

Case Study 6: Eroding Shoreline Threatens Historic Peale Island Cabin, Yellowstone National Park, Wyoming

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Peale Island Cabin is located on a small spit of land on the northwest corner of Peale Island. Image credit: Yellowstone National Park.

Goals

Yellowstone National Park collaborated with the National Park Service Geologic Resources Division (NPS GRD) to examine the causes of shoreline erosion on Peale Island and to identify adaptation options for protecting the shoreline and a historic cabin on the island.

Challenges and Needs

Peale Island is located in a wilderness area in the South Arm of Yellowstone Lake. It is composed of glacial till and has no source of new coarse sediment but does receive a minor supply of erodible fine sediments. Several processes may be accelerating shoreline erosion, including a change in sediment transport processes, tectonic uplift, longer ice-free periods, tree death, and changes in wave and wind patterns. Climate change has already affected the park in ways such as reduced annual snowpack, declining streamflow, increased stream temperature, and more frequent wildfire events. Ongoing climate change has the potential to drive several process changes: increased precipitation may raise Yellowstone Lake water levels and increase shoreline submergence; higher summer temperatures may increase evaporation that lowers water levels; and warmer temperatures may increase the number of ice-free days on Yellowstone Lake and cause a corresponding increase in exposure of the Peale Island shoreline to wind-driven waves and coastal erosion.

The historic Peale Island Cabin is eligible for listing in the National Register of Historic Places and is used regularly by park staff including backcountry patrols. It is located on a narrow spit on the eroding north end of the island. As of 2013, the shoreline had moved closer than 2 m (6 ft) from the cabin porch, and the number of live trees along the shoreline continued to decrease.

The park needed to know how the shoreline would continue to change, how it would threaten the preservation and functionality of the historic cabin, what options were available to protect the shoreline and cabin, and the impacts of implementing alternative management options.

Responsive Actions

The park asked the NPS GRD to develop information about shoreline change on Peale Island and to clarify the options for the Peale Island Cabin and shoreline. The resulting natural resources report (Beavers et al. 2014) presented and described 10 coastal adaptation options:

- Increasing/improving public awareness, education, and outreach efforts
- Conducting/gathering additional research, data, or products
- Monitor, learn, and interpret the change: Continue current management practices
- Record, then let go: Deconstruct cabin
- Improve structure resiliency: Elevate cabin
- Indirect/offsite action: Nourish shoreline with compatible sediment
- Indirect/offsite action: Armor shoreline with rocks, logs, or other materials
- Relocate cabin to Peale Island interior
- Relocate cabin to outer shore of Yellowstone Lake
- Replace cabin function and structure

Many of the adaptation options suggest similar “no-regrets” actions, including monitoring shoreline position and lake water level; documenting the historic resource and cultural landscape; and monitoring the condition of the historic structure.

Several datasets would improve estimates of how long each option would protect Peale Island resources: historic wave and wind conditions; detailed erosion rates for the Peale Island shoreline; and tree stand chronology data.

As of September 2014, the park intends to initiate a planning process for an alternative management option. The process will include screening of the potential project, discussions with the Wyoming State Historic Preservation Office and engagement in appropriate National Historic Preservation Act and National Environmental Policy Act processes to evaluate the project and make a final decision (Dave Hallac, Chief, Yellowstone Center for Resources, email, 21 October 2014). In summer 2015, alternate sites along the shores of the South Arm of Yellowstone Lake were evaluated to define suitable sites for potential relocation of the cabin.

This is an ongoing project. This case study is an example of the following adaptation strategies:

- Increasing/improving public awareness, education, and outreach efforts
- Conducting/gathering additional research, data, or products
- Conducting vulnerability assessments and studies
- Developing/implementing an adaptation plan
- Incorporating climate change into policies, plans, and regulations
- Managed retreat of built infrastructure

For more information:

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Beavers, R. L., C.A. Schupp, I.A. Slayton, and M. Caffrey. 2014. Shoreline erosion and adaptation strategies for Peale Island Cabin, Yellowstone National Park. Natural Resource Report NPS/NRSS/GRD/NRR—2014/858. National Park Service, Fort Collins, Colorado.
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