

## Grand Canyon Research Proposal

**Draft proposal Due Date:** Tuesday 19 November 2024

**Revised proposal Due Date:** Tuesday 26 November 2024

**Recommended length:** 2-4 pages

The Grand Canyon offers diverse research opportunities, spanning a wide range of topics and basic vs. applied orientations. Much research has been conducted in, on, about, and with the Grand Canyon and its residents, but the place has much more to teach. The Grand Canyon and its river(s) also could benefit from research, including study of climate change impacts, strategies to reform Colorado River management, and designs to support Indigenous efforts to restore human-Canyon reciprocity.

For this assignment you will design a research project on a Grand Canyon topic that interests you, ideally based on your Literature Review. You do not need to implement your project for this course, although the project design should be feasible within a reasonable time frame. If you do want to implement your project, you could do so for credit as a project for ESCI 300, 400, or 498c. You also could present your results in May 2025 during [WWU's Scholars Week](#). To pursue any of these options, please consult the instructor.

Below are suggestions for project topics involving various approaches to research. Feel free to use or adapt any of these suggestions or develop your own.

For field research projects, you should consider constraints of winter season, trip logistics, and restrictions on handling vertebrate animals. The winter season is not suitable for many vegetation sampling protocols or studying most wildlife. Exceptions include vegetation types (e.g., NHWZ and OHWZ) and winter-active animals. A single river trip would not allow repeat site visits or time-consuming sampling protocols such as measuring sediment volumes. Other kinds of projects would be constrained by accessible information resources and your creativity.

The following topics could be developed as field projects during the winter season and within river trip logistical constraints.

- (1) Post HFER sediment distributions or conditions
- (2) Woody debris distribution along the Colorado River, including wood pre-dating Glen Canyon Dam, wood deposited since the dam was built, or both
- (3) Distribution of OHWZ vs. NHWZ riparian zone vegetation types
- (4) Results of Tamarisk management and/or restoration of native Cottonwood and Willows, e.g., at Lees Ferry, Soap Creek Camp, Cardenas Camp, and Granite Camp.
- (5) Wintering bird habitat use, perhaps relative to OHWZ and NHWZ vegetation zones
- (6) Wintering riverbird distributions and abundances, comparable to Stevens et al. (1997). See [this module](#) for ideas about design, implementation, and data analysis.
- (7) Campsite condition and recreational impacts
- (8) Sediment erosion under low flow conditions
- (9) Assess legacies of debris flows, e.g., applying information in [Griffiths et al. \(2004\)](#).
- (10) USGS Community Science project: Sampling Aquatic Insects with Light Traps  
<https://www.usgs.gov/centers/southwest-biological-science-center/science/community-science-grand-canyon>

The following topics could be developed as projects done remotely, using data available online.

- (1) Evaluate river campsite condition and recreational impacts, e.g., applying work of [Byerley et al. \(2024\)](#).
- (2) Evaluate effects of Glen Canyon Dam operations on GC beaches, using [Adopt-a-Beach program](#) photo archives.
- (3) More projects and ideas could be developed from USGS resources: <https://www.usgs.gov/search?keywords=Colorado%20River>

The following topics could be developed into policy analysis or recommendations.

- (1) [Colorado River management scenario modeling](#), to inform Bureau of Reclamation's Post-2026 Operations review.
- (2) Analysis of [proposed Post-2026 Operations river management alternatives](#), relative to ecosystem conditions, river recreation, Indigenous interests, or other considerations.
- (3) Develop Post-2026 Operations alternative(s) that would address values, interests, and needs of an Indigenous Tribe(s) associated with the Grand Canyon, perhaps as expressed in your Tribal Profile report.
- (4) Develop or analyze policies for supporting endangered native fish in Grand Canyon or for minimizing impacts of introduced non-native fish.
- (5) Develop or analyze policies or operations to restore sediment supply and dynamics along the Colorado River corridor in Grand Canyon. For operational ideas and more information, see Schmidt et al. (1998), Hamill and Melis (2012), and Collier et al. (1996) in course readings.
- (6) Determine priorities for Land Back proposals relevant to Indigenous Tribes associated with the Grand Canyon. Translate those priorities into a map of lands to be transferred. Alternatively delineate (map) land designations with revised management policies to include Indigenous traditional uses – comparable to the Baaj Nwaavjo I'tah Kukveni – Ancestral Footprints of the Grand Canyon National Monument. For more information, see [Grand Canyon Trust](#).

The above three kinds of projects would involve different research approaches. Below are components you should include in your proposal, particular to each kind of project. For all projects, please lead your proposal with your name(s) and project title.

## Field research projects

### 1 Question (10 points)

State explicitly what question(s) your project would address.

### 2 Hypotheses (10 points)

State your hypotheses (answers) about the question. You should state at least two. I strongly recommend that you frame your hypothesis using the following format: “If (premise), then (prediction), because (mechanism).”

#### Example 1:

Hypothesis 1. “**If** most birds in Whatcom County specialize on a relatively small number of food types, **then** Bellingham’s central business district will support fewer birds species than any comparable sized area in the county, **because** fewer kinds of avian foods are available in the central business district than anywhere else in the county.”

