WILDLAND URBAN INTERFACE (WUI) FIRE-FUEL MITIGATION

FY23 ABOR REGENTS' GRANT REQUEST FOR PROPOSALS- OPPORTUNITY STATEMENT #5

OCTOBER 2022

ARIZONA BOARD OF REGENTS

ASU ◆ NAU ◆ UA

OPPORTUNITY STATEMENT

Fire departments and land managers across Arizona are increasingly being called upon to respond to wildfire in the wildland-urban interface (WUI), including fires burning in grass-, shrub-, and tree-dominated ecosystems. Unfortunately, the data and models utilized by local, state, and federal land managers to develop and communicate strategic fire and fuel management strategies often have low accuracies at the spatial scales needed for effective fuels treatment planning. Advancements in 3-dimensional fuel assessments and fire behavior modeling, have tremendous potential to help guide agencies and local officials in planning and implementing appropriate hazardous fuels reduction and wildfire mitigation programs that meet human community needs as well as improve ecosystem health and resilience. This work will assess existing fuels and model fire behavior and post-fire flooding in the WUI helping to direct where and what ladder fuels need to be removed. The outputs of this work will also help Arizona cities and counties by providing information that will better allow them to leverage federal partnerships and funding for fuels reduction and flooding mitigation work before future wildfires. For example, outputs from this work could help cities and counties develop fuel reduction programs with their federal and state partners, as well as flooding mitigation plans, that will allow them to apply to FEMA's Building Resilient Infrastructures and Communities program that can provide up to 75% of the funding to get flood control work done locally.

PROPOSAL SUMMARY

Northern Arizona University's Ecological Restoration Institute (ERI), School of Forestry (SoF) and Southwest Fire Science Consortium (SWFSC); University of Arizona's Department of Geoscience, Arizona Geological Survey, and national cyber infrastructure center, or CyVerse; and U.S. Geological Survey (USGS) Southwest Biological Science Center (SBSC) and Land Change Science Program propose to develop and apply a new 3D fuels mapping and modeling framework that links local, regional and national data sources to provide accurate fuel assessments, improve the usability of fire behavior simulations for fire managers, and create watershed response information to assist with strategic fuels reduction, wildfire mitigation, and restoration of ecosystem health. This work builds upon the team's collective and respective strengths and successes to work with land management agencies and partners to identify and meet the critical fuels information needs and better understand potential wildfire behavior, subsequent flood risks, and overall watershed integrity and ecosystem resilience.

PROPOSAL ADVANTAGES

As a Congressionally authorized program, the ERI delivers science-based and actionable forest restoration and wildfire risk reduction information to a wide spectrum of affected entities, and NAU's School of Forestry is the state's premier institution for forestry research. The SWFSC provides over a decade of collaborations, partnerships and science outreach between managers and scientists and is a leader in helping to develop co-produced science that is applicable to the needs of mangers on the ground. Our collaborators at USGS are uniquely positioned to bridge the growing gap between science and land management, and the U of A's CyVerse is ideally suited to provide land managers and fire-affected communities access to much needed fuel and wildfire risk information through advanced computing power, trainings, and data visualization that can be used to develop real-world solutions to climate change and the wildfire crisis.

The Regents' Call for Proposals has identified an important need to better understand how the strategic removal of accumulated fuels from grasses, shrubs, and trees can restore and maintain natural ecosystems, as well as limit the negative impacts of wildfires on human communities in Arizona's WUI. We propose to leverage our team's collective capacities to develop strategies that restore ecological resilience, protect critical infrastructure, ensure public safety, and minimize future catastrophic fires in WUI environments. In particular this project aligns well with:

- Existing federal partnership and strategies like Shared Stewardship, the USDA and DOI Wildfire Crisis Strategy, the Cohesive Strategy, and Arizona State's Healthy Forest Initiative.

- ERI's extensive research in forest restoration treatment effectiveness.

- ERI's recent engagement in treatment prioritization and optimization as well as our work to examine tradeoffs between managing for fire resilience versus economic objectives on a large scale (240,000 ha) federal collaborative forest restoration project in the southwestern United States (Ager et al. 2021).

- ERI's past collaboration with AZ Department of Fire and Fuels Management to identify actions that help advance an all-lands approach to restoration and wildfire risk reduction coordination and planning and to assess the effectiveness of a cross- boundary wildfire risk model (Colavito 2018).

- The Southwest Fire Science Consortium (SWFSC) is nationally recognized for getting emerging science on the ground by connecting scientists, land managers, and the public. By facilitating these connections, the SWFSC works to understand the most pressing questions that managers face to help facilitate new science that is applicable and matters to those working on the ground.

- The US Geological Survey's ongoing engagement with diverse federal, state, and tribal land management agencies to guide decisions on restoring ecosystems through the Restoration Assessment and Monitoring Program for the Southwest (RAMPS).

- The emerging Department of the Interior Southwest Fire Innovation Landscape Network run by USGS SBSC that aims to prepare fire and natural resource managers for rapidly changing fire landscapes by conducting research and building science-management partnerships to assess fuel conditions, treatments, and wildfire risks in southwestern US ecosystems.

