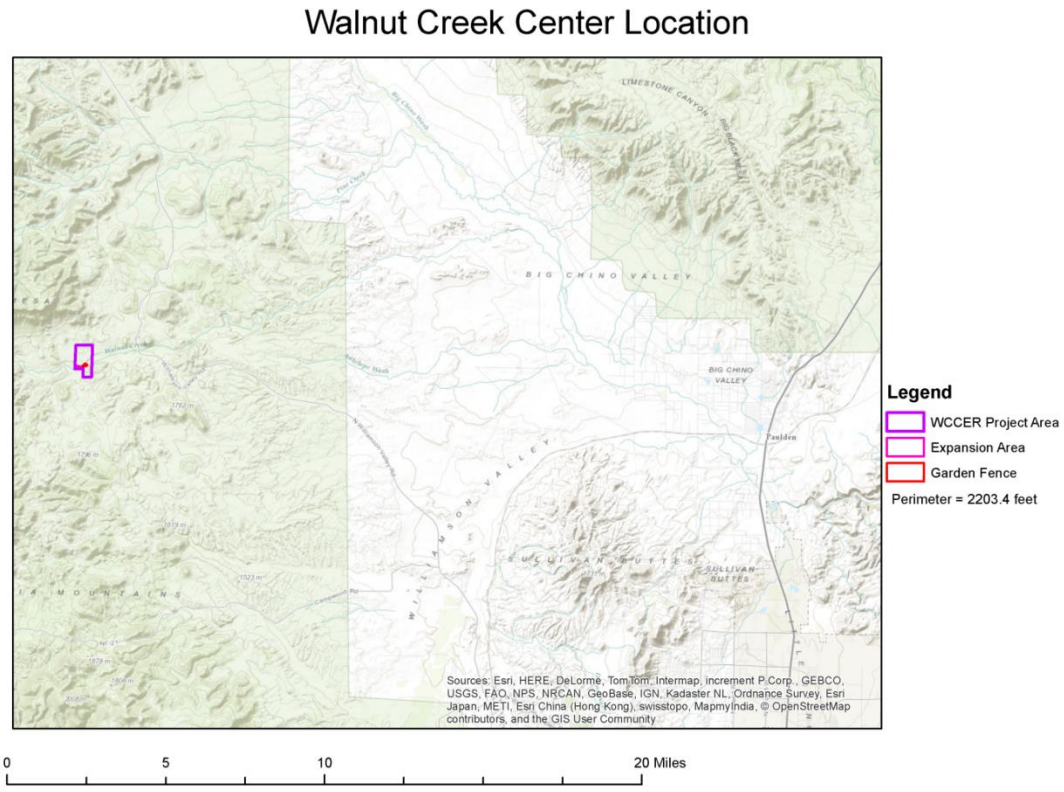
leach field. This sewage system was designed to handle the waste stream of up to 40 people at one time. Toilet facilities at the manager's house and one freestanding bathroom are supplemented by portable toilets as needed. Running water is available from a number of spigots across the site. Power comes from a propane generator and from a small array of solar panels that provide electricity for the manager's residence. Communication is by cell phone and a two-way satellite internet connection distributed via wireless network. Access to the site is by county maintained paved and gravel roads from Prescott (55 km to the southeast of WCCER).

History of WCCER

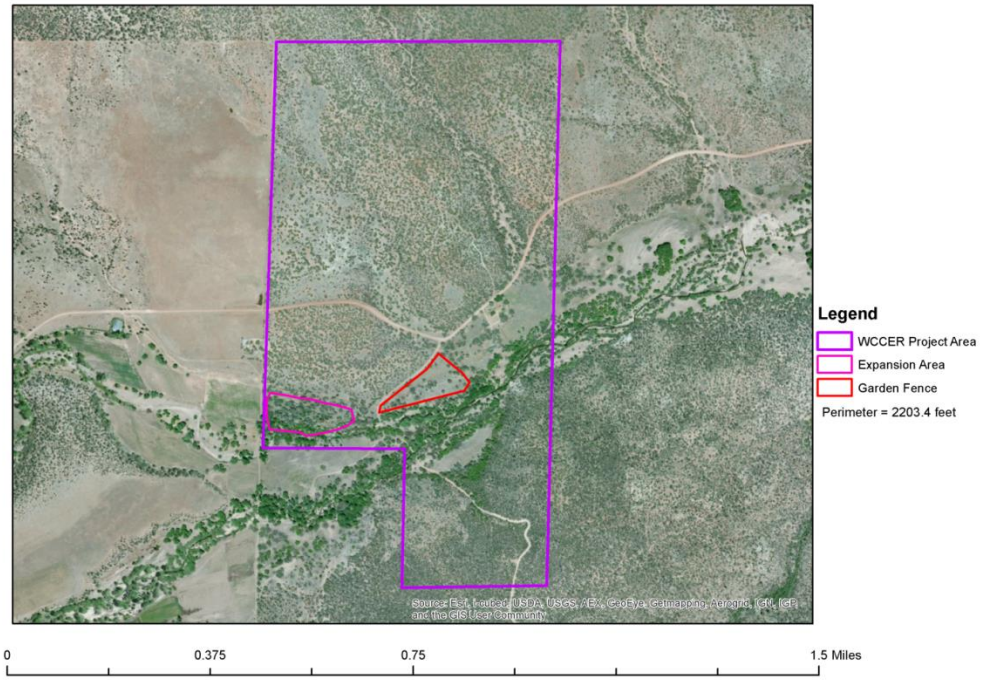
The Prescott National Forest established the Walnut Creek Ranger Station (WCRS) in 1908 to serve as the headquarters for the District. The WCRS also served as a center for fire suppression activities, working in concert with the nearby Hyde Mountain fire lookout. The CCC established a camp west of the Station in the late 1930s. During this time, the ranger's residence (1934) and a Barn (1936) were constructed. In the 1970's the station was expanded with the addition of a large septic system and leach field and a new area of trailer pads for housing firefighters and other seasonal employees. In 1980 the Walnut Creek District was consolidated with the Chino Valley Ranger District. The office was relocated to the town of Chino Valley and the Station was then used as a work center. In 1993, the Station was listed on the National Register of Historic Places (NRHP).

