Our Forests: Community and Citizen Science in Western Forests with Elementary Students

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INTRODUCTION

Our Forests is a four-year Research-Practice Partnership (RPP) amongst a community-based watershed stewardship organization (**Sierra Streams Institute**), university-based educational researchers (**University of California, Davis)** and a county office of education (**Nevada County School of Superintendents)** and engages 3-5th grade students in monitoring forest health across a rural Northern California county through Youth-focused Community and Citizen Science (YCCS).

Students engage with local forest ecology data to inform how a community can manage their forests to promote forest health while preventing catastrophic wildfire. (Fig. 1). Monitoring local forests is the core phenomenon of student inquiry and is directly related to students' lived experiences.

Figure 1: *From left to right, Our Forests Project location in Northern California; Mixed conifer forest in Nevada County; Catastrophic wildfire in CA 2020*

There is enormous potential for Community and Citizen Science (CCS) to transform science learning, particularly in elementary schools [1]. We examine ways a standards-aligned YCCS program can support students' development of environmental science agency (ESA; [2]). As hundreds of CCS projects around the world have started to engage schools in CCS, little to no empirical research on science learning outcomes of citizen science exists for this age group, particularly in school settings [3].

PROGRAM DESIGN

Unlike many CCS programs that focus only on data collection, our project focuses on three design features across the Data Life Cycle[1], including collecting data, analyzing data and sharing with local forest managers, called “Community Partners” (Fig. 2):

Design Feature 1: Students Collecting Data
Students participate in Forest Investigations (FI) and collect real-world forest ecology data such as stand density and plant diversity (Fig 2, Fig 4).

Design Feature 2: Students Analyzing Data
Students participate in Classroom Visits (CV) to create and analyze data visualizations such as bar graphs (Fig 2, Fig 4).

Design Feature 3: Students Sharing Data
Students present their findings to their Community Partner who can use the information to manage the land where the data was collected (Fig 2, Fig 4).

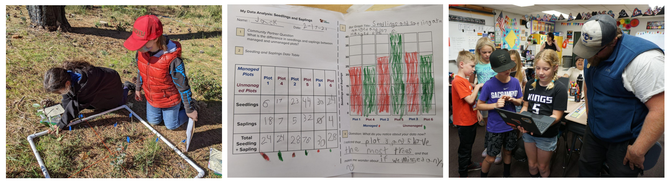

Figure 2: *From left to right, students collecting plant diversity data; graphs produced by students, and share-out with Community Partners*

- **Year 1**: Participating teachers, forest ecologists, SSI and UCD outlined curriculum and forest monitoring protocols for the 1st design cycle
- **Year 2**: Produced online forest health lessons and videos for teachers due to COVID-19 pandemic.
- **Year 3**: Implemented 1st design cycle. Teachers, SSI instructors, and researchers provided reflections, and feedback.
- **Year 4**: Implemented 2nd design cycle over the school year (Fig. 4).

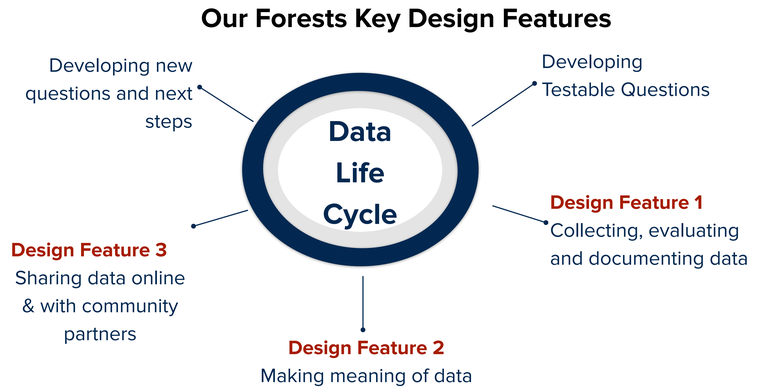

Figure 3: *Community and Citizen Science Data Life Cycle with Our Forests Design Features imbedded (adapted from Bird et al. 2023)*

RESEARCH QUESTIONS

1) To what extent and in what ways do students participating in a school-based, community-engaged, place-based, environmental CCS-focused program develop *environmental science agency* (ESA), including:
   a) Next Generation Science Standards (NGSS)-defined environmental science content and practices
   b) Students identifying their own roles and expertise in science [4]
   c) Using this environmental science to problem-solve and initiate actions in their communities and environment.

2) How might our three *YCCS Central Design Features* (DFs) foster the three ESA science learning outcomes for students?
   a) Purposeful data collection focused on local resource management questions;
   b) Youth making meaning with those data and larger shared datasets
   c) Youth interacting with community stakeholders

RESEARCH METHODS

For each of 2 years of implementation of the year-long program, we collected Pre-Post surveys from all participating students (15 classes), and ethnographic field notes (2021-22) or video data (2022-23) of all Our Forests Field Investigation days and Class Visits, semi-structured student interviews with 5-8 Focal Students per Focal Class, and teacher interviews with up to 10 Focal Classes per year. We are using thematic analysis to identify patterns in relationships between their participation activities, engagement in science practices, identity and agency relate (Fig. 5).