Hypothesis 2. “**If** avian species diversity in Whatcom County is limited primarily by the variety of predators, **then** Bellingham’s central business district will contain more bird species than any comparable area in the county, **because** predator control measures, habitat isolation and fragmentation, and low availability of predator den and nest sites reduces predator variety in the central business district relative to other areas.

Example 2:

Hypothesis 1. “**If** the distribution of American marten (*Martes americana*) is determined primarily by the availability of suitable habitat structures (large snags, logs, trees with broken tops, etc.) at the local habitat scale, **then** marten will be ubiquitous in old growth forest fragments of all sizes, **because** fragments of all sizes contain those habitat structures.

Hypothesis 2. “**If** American marten (*Martes americana*) persists in old growth forests in the North Cascades via metapopulation processes, **then** marten populations will occupy old growth valleys in the Glacier Peak Wilderness and they will be absent from the Finney block, **because** old growth valleys in the Glacier Peak Wilderness are connected by habitat suitable for marten dispersal but the Finney block is isolated from source populations by dispersal barriers that are impassable to marten.

3 Study Design and Methods. (30 points)

3.1 Where would you conduct your work? Be specific.

3.2 What kinds of data would you collect?

3.3 Why would these data be needed to answer your question?

Would these data be sufficient to answer your question?

3.4 How and when would you collect your data?

3.5 What form would your data take on paper or on a digital device?

3.6 How would your activities affect your study sites and their inhabitants?

4 Data Analysis. (30 points)

4.1 How would you analyze your data? Identify statistical methods you would use.

4.2 Does your study design provide adequate power to detect the patterns or effects that you would study? Consider sample sizes in your design and magnitude of effects.

5 Interpretation of Results. (20 points)

How would your data support or refute your hypotheses?

Anticipate how you would interpret both positive and negative results.

Your hypotheses should make predictions about the results your design would yield. Describe potential outcomes of your data analysis and the resulting conclusions you would make about your predictions and hypotheses. How would you answer your question(s) (stated in 1), given each potential outcome of your data analysis.

### Projects conducted remotely using data sources available online

#### 1 Question (10 points)

State explicitly what question(s) your project would address.

#### 2 Hypotheses (10 points)

State your hypotheses (answers) about the question. You should state at least two. I strongly recommend that you frame your hypothesis using the following format: “If (premise), then (prediction), because (mechanism).” See hypothesis statements above for examples.

#### 3 Study Design and Methods. (30 points)

3.1 Which data sources would you use? Where would obtain them? Be specific.

3.2 How and when were those data collected? By whom?

3.3 Why would these data be needed to answer your question?  
Would these data be sufficient to answer your question?

3.4 What limitations constrain the data? Consider which locations, seasons, river flows, etc. were included and which were excluded. How might these limitations influence the data values?

3.5 How representative of your study system are the data?

#### 4 Data Analysis. (30 points)

4.1 How would you analyze your data? Identify statistical methods you would use.

4.2 Does your study design provide adequate power to detect the patterns or effects that you would study? Consider sample sizes in your design and magnitude of effects.

#### 5 Interpretation of Results. (20 points)

How would your data support or refute your hypotheses?

Anticipate how you would interpret both positive and negative results.

Your hypotheses should make predictions about the results your design would yield. Describe potential outcomes of your data analysis and the resulting conclusions you would make about your predictions and hypotheses. How would you answer your question(s) (stated in 1), given each potential outcome of your data analysis.

### Projects involving policy analysis or recommendations

#### 1 Policy goals or objectives (20 points)

State the policy goal(s) and explicit objective(s) your project would address. If your recommendation(s) were fully implemented, the objective(s) should be achieved.

#### 2 Policy authority(ies); relevant laws or regulations (10 points)

State the law(s) or regulation(s) pertaining to the focal topic for your project. Who has responsibility or authority to decide and implement your policy recommendations?

#### 3 Stakeholders. Identify key stakeholders that would need to be included or consulted during policy development or implementation. (10 points)

#### 4 Assumptions. State any assumptions regarding environmental, societal, fiscal, or legal factors that would influence system status relative to policy goals or objectives. (10 points)

- 5 Information resources. Describe information sources or other resources needed to inform your policy analysis or recommendations. (10 points)
- 6 Describe the approach you would use in applying information resources (5) to analyze policy or develop policy recommendations. (25 points)

Example (1): Consider policy topic (2) above, analysis of Post-2026 Operations alternatives. Describe the qualities, conditions, or entities you would use to evaluate alternatives. Would you consider water available to various user groups? Ecosystem conditions resulting from a given operation scenario? Capacity for drought resilience?

Example (2): Consider policy topic (4) above, priorities for Land Back proposals or policies to allow restoration of Indigenous uses. Describe how you would determine which locations would be included and how you would delineate policy domains on a map.

- 7 Assessment. Describe how results of implementing your policy recommendations could be evaluated relative to policy goals or objectives (1). (25 points)