Discussions were initiated in the 1990's among representatives from Prescott College, Sharlot Hall Museum, Yavapai College (all located in Prescott), Northern Arizona University (located in Flagstaff) and the Prescott National Forest about the possibility of developing an educational and research facility at the site. In 1997, the museum, colleges and university formed the Walnut Creek Center for Education and Research as a legal partnership. In 1999, WCCER entered into lease agreements for the Walnut Creek Administrative site with the Prescott National Forest. The lease that covers the primary facilities and grounds of the field station is a special use permit under the authority granted by the Granger-Thye Act of 1950.

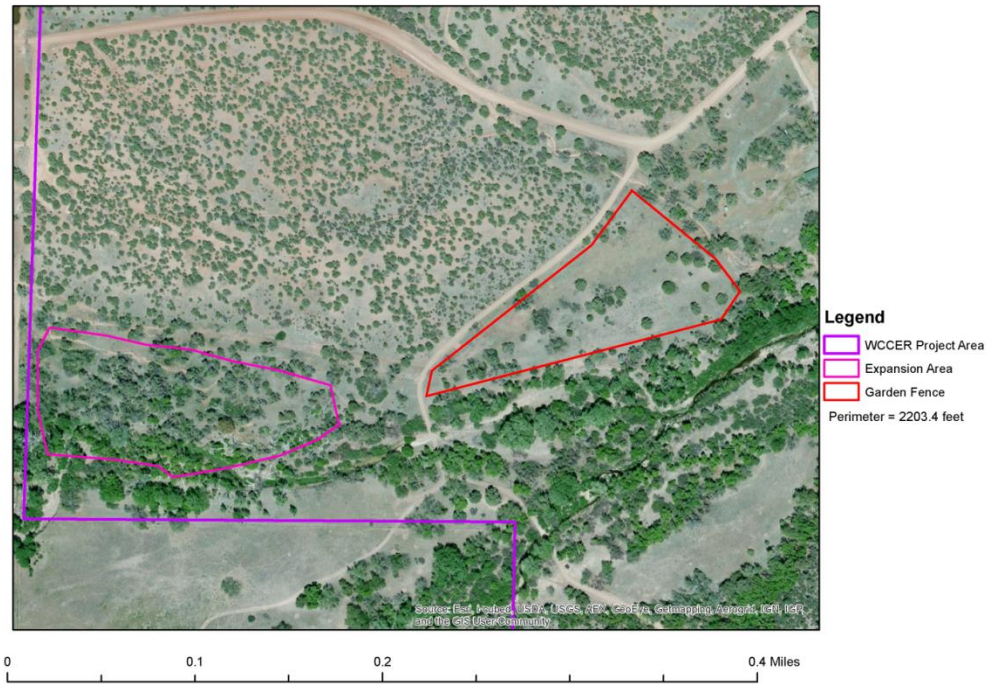
Figure 2. Vicinity map, project area, and proposed research garden areas.



Walnut Creek Center Project Area



Walnut Creek Center Gardens



Need for the Proposal

The combined Walnut Creek Center and Southwest Experimental Garden Array will:

1) promote research on sustaining landscapes that will inform management to maintain desired landscape conditions on the Prescott National Forest and particularly develop understanding of the impacts of global change on vegetation,
2) provide educational opportunities for regional students and institutions
3) provide a presence at the Walnut Creek Center that enables public contact and outreach,
4) Assist the Prescott National Forest with the maintenance of the historic properties at the Walnut Creek Ranger Station.

These initiatives have support from existing partners: Prescott College, Northern Arizona University, and The Arboretum at Flagstaff. As outlined in a National Science Foundation Strategic plan we will seek to expand the partner list over the next three years to further strengthen the program.

The Walnut Creek Center for Education and Research
Since 1999 WCCER has operated as a remote field station. The site has hosted many undergraduate courses, several K-12 outreach activities, numerous research projects, and provided area information to the public. The WCCER partnership has worked closely with the PNF to preserve and maintain the historic character of the site. This proposed action would enable these activities to continue. Research activities included under this permit include non-destructive measures, marking plants or plots in the field, and sampling on plants, soil and insects on the 275 acre project area.

The Southwest Experimental Garden Array (SEGA) is a new field-based experimental research platform that uses an elevation gradient to mimic the effects of climate change on temperature. This is possible because temperature increases predictably as elevation decreases. SEGA will create a system of 10 gardens along an elevation gradient in northern Arizona. (Only the garden at Walnut Creek is being analyzed in this EA). The gardens will make it possible for researchers to identify those individuals and populations of plants that will survive in the climates of the future and to come up with other strategies to minimize the effect of climate change on vegetation. SEGA was recently described as an example of "experiments as infrastructure," one of the top ten emerging trends at field stations, by the national strategic plan for field stations (Billick et al., 2012). Creating the type of research infrastructure envisioned by SEGA will advance environmental science and highlight the role that field stations can play in identifying climate change solutions.