PROGRAM OVERVIEW 2022-23

CV: Classroom Visit led by SSI | FI: Forest Investigation led by SSI | Teacher Led Lessons

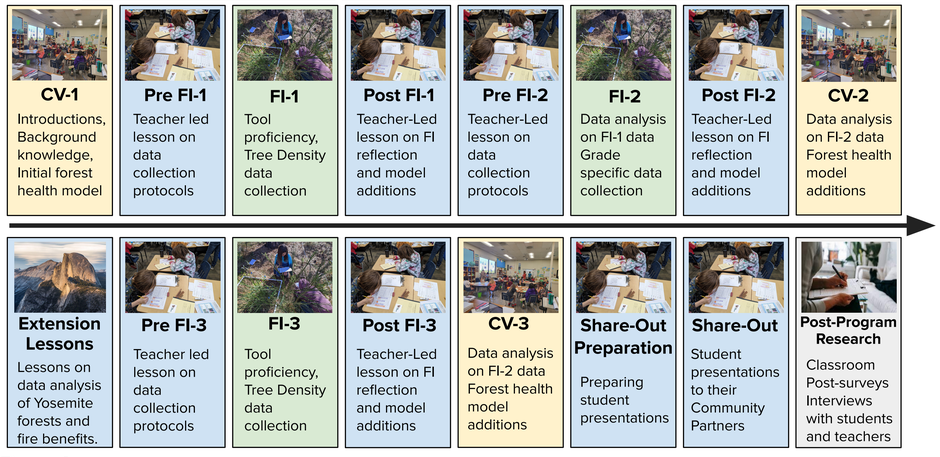

Figure 4: *Our Forests Project Overview 2022-23 including Program Implementation and Research Data Collection.*

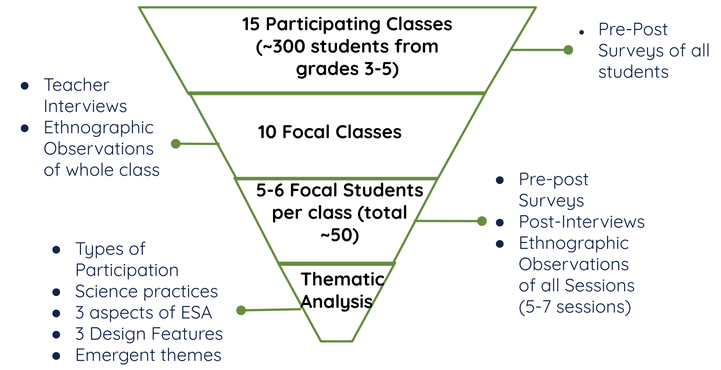

Figure 5: *Overview of Research Methods for Our Forests 2021-23 (2 years or design cycles of implementation)*

SAMPLE INITIAL FINDINGS (from 2021-22 Program)

(1) Authentic Scientific Tools Mediated Students' Identity Development
We found many students contextualized both conceptual and physical scientific tools with authentic work of forest manager Community Partners. Seeing or hearing that the same tools they used were legitimate scientific tools, inspired those who used them in the program to identify themselves as scientists.

> *“It was **like I was an actual scientist 'cause I've seen other people use this (tool),** like Cameron” (forest manager Community Partner).” - 4th grade student*

(2) Place-based Data Collection Broadened Science Identity and Agency
We found a strong reciprocal relationship between students’ increased scientific knowledge and practices and a sense of place, particularly related to studying the same site over time. Several students saw their own roles in creating knowledge about the forests that surround their community as a way to make scientific contribution to help manage the forests.

> *“...[Y]ou're not just doing science in some lab where everything's white. You actually get to do [science] in a place you're studying. . . **you're studying what you're in,** I guess".* - 4th grade student

> *“Like you're actually...in the forest, so you can have a lot like **better sources, not just like a document that they hand you**. But like you can actually **be in the moment** and like **get the information for yourself and write it down**.... Cause then like **you're actually there** and **you're not just talking about it**.”* - 4th grade student

DISCUSSION

(1) Though tools seem to play an important role, we also observed that students did not seem to go beyond the use of physical tools to credit important skills such as observation and reasoning as “doing science” or “being a scientist,” despite the fact that they used those skills extensively. With the goal of empowering students, we suggest instructors should help students recognize how <u>they</u> are powerful instruments to make scientific contributions. (2) We argue that place-based data collection is crucial in supporting youths in generating scientific knowledge, using the knowledge to change daily life, broaden what it means to do, and contribute to science. Apart from its role in disciplinary knowledge learning, a sense of place in this study broadens students' perception of what counts as science, and can be transformative for science learning.

REFERENCES

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