

ER390 Project Proposal

Vizualizing HAT's GOE Monitoring Data

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2025/08/31

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The Idea behind submitting this project proposal

- I am a student in UVic's Restoration of Natural Systems program, as well as the equivalent of a double major in Environmental Studies and Geography, and a life-long learner with an interest in making a significant contribution to the local restoration community, and I'm looking to assist a willing community partner through the creation of a Final Restoration Project
- Nancy Shackelford (RNS Director) suggested that I might consider helping HAT GOE Monitoring Project of Southern Vancouver Island by creating a tool for visualizing GOE Monitoring Data.

Background

- Data used for this proposal is from two tables in the report that HAT used as a model for their GOE Monitoring Project (Malloff & Shackelford, 2024)
- use data to represent data in a visual manner, to make it more understandable than a table of numbers (?? CITE ??)

Project Partner

- I have already spoken to Vanessa Brownlee, Habitat Restoration Coordinator, Habitat Acquisition Trust (HAT) on 2025-08-27, who was very interested in my proposed project idea, and seemed willing to consider letting me start in Fall 2025.
- I have already spoken briefly to Board Chair Andy MacKinnon at the HAT Social 2025-08-27, and he seemed keen to know I was interested in doing my RNS Final Project with HAT and was looking forward to know more about what I had in mind.

Project Goals (overarching purpose)

- I propose to create a customized, automatic coding and reporting tool, with tutorial instructions, using open-source tools like R libraries which can be used by non-coders at HAT for formatting and interactively visualizing data collected at multiple sites for their Garry Oak Ecosystem (GOE) Monitoring Program, to determine what stories the collected data may illustrate much easier than tables of numbers
- a tool for communicating

Project Objectives (actionable targets)

- Analyze the collected data to understand the underlying structure, ensure the use of consistent naming protocols for variables, and format data to be usable for use with data visualization code
- Create data visualization code, using RStudio, RMarkdown, and RShiny, to create appropriate visualizations to enable a better understanding of the collected data
- Customize data tools to reflect a consistent presence that uses HAT's colours, logos, and plotting themes
- Create RMarkdown documents to automatically download and format data, create data visualizations, produce reports for the whole project and individual sites
- Create scaleable data visualization tools that can have more sites added, sites with different measuring and sensitivity criteria (e.g. First Nations GOE sites)
- Track differences between sites: native species, exotic invasive species,
- Create custom functions for reading, analyzing, and plotting data
- Create an interactive, browser-based Shiny app for user-chosen custom-make data visualization plots and maps for selected location(s), and variables, with the ability to download the resulting data, html widgets, plot images, and interactive web maps

What I need

From HAT

- permission to participate in a HAT-related project
- access to HAT GOE Monitoring Data, including metadata
- support, input, and feedback
- I met with Vanessa Brownlee at the HAT Social 2025-08-27, who asked that I send her further information about my proposed project, and though still new to her position, she seemed to be willing for me to start this project in Fall 2025 semester

From RNS

- support and supervision from RNS Nancy Shackelford, particularly before she goes on sabbatical July 2026

What I can offer

- I am a self-motivated, low maintenance student, very interested in the natural environment, and who loves to continue learning in meaningful ways, and help create useful digital tools to enhance the learning experience
- I have extensive experience with coding using R, especially with data visualization and mapping techniques, often learning new method through self-researched knowledge as the need arose.
- My long-standing, keen interest in local Garry Oak Ecosystems, including helping remove invasive species and plant native species in a variety of local restoration projects, and while also observing changes over time, I am intrigued by learning how to visualize monitoring measurements to see if the data can help recognize if there are any patterns of change over time and location.
- I have already spent more than 30 hours (during August 2025), creating, cleaning, formatting, and filtering example data (Malloff & Shackelford, 2024), and then reviewing and learning the new-to-me R code I would need to complete this project. I feel confident I will be able to learn any other R code as will be deemed needed after consultation with HAT, and receiving HAT DATA to analyze its structure and formats
- I can also assist HAT with any raw data clean-up as needed, including creating R code for calculating any indices from the measurement data
- (see Gantt Chart for proposed timeline and Mermaid Flow Chart for Methods Workflow)
- Continue to research and learn how to code in Shiny reactively in order to make interactive data choices (e.g. a drop-down list of Sites) respond to a prior data choice (e.g. Subregions), in order to filter the results of specific interest. I'd like to extend these interactive choice reactions to the selection of monitoring variables being measured in order to be able to make custom-made visualizations and analysis with only a few clicks
- Sign any data confidentiality agreements as may be required by HAT
- Consult with HAT restoration monitor team to explore and understand the nature of the collected data, data format (forms, spreadsheets), the variables that are being measured, any indices to be calculated using the collected data, what questions they would like to explore with the data
- Create a Project folder, with subfolders for R scripts, raw data, processed data, images, reports, download a copy of the current data (including any meta data e.g. measurement units, description of measurement variable, date collected, etc)
- Clean data, check for errors, inconsistencies, data quality, calculate values from raw data measurements