The common garden approach to examining genetics and climate change impacts on plants, communities, and ecosystems is a crucial tool for (1) predicting impacts of climate change and (2) developing strategies to mitigate climate impacts to biodiversity and ecosystems through managed translocation and other mechanisms. Not only does the SEGA non-biological infrastructure represent a large investment in a burgeoning research area, but also the plantings proposed for SEGA research projects will represent large investments. Once a well-designed planting is conducted, it will be of great value to many researchers, meaning it will be important to work collaboratively on the design of experiments and to view these experiments as infrastructure for multiple researcher use in the future. This model may require developing new views of how research infrastructure is maintained.

SEGA is viewed as an important resource to experimentally validate or parameterize predictive models of climate change impacts, which are often based on data showing correlation, not causation. SEGA represents an opportunity to understand climate change impacts as they will occur in a field setting with suites of interacting species. Assisted migration, or managed relocation, was also raised by several participants and is a controversial topic for land managers and researchers alike. SEGA can be used to

understand the likely results of assisted migration, research that is greatly needed. Additionally, because research cannot cover all species there should be a focus on foundation species that drive ecosystems.

SEGA will include discussions and perspectives from land managers in developing experiments because this audience brings a very different but highly relevant view to the research vision. Landowners and managers are particularly concerned with understanding future trends in plant growth and cover; the interaction of climate change, fire regimes, and invasive species; restoration of high-value/riparian ecosystems; and the development of realistic mitigation strategies that do not involve intensive planting. For example, what are the likely trends in invasive plants under climate change and alternative, realistic management scenarios? Managers indicated that information about particular combinations of genotypes and climate scenarios and their ensuing fitness consequences would be informative. Species of particular interest include common species like *Pinus edulis, Juniperus monosperma, Pinus ponderosa*, and grasses as well as endangered species which require active management. In the case of endangered species and endemics in particular, there is interest in developing a framework that accounts for range shifts in managing endangered species rather than trying to manage them in a historical location.

The creation of multiple mechanisms for information exchange with and technical transfer to landowners and managers will benefit the network. Land managers want to (1) to be involved in planning research activities that are to take place on their lands, (2) be informed of likely trends impacting their lands, and (3) have a mechanism to facilitate the translation of SEGA knowledge into information that can be used to improve their projects and plans. In addition, observations by those on the land on a daily basis could provide important insights to inform research. The SEGA network will need to be expanded to address the issues identified by land managers at broader scales, encompass the vast diversity of habitat types, and provide broad replication for data acquisition that will be useful for global climate models. Expanding the network will require the full cooperation and support of major land managing agencies, particularly the USDA Forest Service.

Due to limited federal agency staffing and increasing regulatory burdens, access to field sites is becoming more limited. A coordinated effort on many fronts can help alleviate this constraint, foster research, and lessen the time researchers and agencies spend on permitting. Keeping in good communication with agencies and collaborative efforts like the Kane-Two-Mile Partnership should enable more research opportunities in the future.

Finally the sustainability and impact of SEGA will be greatly enhanced by integrating education and outreach activities into the program. Engaging both undergraduate and graduate students in SEGA research efforts will not only provide the workforce required to intensively monitor and manage the gardens, but also provide hands-on training to the next generation of scientists in climate science, ecology, genetics, engineering, and informatics. Volunteers and citizen scientists could also play an important role in maintaining and monitoring the gardens, which would also build community support for the program and improve understanding of the role that science can play in mitigating climate change. Outreach to K-12 audiences and the general public would complete the picture of a well-rounded education and outreach effort.

Vision:
Develop knowledge resulting in a better understanding of: 1) the ways genetics interact with climate change to impact biomes, 2) the feedback of biomes and the climate system, and 3) potential strategies to minimize impacts of climate change on organisms and ecosystems.

MISSION STATEMENT

The mission of this facility is to enable a new generation of climate change studies that allows researchers from multiple disciplines to quantify the ecological and evolutionary impacts of climate change on 1) foundation plant species that drive their respective ecosystems, 2) their associated arthropod, microbial, and understory communities, 3) native-exotic species interactions, and 4) the ecosystem processes that emerge from these interactions. This facility will enable the identification of physiological mechanisms that underlie differential species and genotype performances under current and future climatic conditions. Plant performance results from the array will provide modelers with calibration to better predict vegetation shifts, whole community responses to climate changes, and their effects on ecosystem processes. Because the southwestern USA is experiencing some of the highest levels of climate-change impacts in North America, our garden array can serve a regional as well as a global role in addressing the gene by environment interactions that are likely to reshape biotic communities this century. **We expect research findings to result in two major outcomes: 1) increased knowledge of fundamental principles governing genotype by biotic and abiotic interactions in a community context, and 2) real solutions to climate change such as the identification of source populations and genotypes that might best survive and thrive in predicted future climates.**

SEGA will:

1) Provide infrastructure and data management to support the next generation of research on the impacts of climate change on the environment by including an explicit emphasis on genetic variation and evolution. This infrastructure will include ten or more instrumented experimental gardens across a range of temperatures and accessible environmental and experimental data

2) Participate as part of a community of interacting researchers, land-owners, managers and policy makers to support dialog and spur progress in innovative research and management.

3) Participate in the integration of both formal and informal education into research activities through programming involving K-12 institutions, colleges and universities, volunteers, and citizen scientists.

History and Justification of the Common Garden Approach

The common garden concept has a rich history in experimentally partitioning genetic and environmental factors. The famous common garden experiments by Clausen, Keck and Heisey (1940) showed how plants can be locally adapted through reciprocal transplant experiments along an elevation gradient that reflected major changes in temperature and moisture. The U.S. Forest Service has a long history of using provenance trials in which trees are reciprocally transplanted among numerous sites throughout a species range to identify superior source populations and genotypes for use in commercial plantations and replanting projects.

