Yuba IRWMP –

Project Short Form[1]

Please fill out the following information to the best of your ability/knowledge. Once the project has been received, and a preliminary review completed, the project team will work with you to develop additional information.

PROJECT SPONSOR INFORMATION

Lead Agency/Organization	The Nature Conservancy
Name of Primary Contact(s)	Edward Smith
Mailing Address	830 S Street Sacramento, CA 95811
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Project Partners/Collaborators	North Yuba Forest Partnership: Yuba Water Agency, Blue Forest Conservation, US Forest Service, The Nature Conservancy, South Yuba River Citizens League, Camptonville Community Partnership, Nevada City Rancheria Nisenan Tribe, National Forest Foundation, Sierra County
YWA Liaison	JoAnna Lessard

GENERAL PROJECT INFORMATION

Project Title	North Yuba Legacy Tree Conservation
Project Total Budget (Attach detailed budget, if available)	$475,792
Budget Breakdown	Planning/Design Budget:
	Implementation Budget:
Project Funding Match, if any	$237,896
Total Project Funding Need	$237,896
Project Location (Attach map if available)	North Yuba Landscape Resilience Project
City/Community	
Watershed/subwatershed	North Fork Yuba River
Groundwater Basin	
Funding Area	SRFA or MC
Project Priority (Select one)	High/Medium/Low
Project Type (highlight in gray *all* that apply)	Conceptual Feasibility Study Study/Assessment Planning Engineering/Design Permitting CEQA/NEPA Facility Construction Restoration Monitoring Best Management Practices Acquisition Demonstration/Pilot Project

[1] Completed Project Short Forms should be sent via email to Keri Rinne at keri.rinne@gmail.com

Please select the *status* of the CEQA/NEPA/Permitting for this project:

CEQA **(Select one)**	Exempt - Not Started - Initial Study - EIR – Determination - Unknown if Required
NEPA **(Select one)**	Exempt - Not Started - Environmental Assessment - EIS – Record of Decision - Unknown if Required
Permitting **(Select one)**	Not Required - Not started – Identified – Consultations Complete – Application Submitted – Complete – Unknown if Required

PROJECT DESCRIPTION

Write a narrative briefly describing the project components and/or characteristics (maximum of 300 words).

We are proposing a unified study design that we will leverage to address two key issues facing the North Yuba Forest Partnership (NYFP) and other collaboratives throughout the Sierra, helping to support the goals of the Project: **1) cost-effective drone-based forest monitoring and assessment** and **2) large shade-tolerant tree identification for potential removal to favor retention of shade-intolerant and fire-tolerant large trees.**

1) TNC recently funded a pilot study by Dr. Derek Young (UC Davis) to collect and analyze drone imagery at North Yuba in Fall 2021 to test his application, and we had a crew collect field data to develop highly accurate stem maps to calibrate and verify the accuracy of drone imagery. The preliminary results from the Galloway treatment unit suggest that the drone imagery and subsequent analysis were 97% accurate in predicting tree heights, and Dr. Young has achieved similar accuracy with determining tree species in a previous drone study at Lake Tahoe (Young et al 2022). We propose to collect drone imagery in the North Yuba project footprint, process the imagery to enumerate tree height and species in comparison with stem maps derived from field work. Drone imagery collected and processed in subsequent years could replace more costly LiDAR acquisitions for post-treatment implementation and effectiveness monitoring and serve as visual aids to help with communicating accomplishments to the public, project funders, managers and other stakeholders. The advantage of using drones over other technologies to quantify forest structure is that drones are relatively inexpensive to own and operate, making this technology available to almost any management unit. The image processing software and scripts will be made available to anyone who is interested, placing the data products in the hands of end-users.

2) Recent research in a similar dry forest in Oregon showed that there were some areas where the exceedance of socially determined diameter limits was needed to meet forest structural restoration goals (Johnston et al 2021). However, this Oregon study is not adequate for evaluating the issue in the NYFP because it examined a lower diameter limit (24”) and the forests studied may not be as productive as NYFP forests. A parallel examination of this issue within the NYFP landscape is needed to objectively determine the conditions under which larger tree (30-39.9”) removal is warranted and justified. This study will result in a defensible, peer-reviewed publication that can be used to demonstrate the conditions under which the removal of larger trees might be warranted; to date the only Sierra Nevada relevant scientific publications on this topic focus on the overall lack of large trees on the landscape, with little consideration of local forest conditions. The study will not identify all instances under which large tree removal is justified but will be large enough (100+ plots) to demonstrate the types of stand conditions that can merit larger tree removal and also examine the frequency such instances exist. The research and study design in this proposal will provide data and maps to the Partnership and US Forest Service about the forest structure conditions that might justify large (30-to-39.9-inch diameter at breast height) tree removal to inform decision-making about project design and attainment of management goals.