- create file and variable naming protocols
- Create data visualization plot charts that appropriate to reflect the nature of the variables being measured
- Documents my methods, successes, and failures in the process of the project
- Continual research for finding appropriate R coding methods, and to contribute to writing my final paper

Proposed Deliverables

Data Visualizations

- data tables, chart plots, interactive maps
- for individual sites
- for comparing sites (all together, or grouped by subregion)
- statistical analysis, and data summary stats (depending on HAT goals)

RMarkdown Data Processing Document

- for data downloading, cleaning, and formatting data visualizations
- explain process for preparing data for use
- can be used to create HTML, pdf, or Word reports, with table of contents, plot output images, and even code if desired
- HTML Document includes a linked Table of Contents for easy navigation between sections

Customizations

- colour palette for background app
- change default colour palette from pink and blue to something else
- add HAT logo
- add colour to Shiny tabs
- create custom HAT plot chart theme
- Individual site reports

Shiny interactive tool

- <https://goe-interact.shinyapps.io/Test-Shiny-GOE-Monitor/>
- using data processed with RMarkdown document
- for choosing data variables to visualize in tables, plot charts, and maps

Tutorials for using Data visualization Tools

- easy to understand
- customized

Presentation

- The completed project will be presented to HAT, my community partner

Written report

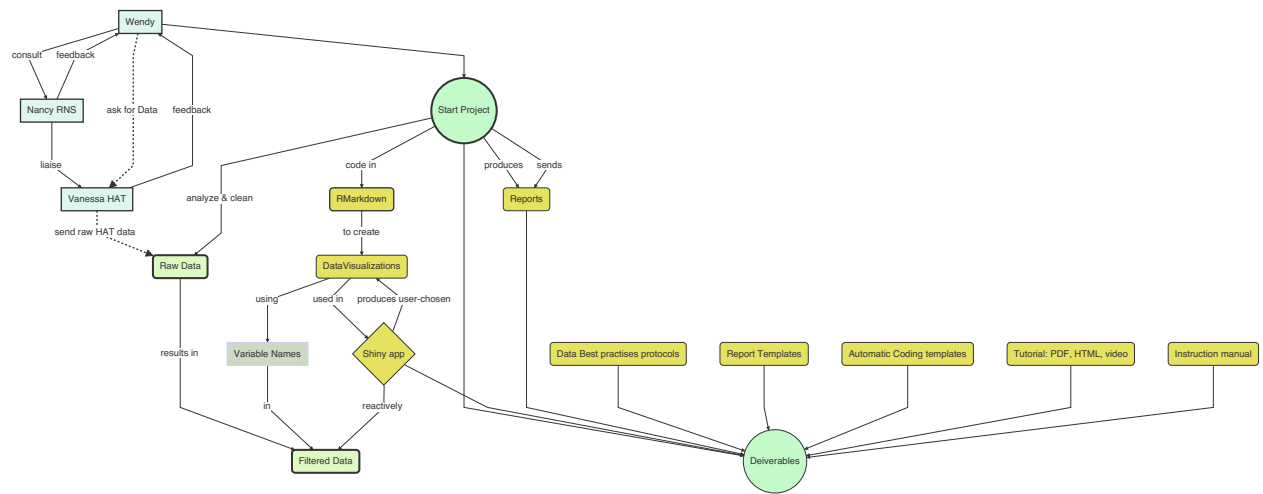
- The final RNS report will document the work I did to complete this project

- Report will follow the expectations of RNS program, including format (submit as Word document) and length (5000 words), to eventually be published in the online journal Eco restoration: RNS Technical Series