The San Francisco Peaks area is ideally suited for an experimental garden array as it represents a dramatic elevation gradient. C. Hart Merriam conducted his classic life-zone research in Flagstaff, Arizona (Merriam 1894) taking advantage of the pronounced shift in vegetation types over just 50 km from desert at 1,220 m to alpine tundra at 3,960 m at the top of the San Francisco Peaks. This gradient spans from 2.4 to 14.5°C in mean annual temperature and 153 to 1292 mm in annual precipitation, thus capturing far greater climatic and biological variation than is accessible in typical large-scale global change experiments. Reciprocal transplant experiments along an elevation gradient are relatively easy to conduct, can test the natural potential of plants to migrate, and represent ideal test beds for managed translocation studies.

The Southwest Experimental Garden Array combines traditional reciprocal transplant and provenance trial experimental designs with state-of-the-art multi-factor climate change manipulations, enabling the integration of genetics and climate change research. This facility will allow research that scales from genes to ecosystems to test the genetic basis of plant performance along environmental gradients. The generation of new knowledge regarding fundamental principles from the array will provide genetics information for scientists to make better informed predictions of the impact of climate change on individual genotypes, species, communities, and ecosystems, which in turn will inform land

management and restoration projects. Our array will: 1) provide a scientific basis for the concept of managed translocation, 2) identify drought tolerant genotypes and source population(s) that perform best at a given location for current and expected future climatic conditions and buffer against loss of ecosystem function, 3) help develop techniques for managing exotic species that are becoming more harmful with climate change.

Public Involvement and Tribal Consultation

The Forest Service, NAU, or NSF consulted the following individuals, Federal, State, tribal, and local agencies during the development of this EA:

A scoping letter was release to the public on September 5, 2012. No public comments were received.

Input applicable to all SEGA common garden sites on USFS lands was received from Barbara Phillips (USFS Botanist serving multiple forests) who approved the wording of the list of plants that may be planted in the gardens (see proposed action).

Several Prescott National Forest staff contributed analyses, surveys, modifications, and improvements: James Gilsdorf, District Ranger; Noel Fletcher, Wildlife Biologist; Jodi Wetzstein, Vegetation; Greg Olsen, Hydrology; and Elaine Zamora and Jim McKie, archaeology.

The Arizona State Historic Preservation Office (SHPO) was consulted by the PNF archaeologists who provided their surveys and recommendations of the area. In addition, the National Science Foundation (NSF) communicated their desire to have PNF consult on their behalf. NSF has NEPA and Sec.103 responsibilities as well because of funding of SEGA.

NSF consulted with relevant Arizona-based tribes in a letter sent on April 8, 2014 to Fort McDowell Yavapai Nation, Havasupai Tribe, Hopi Tribe or Arizona, Hualapai Tribe, Kaibab Band of Paiute Indians, Navajo Nation, Tonto Apache Tribe, White Mountain Apache Tribe, Yavapai Prescott Tribe, Yavapai-Apache Nation, Colorado River Indian Tribes, Paiute Tribe of Utah, San Juan Southern Paiute Tribe, Fort Mojave Indian Tribe of AZ, CA, and NV, and Pueblo of Zuni. There have been no responses from the tribes.

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Proposed Action and Alternatives

The Prescott National Forest is proposing to issue special use permits to Northern Arizona University, The Arboretum at Flagstaff, and Prescott College (WCCER partnership) to use the Walnut Creek Administrative Site, 275 acres of surrounding national forest, and 10 additional acres for research gardens for the purposes of education, instruction, and research. An environmental assessment (EA) is prepared as part of this process. The Walnut Creek site is considered unique for this research that cannot be easily replicated elsewhere due to its topographical and elevational position and established facilities. It is also advantageous that NAU has been an existing special use holder for the facility.

The proposed action and following alternatives were considered:

Proposed Action

Northern Arizona University and Prescott College have previously held two special use permits; one for the Walnut Creek administrative site, and one for an adjacent 275 acres of the Prescott National Forest. These permits were issued for use of the facilities and lands for research and education on river restoration, watershed management, field biology, and cultural/natural history. The two institutions have

requested that these permits be reissued. They, along with the Arboretum at Flagstaff, have also requested a new permit to establish a Southwest Experimental Garden Array at the site for research on the interactions of genetics and climate change on plant genotypes, species, communities, and ecosystems.

The Administrative Site includes a historic house and barn and additional outbuildings. The WCCER partnership has played a key role in maintenance and protection of this property and will continue to do so. The partnership would continue to employ on-site managers who will live in the house and oversee the facilities. The Administrative site is run as a small field station hosting research, courses, and outreach activities. Groups generally do not exceed 40 people. The permit for the surrounding 275 acres is intended for class and outreach use, monitoring of marked plots and trees, and other minimally invasive research and teaching use.

The proposed 10 acres of garden area will have perimeter fencing for 5 acres on each of two plots. Final fencing plans will be designed in consultation with the Arizona Game and Fish Department to minimize disruption of wildlife. The fencing will need to exclude elk, deer, javelina, and livestock. Within a site, individual experiments may use additional fencing and exclusion methods to prevent the consumption of plants by rodents and other small animals. The garden site will be connected to the existing well for the administrative site. New power sources will be added. Some clearing of vegetation will occur depending on individual research protocols. Most clearing will consist of cutting a few existing juniper trees where they have encroach into meadows, and which may interfere with research results. Both of the proposed sites have been disturbed in the past by clearing, pasturing, or farming.

Connected actions:

Power: Solar power systems for the administrative site will be augmented to operate the weather stations, monitoring systems, and irrigation systems. These would have about a 9'X16' footprint. The solar power system would use an in-ground metal posts. Batteries would be placed in a portable, on-ground vented enclosure.