PROJECT RATIONALE/ISSUES STATEMENT

Briefly describe the need for the project and the desired outcomes/deliverables (maximum of 200 words).

With the dramatic increase in fire activity in recent years, there has been a parallel push to increase treatments across the landscape. Although many institutions have stepped up to help address the enormous need, many hurdles to successful implementation remain. To date, the need to remove large trees >30" to meet forest and fire resilience goals has been controversial, in part because the science has not been conducted explicitly to support the need for their removal. While some basic forestry and ecology principles can support the need for removal under some conditions (e.g., on highly productive sites, to retain more desirable pines where species composition has shifted to white fir, etc.), the existing literature for this region describes the overall lack of large trees on the landscape.

The project proposed here will deliver three main bodies of product: (1) stem maps of trees measured in the field annotated by species and their diameter at breast height covering sufficient area to validate the drone imagery**;** (2) drone derived canopy height model with associated tables and graphics indicating the abundance and location of individual trees by their heights, species, size class and distribution, along with an associated accuracy assessment for ~**16,000 acres**; (3) a dataset and manuscript for a peer-reviewed publication similar to Johnston et al (2021) for North Yuba. The establishment of the more traditional field forest measurement plots will serve double duty, both for the large tree study and as traditional monitoring plots to assess treatment impacts (for examples, see Table 1 below).

These two projects can stand alone, but together they will provide robust support for a novel approach to monitoring. CFLRP funding and best practices both require monitoring of treatment impacts to evaluate how well we are meeting objectives and if we are having any unintended impacts – both of which will become even more important under the warming climate. By comparing the data from traditional monitoring plots (question 2) and drone imagery (question 1), we can quantify where/when drone imagery is sufficient to meet our monitoring needs, and when it must be supplemented with "on the ground" work. Because drone imagery has not been widely used for monitoring in this way, linking the two will enable us to justify its use for monitoring to CFLRP and other funders, and will establish the North Yuba on the vanguard of forest restoration science in the Sierra Nevada.

Table 1 Categories of land management and restoration activities where data produced from this proposal are relevant and useful.

Management Application & Source	Field Plots	Stem Maps	Drone Imagery
Planning	More detailed data on existing conditions helps with identify appropriate treatment approaches.	Ground verification of restoration need could improve Proposed Action	Availability of tree height and species data help identify areas in need of treatment and can inform prescriptions

Management Application & Source	Field Plots	Stem Maps	Drone Imagery
Layout / Implementation	More detailed data on existing conditions helps with placing silvicultural prescriptions. Improve accuracy of burn plans by using a detailed inventory of forest structure, which can enable fine-tuning of burn windows and delineating stand-specific acceptable levels of mortality	Where we have data on individual trees, may be able to use 'virtual tree marking' to identify leave trees, unit boundaries displayed on phones or tablets for loggers and contracting officers. Stronger data on location of instances where large shade-tolerant trees need to be removed to improve growing space for shade-intolerant and fire-resistant legacy trees.	Where we have data on individual trees, may be able to use 'virtual tree marking' to identify leave trees, unit boundaries. For prescribed fire, desirable Legacy Trees could be efficiently identified for raking and other protection measures to promote resilience to fire.
Monitoring	Was treatment implemented as designed? Were there any unintended impacts on invasives, fuels or other metrics?	Clearly display where large shade-tolerant trees were cut to benefit shade-intolerant legacy trees.	Efficient ID of the intermix of trees and openings gives us post-treatment structure. Efficient assessment of forest canopy changes Fire effects monitoring could be improved in efficiency and possibly accuracy.