Bibliography

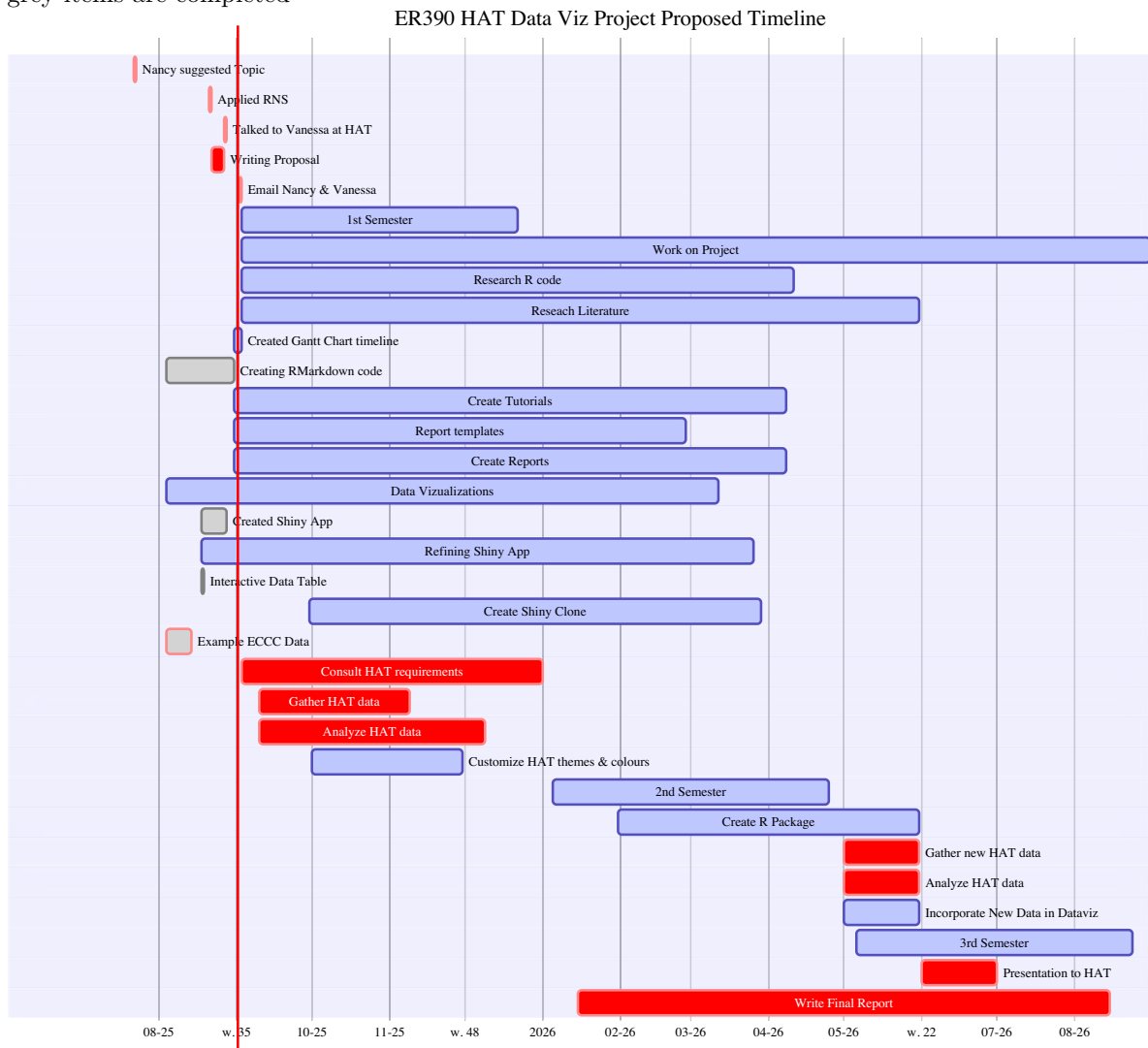
- Malloff, J., & Shackelford, N. (2024). Feeling the Pulse: Monitoring methods and initial outcomes in oak meadow ecosystems. Restoration Futures Lab at the University of Victoria.

Workflow Graph



Proposed Timeline

- red coloured items are considered critical
- grey items are completed



Results of Example Data Visualizations

Data download and formatting

- Data (in excel or csv format) is uploaded
- Data is formatted, saved, and managed to be useful for creating visualizations
- The code has been hidden for this report, highlighting only the resulting plots

Load Site Data

Click to see results of `data`

Data Visualization Example Results

Data Table (Malloff & Shackelford, 2024)