- UArizona CyVerse is the largest ever investment ($115M to-date) by the National Science Foundation in cyberinfrastructure for life sciences (agriculture, biology, ecology, forestry, genetics). CyVerse 100,000+ verified users have access to advanced resources for cloud computing, high performance and high throughput computing and a secure, shareable, mutli-petabyte cloud data storage service.

- UArizona CyVerse personnel have specialized experience in cloud-native and scalable computational workflows for big data analyses. CyVerse personnel specialize in digital literacy and data science training. They have existing partnerships and collaborations across federal, state, and tribal governments and academic institutions and in commercial industry.

SCOPE OF WORK

In this proposal, our NAU, UofA, and USGS team propose to improve fine-scale fuels mapping capabilities by 1) engaging managers to identify critical fuels information needs; 2) designing and collecting targeted local fuels data in past and ongoing fuels reduction treatment areas and other critical areas using field and terrestrial lidar scanning data; 3) assimilating local, regional and national datasets into a comprehensive fuels modeling framework to produce new fuels maps; which can then be used to 4) analyze potential wildfire behavior and subsequent flood risks; and 5) simulate strategic fuels reduction (surface and ladder fuels) treatments that marry effective fire risk mitigation and improvement of watershed integrity and ecosystem resilience.

Using a knowledge co-production framework (Colavito et al., 2019), the proposed effort will enhance fuels mapping and management capabilities through improved assessments at resolutions necessary for effective fuels and fire management applications. Linking of 3D fuels with advanced fire behavior modeling is currently operational in New Mexico and California as part of federal and state projects for which USGS (Loehman) is lead. This work will leverage those efforts with an Arizona focused team to create new data sets and opportunities in Arizona. Furthermore, this project will develop and apply next-generation fire behavior and effects models that can be used for scenario planning and treatment prioritization. Partnerships throughout the project will target a mixture of local county, regional, state, federal and tribal partners. A variety of science delivery methods will be used to facilitate the communication of our results to forest, natural resource, and fire managers. Dissemination will also be aided through a combination of conference presentations, refereed publications, and manager-focused workshops to make the research accessible to a diverse audience.

The overall objective of this proposal is to develop and apply a new 3D fuels mapping and modeling framework that links local, regional and national data sources to provide accurate fuel assessments, improve the usability of fire behavior simulations for fire managers, and create watershed response information to assist with strategic fuels reduction, wildfire mitigation, and restoration of ecosystem health.

This will be accomplished through a collaborative approach that utilizes FastFuels, a 3D fuels database and modeling platform (Parsons et al., 2018). FastFuels leverages existing data from LANDFIRE and live, dynamic forest inventory and analysis data to generate 3D descriptions of the fuels complex within a management unit and is being developed to support next-generation fire behavior and effects models. Our project complements the ongoing development of FastFuels by expanding the program's fuel condition dataset to include Arizona's grassland, woodland and forest ecosystems, including areas that have been invaded by highly flammable, non-native species such as cheatgrass, red brome, and buffelgrass. These data will then be used to parameterize coupled fire-atmospheric models (such as QUIC-Fire) to simulate potential fire behavior and effects, paired with existing national-scale data (e.g., LANDFIRE) and fire behavior mapping and analysis (e.g., FlamMap) to ultimately improve fuel and fire behavior predictions for high-priority locations. Lastly, we will couple our results from the fuels reduction treatments with ecological response models such as PFHydro watershed model (Wang et al. 2020) to assess the combined effects of fuel treatments and fire risk on flooding and other ecosystem parameters in WUI watersheds.

Deliverables:

The team will produce the expected outcomes as identified in the proposal, including:

- Information on the necessary levels and configuration of treatment needed to implement safe and effective hazardous fuels reduction and wildfire mitigation projects in Arizona's grass-, shrub-, and tree-dominated ecosystems;

- A guidebook focused on providing managers with an understanding of how local lidar scans and field data can be used with simulations of potential fire behavior and effects to guide the development and communication of strategic fire and fuel management activities. The guide will also document the process for identifying, collecting, and preparing local observations to be integrated with modeling and national fuel mapping efforts. Anticipated as a technical report to be published through a joint effort (i.e., a joint ERI-UofA-SWFSC-USGS document);

- Maps and magnitudes of potential flooding risks following fire under the different fire and fuels reduction scenarios;

- All generated data, model output, runoff, and fuels and fire behavior data layers (i.e., raster maps) will be made available with metadata to aid in use and interpretation through CyVerse.

- Three conference presentations and three refereed publications;

- Three one-page fact-sheets that summarize the publications and importance to managers and policy makers;

- Three webinar presentations through the Southwest Fire Science Consortium;

- Two Field trips (joint NAU-UofA-USGS) to discuss field to modeling results from actual landscapes with manager-scientist-policy maker teams; and

- Three annual and one final report documenting the project.

Team Members

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Budget: 3-year budget $900,000

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