Fences and weather stations: Exclosure fencing for the 5 acre plots (maximum of 2) is proposed using steel posts in concrete to maximize longevity and avoid repeated disturbance. There will be two tiers of field fence going up to 8 ft. The weather station and rain gauge are proposed using in-ground mounting systems. The weather station tripod would be staked. The Geonor vibrating-wire precipitation gauge requires damping against vibration that can be provided by mounting a large metal pipe in concrete below ground.

Water: We anticipate potential use of 50,000-250,000 gallons of water per year depending on the site and the number of experiments. The existing well located on the administrative site, under permit to the US Forest Service, has sufficient capacity within its authorized allocation (max 30 gpm well pump) to meet these needs with the additional installation of 1-2 (2,500 gallon or more) water tanks. Irrigation systems would be a mix of above ground and below ground to minimize trenching, but maximize functionality and longevity of the system. Soil moisture sensors and lysimeters may be installed in ground. Other sensing and irrigation infrastructure, including pipes, emitters, and wireless sensor/actuator nodes, would be installed above ground, with small (18" maximum) ground stakes for stabilization against high winds. Initially, 30 soil moisture sensors, measuring approximately 2mm X 3cm X 15cm, would be inserted in the ground. Additional sensors will be added for specific experiments. Whenever possible the lowest water use, drip styles system will be used that will meet the scientific goals of an experiment.

Plant Species and Planting: The experimental garden approach is based on reciprocal transplants of multiple species and genotypes at multiple locations. Use of plant species native to the southwestern United States will generally be accepted without special authorization. Determination of plant status will

rely on the USDA PLANTS database (http://plants.usda.gov/java/). Planting of other species, endangered or threatened species, or noxious or invasive weed species will require review on a case-by-case basis in consultation with the SEGA Governing Board, Scientific Advisory Board, and the Forest Service. The USDA PLANTS database will again be used to determine weed and rare status. State and National Forest noxious weed lists will be consulted as well. Limited clearing or suppression of existing vegetation may occur for some experimental planting designs. Planting may include sowing seed (hand collected by researchers or certified weed free), digging holes the size of the root ball or plants to be planted, or furrowing the ground. With any ground disturbance, weed management BMPs will be followed, the site will be monitored for weed species, especially cheat grass and horehound, and initially weeds will be removed by hand. Should additional measures become necessary the herbicide guidelines in the Integrated Treatment of Noxious or Invasive Weeds EIS for the Coconino, Kaibab, and Prescott National Forests will be followed.

Pesticides and Herbicides: Although we discourage the use of chemical toxins, some use is allowed when deemed important to the experimental design or when other methods are deemed too costly or unlikely to be successful. We are trying to maintain a controlled environment with as few external factors as possible, which may have unintended short- and long-term legacy effects. Only pesticides, herbicides, and fungicides approved by the Integrated Treatment of Noxious or Invasive Weeds EIS for the Coconino, Kaibab, and Prescott National Forests will be allowed, but use will be reviewed by the SEGA Governing Board and Scientific Advisory Board with prior approval from the Forest. Alternative methods of control will be explored before using chemicals such as biotic or manual treatments.

Small exclosures and enclosures: Exclosures and enclosures for individual plants are approved as long as they do not cause harm to other organisms or interfere with avian flight patterns (e.g., no netting in which birds, lizards, and other animals may become entrapped). Maintenance of exclosure and enclosure fencing, except fencing around the SEGA plots, is the responsibility of the individual researcher.

Heating: Heating experiments will be permitted where energy needs can be met. Other considerations include fire safety and potential impacts on other users. Because of the high energy demands of such experiments, users are advised that they will need to pay for their energy use and infrastructure needed to provide energy where such infrastructure is not already established.

Soil import: Importing soil from nearby areas in Arizona that is associated with potted plants or for the purposes of studying the effects of warming on soil organisms or controlling for soil effects in elevation treatments is approved, unless prohibited by State or Federal regulations. Soil and plants must be free of disease causing organisms of concern to the best possible knowledge of the experimenter and reviewers. The import of soil for pre-approved study is limited to the minimum amount required by the approved experimental design. Soil must be from weed free areas or be sterilized prior to import. Any other soil movement will require review including the Scientific and Landowner/Manager Boards.

Soil Export: Removal of soil that is associated with root removal is pre-approved. Any volume of soil over that amount will require review on a case-by-case basis in consultation with SEGA staff and the landowner(s).

Rain-out Shelters: The use of rain-out shelters is approved given that the design of the shelters does not cause harm to animal organisms or interfere with avian flight patterns (e.g., use of materials in which birds may become entrapped). Maintenance of the shelters is the responsibility of the researcher. Rainout shelters should be designed to withstand the rigors of weather at each specific site where they will be deployed. Water from such shelters should be redistributed for use on water addition treatments.

Weed Management and Education: All researchers and equipment installers will be educated about weed management Best Management Practices. Equipment and clothing coming from weed invested areas will be cleaned prior to use at the site.

Fees: the partnership will charge fees to researchers to cover maintenance costs for the physical infrastructure of the garden sites and data management costs. Complexity, scope, and resource use of the project will affect its fee-level. Fees will not be charged by the special use permittees for the general use of the administrative site or lands.

Conduct of Research: Initial deployment of experiments and irrigation needs must be coordinated in advance with the SEGA Garden Manager. Research project Principal Investigator (PI) and staff contact information and visitation schedules must be provided throughout the project. This information will be shared with designated landowners and managers. Liability waivers protecting SEGA and landowners must be signed and turned in to SEGA staff prior to starting work.

Southwest Experimental Garden Array Data Policy: Data and information derived from government funded research, including (but not limited to) data from research using facilities such as SEGA that is paid for, in part, by the National Science Foundation, must be made publically available online with as few restrictions as possible. Metadata, or a description that documents the type of information being collected, will be publically available online once the data is collected. Online access to data will require registration for the purposes of being able to track data use.