Full Data Table

- the full table is too wide for use in pdf because variable names are too long

Table Head of Site Information

| Subregion | Site | Land.Manager | Main.Restoration.Type | Restoration.Intensity | Area.ha | Lat | Lng |
|-------------------|--------------------|----------------------------|-----------------------|-----------------------|---------|----------|-----------|
| Gulf Islands | Anniversary Island | GINPR | herbivore reduction | high | 4.39 | 48.82292 | -123.1823 |
| Gulf Islands | AVNR | Saltspring conservancy | herbivore reduction | minimal | 20.54 | 48.80351 | -123.4425 |
| Saanich Peninsula | Bear Hill Park | CRD | invasive removal | low | 3.80 | 48.54639 | -123.4078 |
| Gulf Islands | Brackman Island | GINPR | invasive removal | high | 4.41 | 48.71897 | -123.3864 |
| Saanich Peninsula | Camas Hill | HAT | invasive removal | high | 10.10 | 48.40173 | -123.5975 |
| Gulf Islands | Crows Nest | Trinity Western University | herbivore reduction | high | 15.34 | 48.78237 | -123.4612 |

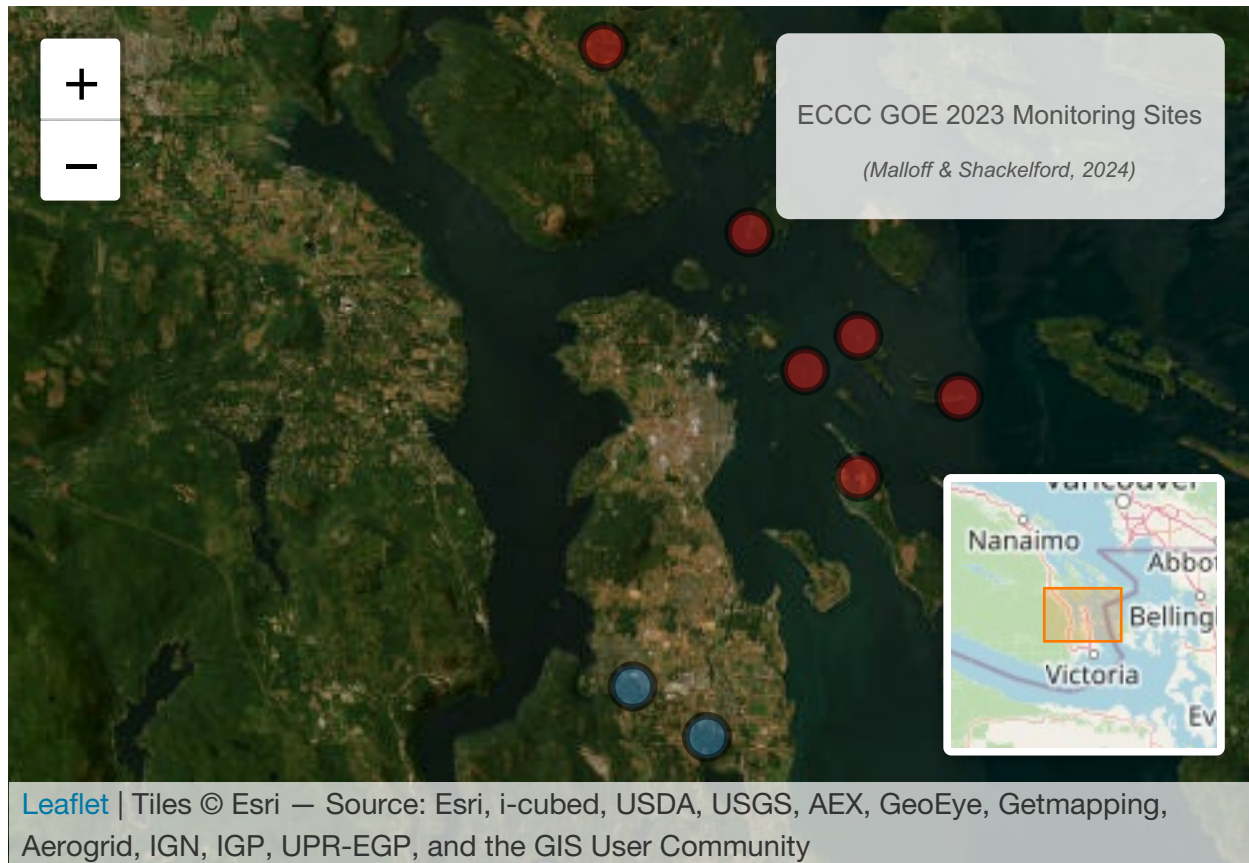
Head of Site Data

| Subregion | Site | Proportion_of_native_species | Cultural_species_richness | Exotic_species | Trampling | Herbivory | Composite |
|-------------------|--------------------|------------------------------|---------------------------|----------------|-----------|-----------|-----------|
| Gulf Islands | Anniversary Island | 0.94 | 2.71 | 0.17 | 5.00 | 1.14 | |
| Gulf Islands | AVNR | 0.55 | 1.30 | 57.19 | 4.70 | 36.50 | |
| Saanich Peninsula | Bear Hill Park | 0.62 | 1.86 | 24.46 | 7.57 | 9.50 | |
| Gulf Islands | Brackman Island | 0.77 | 2.80 | 11.17 | 5.40 | 0.00 | |
| Saanich Peninsula | Camas Hill | 0.61 | 2.43 | 27.19 | 7.71 | 4.71 | |
| Gulf Islands | Crows Nest | 0.66 | 1.07 | 31.51 | 1.64 | 26.71 | |