ATTACHMENTS:

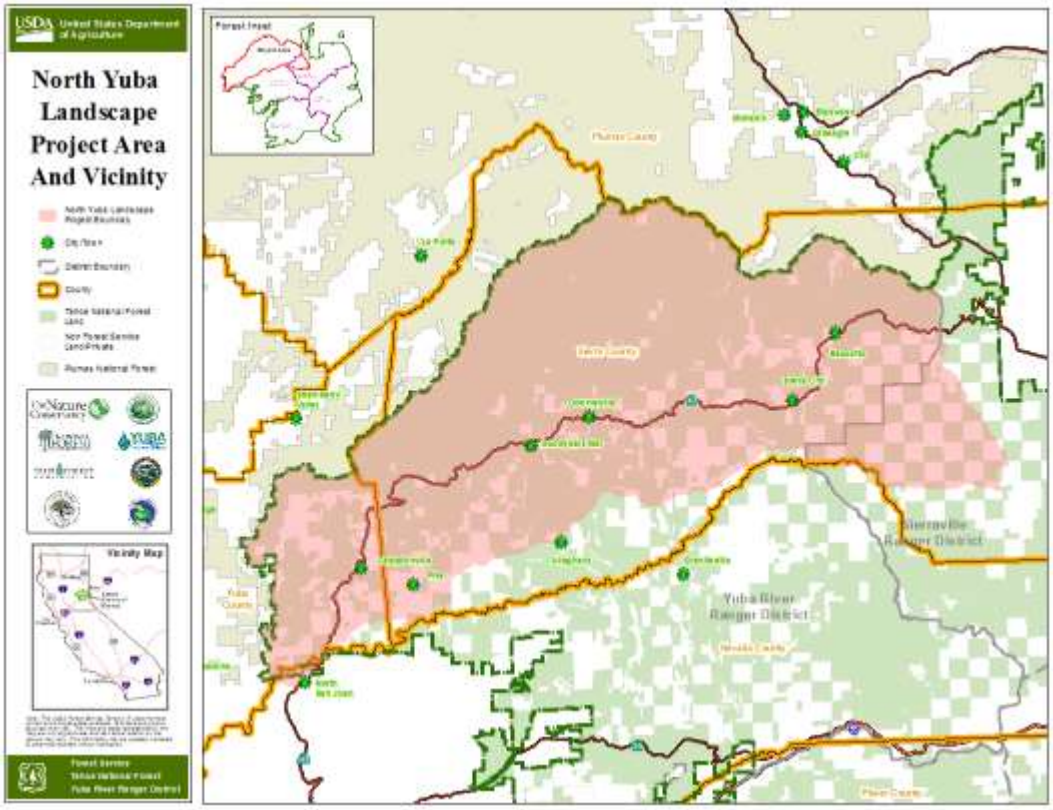
- Task based budget - Table 2

- Map of project location – Figure 1

Table 2 Task based budget for North Yuba Project drone and large tree research

Fiscal Year (July 1-June 30)	Task Based Budget	Total cost
FY23-FY24	Drone data collection	$15,500
FY23-FY24	Drone stem maps	$70,500
FY23-FY24	Drone data analysis, comparison to field plot data and publication	$49,500
FY23-FY24	Supplies	$10,000
FY23-FY24	Indirect Costs UC Davis	$14,550
FY23-FY24	TNC Labor	$22,227
FY23-FY24	TNC Indirect Costs	$46,517
	Total for Drone Study, year 1	**$228,794**
FY24	Field plot data collection for "large tree question"	$68,500
FY24-25	Field plot data analysis and publication for the "large tree question"	$63,000
FY24-25	Supplies	$10,000
FY24-25	Indirect Costs UC Davis	$32,163
FY24-25	TNC Labor	$23,117
FY24-25	TNC Indirect Costs	$50,218
FY24-25	**Total for Large Tree Study, year 2**	**$246,997**
	Total:	**$475,792**

Figure 1 North Yuba Project Area



LITERATURE CITED

Johnston, James D; Greenler, Skye M; Miller, Becky A; Reilly, Matthew J; Lindsay, Amanda A; et al. 2021. Diameter limits impede restoration of historical conditions in dry mixed-conifer forests of eastern Oregon, USA. Ecosphere; Washington Vol. 12, Iss. 3. DOI:10.1002/ecs2.3394

Young, D. J. N., M. J. Koontz, and J. Weeks. 2022. Optimizing aerial imagery collection and processing parameters for drone-based individual tree mapping in structurally complex conifer forests. EcoEvoRxiv.