Data collected by the automated environmental monitoring devices that are part of the SEGA instrument (such as air temperature and precipitation) at each SEGA site as well as background survey data (such as soil analyses and irrigation water quality measures) for each site will be made available to the public nearly immediately online.

Researcher-collected data (e.g. data collected by hand such as plant performance, added experiment specific sensors, or genetic data) will be posted online and made available to the general public. Posting of data will occur when it is available, but no later than two years from data collection and processing.

Some data will have restricted access. The justification for such exceptions must be well documented and approved by the PI and SEGA Data Manager. Some examples of restricted data may include: locations of rare or endangered species, data that are covered under prior licensing or copyright (e.g., SPOT satellite data), or data for which release is limited due to confidentiality as specified by the Human Subjects Act. Researchers who get permission to make use of such restricted data may be subject to additional restrictions to protect any applicable commercial or confidentiality interests.

Environmental Impacts of the Proposed Action and Alternatives

This section summarizes the potential impacts of the proposed action and alternatives for each affected resource. Resources that were not affected and therefore not further analyzed include: Wilderness, Wild and Scenic River, Range, Watershed, and Air.

Vegetation

An extensive plant survey in 1998 and 1999 identified 279 plant species (Abbott and Glomski 2000). Vegetation mapping in the same study was accomplished for 297 acres using aerial photography and ground-based surveys. The upland portions of the larger 275 acre site are dominated by the following 3 vegetation types: Manzanita/Scrub Oak, Utah Juniper/Mixed Grassland, and Scrub Oak/Colorado Pinyon with smaller areas of other associations. The administrative area around the structures has: Arizona Walnut/Utah Juniper, Mixed Grassland, and Mixed Deciduous Broadleaf. The proposed garden areas have: Utah Juniper/Mixed Grassland, Mixed Grassland, and Mixed Deciduous Broadleaf. Minor changes in the plantings in the garden will not change the overall vegetation. A few mature junipers may be cut in areas where they have been thought to have encroached over the past 100 years. The WCCER partnership will also monitor for and prevent establishment of tamarisk in the riparian corridor. There will be no direct, indirect or cumulative effects to vegetation based upon the proposed actions or the ongoing cattle grazing, authorized in the recent K-Four Allotment Management Environmental Assessment decision signed on September 30, 2014. Although cattle will overlap portions of the 275 acre permit area, there will be no overlapping or cumulative effects.

Hydrology

Existing Hydrologic Conditions

The project site is located on a river terrace immediately adjacent to Walnut Creek. The project is very near the watershed pour point of the Upper Walnut Creek 6th Hydrologic Unit Code (HUC) I.D. number 150602010805 (see Figure - X). The watershed area is approximately 36.18 mi^2 (23,155 acres). The mean annual precipitation depth in the watershed is approximately 22.1 inches (42,628 ac ft) (U.S. Geological Survey, 2014).

The U.S. Geological Survey (USGS) operated a continuous gage site on Walnut Creek, immediately adjacent to the site, for one year in 1991-1992. USGS flow data from the period, shows mean monthly discharge rates ranging from 8.1 cfs in January to 0.27 cfs in July, with an annual discharge rate of 2.13 cubic feet per second (cfs), or approximately 1,542 ac ft/year (Wolock, D.M., 2003).

According to available Federal Emergency Management Agency (FEMA) floodplain mapping, of the 10.50 acres of project area, approximately 8.13 acres are located within the 100-year floodway of Walnut Creek (FEMA, 2010). It should be noted that the available FEMA mapping is not the result of a detailed flood potential analysis and thus is very approximate in accuracy.