Map of Site Locations

Leaflet Map with Circle Markers

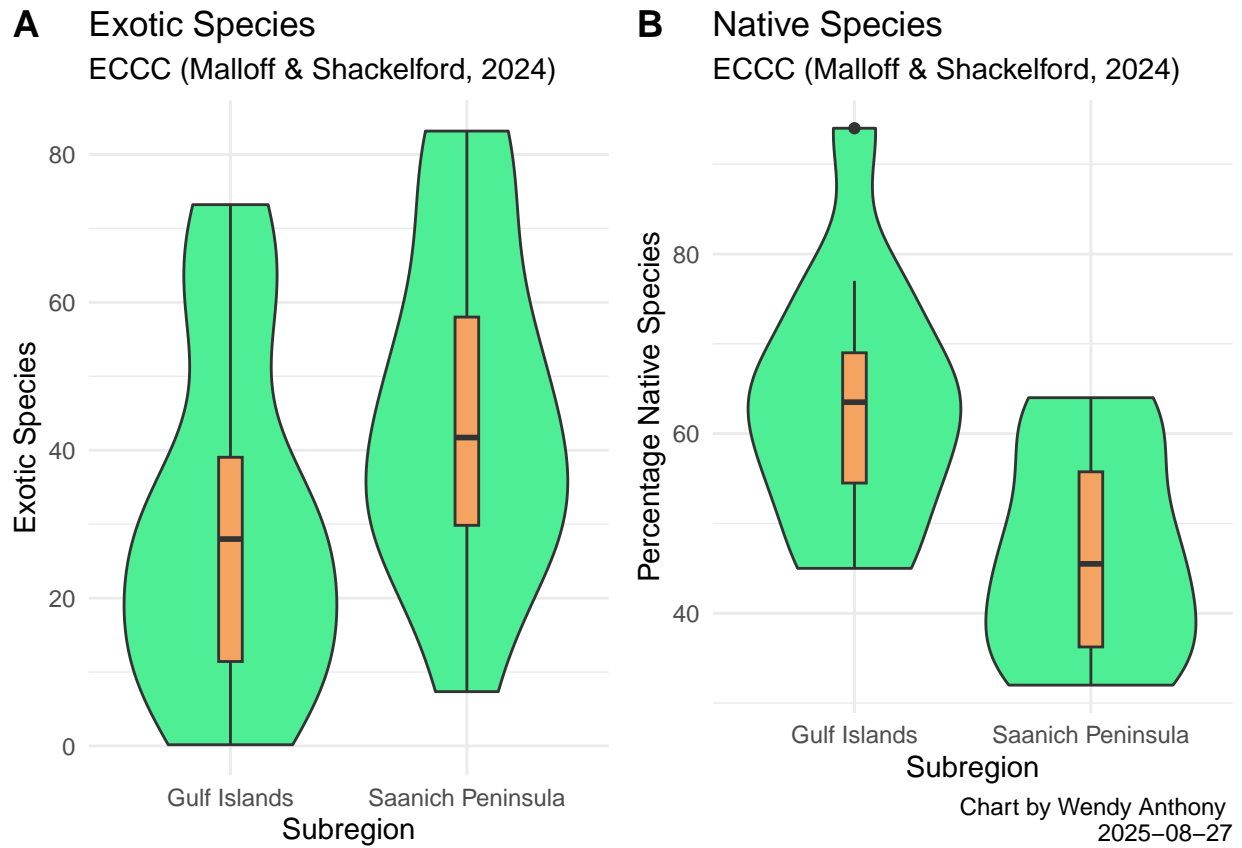
- Data is summarized in map marker popups with summary of site data



Subregion Plots

- these plots compare a variable of 2 Subregions

Violin/Bar Plot: Compare Subregions Exotic and Native Species



Site Plots

Point Plot: Compare Sites by Restoration Intensity

- Sites are ordered by the level of restoration intensity, ranging from high to minimal
- click data points for tool-tip of data results

Plot Site Restoration Intensity