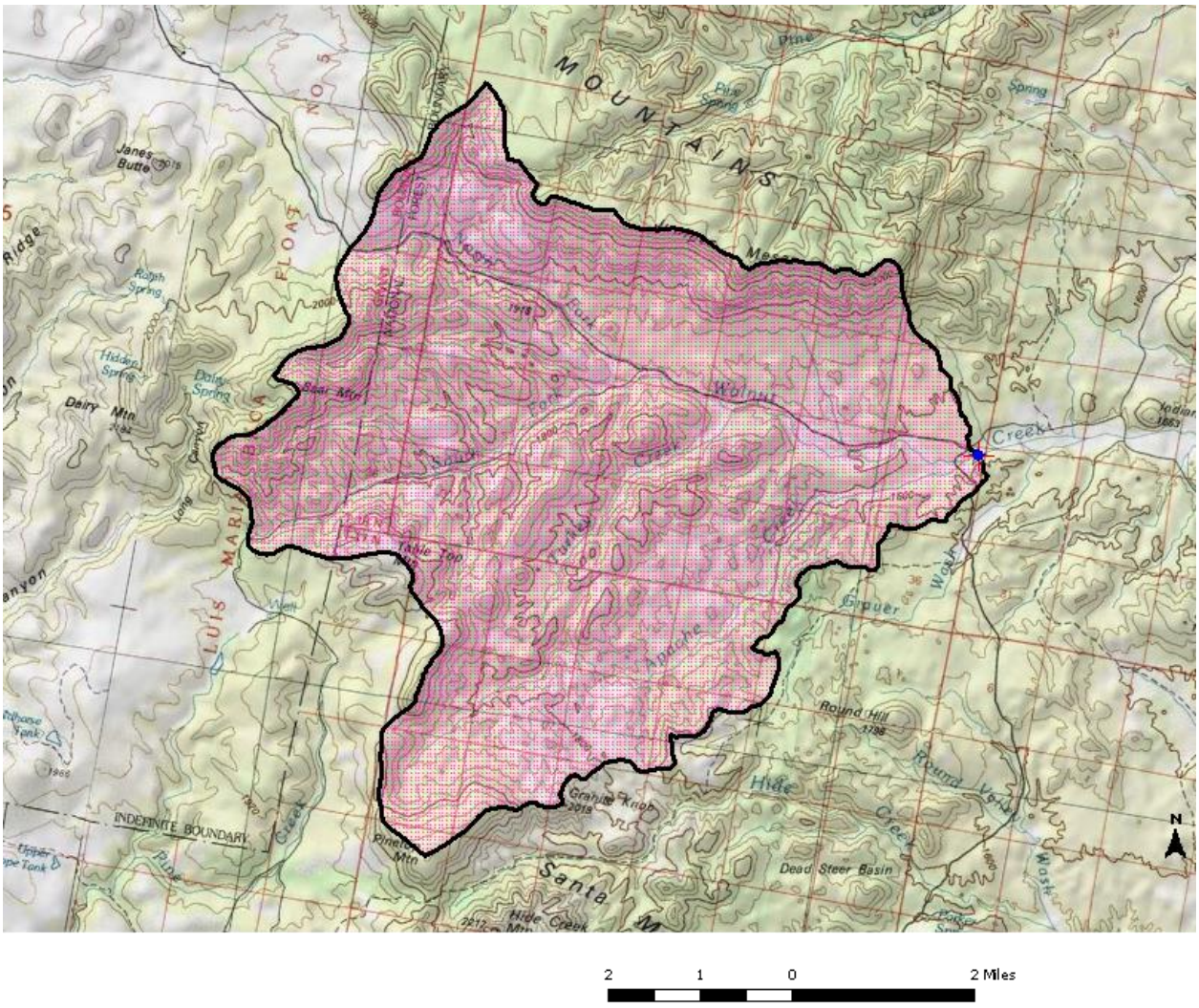

Figure 3 – Upper Walnut Creek contributing watershed area above the project site (USGS StreamStats, 8/6/14)

Effects Analysis – Groundwater and Surface Water

Under the proposed action, the estimated annual groundwater consumption of the SEGA project is between 50,000 to 250,000 gal/year (0.15 to 0.78 ac ft/year). Even at the high end of the consumption estimate, and assuming all of the groundwater pumped is directly tied to (i.e., in direct hydraulic connection) to the surface water flow of Walnut Creek, and further, assuming that all water pumped is lost to evapotranspiration (e.g., no infiltration of the irrigation water back to the groundwater system), the project would decrease the total annual flow of Walnut Creek by 0.05%. Given that even excellent stream gages are only accurate to approximately ±5%, the maximum impact to surface water flow due to the project would be essentially unmeasurable and within permitted amounts for the approved on site well.

Under the no action alternative, there would be no activities that would affect the groundwater or surface water resource.

Proposed Action Effects Analysis Floodplains and Stormwater run-on/runoff

Under the proposed action, approximately 8.13 acres of the SEGA project are located within the 100-year floodway of Walnut Creek. Other than a fence, no other structures are proposed nor are any changes to the existing drainage patterns proposed. Therefore, no impacts to the function of the floodplain or stormwater drainages are anticipated.
Under the no action alternative, there would be no activities that would affect floodplains or stormwater hydrology.

Cumulative Effects on Groundwater and Surface Water
Approximately 80 acres of irrigated agricultural fields is located on private lands about 1/2 mile upstream of the project. There is additional agricultural water use on other private lands located approximately 2 miles downstream. While it is unknown what the actual water consumption is, it is reasonably probable that these groundwater withdrawals may be substantial and at least seasonally affecting streamflow in Walnut Creek.

There is currently insufficient groundwater and surface water data to support making a determination on any degree and extent of the impact to the streamflow of Walnut Creek due to these existing activities. Regardless of this data gap, as mentioned in the affects analysis above, the additional groundwater pumping in the proposed action is small and would have an immeasurable and insignificant change, and therefore, would be a small and insignificant contribution to the cumulative impact.
Under the no action alternative, there would be no activities that would affect the cumulative function groundwater and surface water resources.

Cumulative Effects on Floodplains and Stormwater run-on/runoff
The project does not propose any significant changes to the existing natural drainage patterns across the site, and therefore there is no change to the function of the floodplain and stormwater drainage ways.
Under the no action alternative, there would be no activities that would affect the cumulative function of floodplains and stormwater hydrology.

Project Design Features and Mitigation Measures
As a design feature intended to avoid any potential localized soil disturbances near the banks of Walnut Creek, the SEGA test plots will be setback a minimum of 50 feet from the active banks of Walnut Creek.
As a mitigation measure, the SEGA site will be inspected at least annually by the Forest Service to observe any potential encroachment of Walnut Creek and development of any head-cutting erosion by side drainages. Any erosion problems discovered, would be evaluated for implementation of additional mitigation measures aimed at stemming the erosion.
The project does not propose any changes to the existing natural drainage pattern across the site. Experiment plots will be situated so that they do not impinge on or alter these drainage swales.
To verify the project water consumption is within the estimated use, and to provide a historical record of the water use, a water meter will be installed on the supply line to the project. The volume used will be manually recorded on a log book on a monthly basis.
Agricultural irrigation systems connected to a water supply that potentially provide water to the public, must have appropriate backflow prevention device to protect the drinking water system from contaminants harmful to human health. To mitigate this risk a Pressure Vacuum Breaker (a.k.a., PRV) or Reduced Pressure Principle (a.k.a., RP) backflow preventer, approved by the University of Southern California - Foundation for Cross-Connection Control and Hydraulic Research, will be installed on the irrigation supply line. The backflow preventer must be tested at least annually by a State certified backflow tester, and the documentation will be maintained by the proponents, with a copy sent to the Forest Service.

Wildlife and Sensitive Species

With none of the federally listed species or habitats known to occur within or near the project area, none of them would experience any impacts from either alternative of this project. The proposed action will not result in take of bald or golden eagles protected under the Bald and Golden Eagle Protection Act.

The following migratory bird species were seen around the project area in almost 2 years of systematic survey work or by Forest Service personnel: Band-tailed pigeon, Black-chinned Sparrow, Canyon Towhee, Common black hawk, Grace's Warbler, Gray Flycatcher, Gray Vireo, Phainopepla, Pinyon Jay, Purple Martin, Virginia's warbler, Yellow Warbler (sonorana ssp.), Cordilleran Flycatcher, Brewer's Sparrow, Ferruginous Hawk, Olive-sided Flycatcher, Gila woodpecker, Cassin's Sparrow, MacGillivray's Warbler, Red-naped Sapsucker, and Sage Thrasher (Abbott and Glomski 2000). Plantings and removal of limited amount of existing vegetation on a total area not to exceed 10 acres over 10 years will not have a substantial impact on the overall vegetation composition of the area and hence will not have any indirect effect on any of the migratory species present on sites. Direct effects will be avoided by not using any loose netting known to be a hazard to birds. Snag retention would be compliant with the forest plan direction in this project and snags would only be removed as they pertain to safety.

Some Forest Service Sensitive Species are known to occur or may occur in the project area. American peregrine falcon is not known to occur while both the Bald eagle and Northern Goshawk have been seen in the Walnut Creek area. However, no important habitat for these species occurs on the site and the minor effects over a small area will not impact foraging for these species. The lowland leopard frog is known to occur on the site. Project activities will remain outside of the active stream channel and not remove any riparian vegetation or measurably change surface flows. Therefore, this project would not impact any lowland leopard frogs or their habitat in Walnut Creek. For this same reason, no effect is anticipated on the sensitive caddis fly that is unkown to occur, and unlikely to occur on the site because the habitat is not suitable. Avoiding impact to the moist riparian area will also prevent any impacts to the broadleaf lupine that in known to occur on site.

Management indicator habitats that occur on the 279 acre permit area include riparian, chaparral, and pinyon-juniper. The entire project area is only 0.000216% of the Prescott National Forest Land area. At this level, there will be no discernible impacts to the habitat quantity or quality of management indicator species within the project area. There will be no impact to the forest level habitat or population trends for any MIS that may occur within the project area.

Heritage

Past occupation of the Walnut Creek area includes both prehistoric Indians and historic homesteaders and ranchers. In 1908, the US Forest Service established the Walnut Creek Ranger Station but in 1980 the district was consolidated and the site was converted to a work station. In 1999, The Walnut Creek Center for Education and Research partnership was issued a permit for the use of the station and they have assisted the PNF with the maintenance and upkeep of the historic properties. Under the proposed action these maintenance activities will continue. Under the no action alternative these maintenance activities by the partnership would cease.

Avoidance of adverse effects to the historic station listed on the NRHP was a key consideration in placement of the SEGA research plots. In order to avoid visual impacts to the historic station, the SEGA research plots were placed west of the station's fence which is screened by a grove of tall trees.

Avoidance of prehistoric and historic resources was also an important part in selecting the research garden sites. PNF archaeologists first reviewed forest heritage records and maps. Then intensive heritage surveys were conducted of the proposed project areas. The archaeologist documented a pet

cemetery and 2 isolated CCC water facilities. The pet cemetery was determined not eligible for the NRHP in consultation with the SHPO. The CCC features have not been evaluated for the NRHP but will be protected until a formal determination can be made. Heritage requirements state that the cemetery and the 2 CCC features will be avoided by SEGA activities. An additional heritage requirement states that a PNF archaeologist will be present during the excavation of any below ground water lines or any other below ground utility lines.

Soils

Soil disturbance will be limited in area. Small areas totaling less than a half-acre may be disturbed in the installation of fencing, watering and sensing infrastructure. Additional areas disturbed in the course of research would always be replanted with new vegetation. The cumulative area over 10 years may reach 10 acres. The soils are alluvial and no erosion is anticipated due to the flat terrain.

Recreation

The presence of caretakers and others at the WCCER presents the opportunity for recreation users to obtain local information, be informed about activities at the Center, and obtain water or other assistance. Under the no action alternative this support function would no longer be available. Under the proposed action it would continue. There would be no loss of recreational opportunities under the proposed action.

References

Abbott and Glomski. 2000. Walnut Creek Center for Education and Research (WCCER) Biological Inventory.

Billick, I., I. Babb, B. Kloeppel, J.C. Leong, J. Hodder, J. Sanders, and H. Swain. 2012. Building and Operating the Field Stations and Marine Laboratories of the Future: A Strategic Planning Report. 49 pp.

Claussen, J., Keck, D.D., and Hiesey, W.M. 1940. Experimental studies on the nature of species. I. The effect of varied environment on western North American plants. Publication 520. Carnegie Institution of Washington, Washington D.C.

FEMA, Federal Emergency Management Agency, 2010. Digital Flood Insurance Rate Map Database - Yavapai County, AZ. Federal Emergency Management Agency, Washington, DC

Merriam, C.H. 1894. Laws of temperature control of the geographic distribution of terrestrial animals and plants. National Geographic 6:229–238.

U.S. Geological Survey (USGS), 2014, Surface Water data for USA: USGS Surface-Water Annual Statistics, URL: http://nwis.waterdata.usgs.gov/nwis/annual?, Data accessed 8/6/2014

Wolock, D.M., 2003, Flow characteristics at U.S. Geological Survey streamgages in the conterminous United States: U.S. Geological Survey Open-File Report 03-146, digital data set