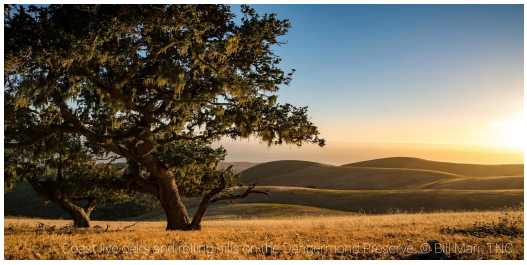
MANAGING THE IMPACTS OF ENVIRONMENTAL EDUCATION IN PROTECTED AREAS

A CASE STUDY AT THE JACK AND LAURA DANGERMOND PRESERVE NEAR LOMPOC, CA

Tess Hooper | Daphne Virlar-Knight | Priscilla Hare | Robert Heim | Jessica Gomez

Faculty Advisor: Sarah E. Anderson, Ph.D.



BALANCING THE TRADEOFFS BETWEEN ENVIRONMENTAL EDUCATION AND CONSERVATION ON THE DANGERMOND PRESERVE

Figure 1. The Dangermond Preserve in western Santa Barbara County, CA.

The Jack and Laura Dangermond Preserve was established in December 2017 by The Nature Conservancy (TNC). The merging climate patterns on the Dangermond Preserve create a unique environment with high native biodiversity. This 24,000-acre preserve includes habitats such as oak woodland, chaparral, coastal sage scrub, and annual grassland. It also supports special-status species such as the Gaviota tarplant (*Deinandra increscens ssp. villosa*) and California red-legged frog (*Rana draytonii*).

TNC is currently developing an environmental education program on the preserve for students in nearby Lompoc, CA. While the preserve represents an exceptional opportunity for nature-based learning, TNC hopes to mitigate the impacts that such a program may have on sensitive plant and wildlife species. This project uses conservation planning tools to inform TNC's trail use decision-making. Our approach provides a framework for managing the tradeoffs between environmental education and environmental conservation in biologically diverse areas.

PROJECT OBJECTIVES

Identify vegetation and wildlife that are sensitive to human presence and map their suitable habitat.

Rank trails for environmental education based on their ecological impact to sensitive vegetation and wildlife.

Create a management tool to select trails that offer suitable educational opportunities while minimizing ecological impacts.

ASSESSING THE ECOLOGICAL IMPACT OF ENVIRONMENTAL EDUCATION TRAILS

To aid TNC's trail use decision-making process, we used a Multi-Criteria Analysis (MCA). An MCA is a method used by land managers globally to evaluate a set of often conflicting criteria against one another. This method allowed us to rank the education trails based on their ecological impact to a set of sensitive plant and wildlife criteria.

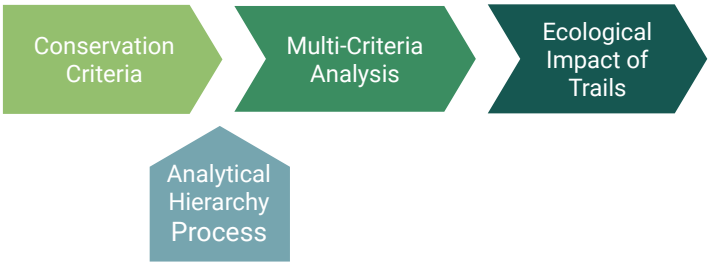


Figure 1. Method Overview. Four steps used to determine ecological impacts on the Dangermond Preserve.

I *IDENTIFY IMPORTANT CONSERVATION CRITERIA TO PROTECT*

After performing a literature review, we selected species that are sensitive to human presence and grouped them into Conservation Criteria. Many of these species are listed as "special-status" at the federal, state, or local level. We then mapped suitable habitat for all species within each Conservation Criterion. These maps served as a proxy for ecological impact.

II *ASSIGN INDIVIDUAL WEIGHTS TO CONSERVATION CRITERIA USING AN ANALYTICAL HIERARCHY PROCESS*

We used an Analytical Hierarchy Process to assign weights to each Conservation Criterion. In this process, we incorporated seasonal sensitivities of species within the Conservation Criteria, as well as TNC's management priorities regarding each criterion.

III *COMBINE CONSERVATION CRITERIA TO CREATE A CUMULATIVE ECOLOGICAL IMPACT MAP*

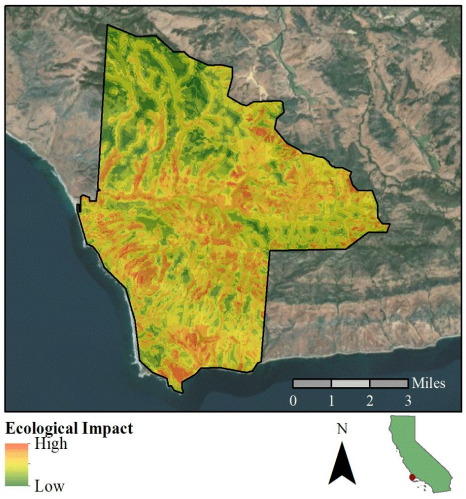


Figure 2. Red areas indicate habitat for sensitive vegetation and/or wildlife that would be most ecologically impacted by education groups. Green areas indicate habitat with the least potential to be ecologically impacted by humans.

We used the weights to combine the impact maps from Step 1 into a single map of cumulative ecological impact on the preserve. Red areas indicate where species would be highly impacted by human presence. There is a concentration of these high impact areas along the coastline and along preserve creeks and streams, where many of the species included in the Conservation Criteria have suitable habitat. For example, all six raptor species have highly suitable habitat near the southern coastal bluff areas. Additionally, riparian habitat supports aquatic species, such as the California red-legged frog (*Rana draytonii*). Alternatively, green areas indicate where trails are least ecologically harmful to sensitive species. These areas, such as in the northern end of the preserve, have a lower occurrence of overlapping suitable habitat.

New trail establishment for environmental education should avoid coastal and riparian habitat areas to minimize ecological impact.

IV *RANK TRAILS FOR ENVIRONMENTAL EDUCATION BASED ON ECOLOGICAL IMPACT*

Initially, we ran our MCA to determine trail rank using weights that reflected TNC's management priorities. We repeated the analysis using weights based on the varying sensitives of the Conservation Criteria throughout the year. Our results indicated that ecological impact is dependent upon seasonality.

For example, the Jalachichi Oak Grove trail is the least impactful trail during spring and summer, but in the fall and winter it is moderately high in impact. This is because the Jalachichi Oak Grove trail largely avoids sensitive vegetation, which is assigned a high weight during the spring and summer. This reveals that seasonality should play an important role in TNC's trail use decision-making.

Table 1. Trails on the Dangermond Preserve ranked by ecological impact. Weights reflect TNC's management priorities and seasonality.

		Seasonality			
Trail Name	TNC	Fall	Winter	Spring	Summer
Army Camp to Bunker	1	2	2	3	3
Army Camp Loop 2	2	5	5	7	7
Army Camp Loop 1	3	4	4	5	5
Bunker Out and Back	4	3	3	4	4
Water Canyon Loop	5	6	7	6	6
Coastal Bluffs	6	1	1	12	12
Jalachichi Oak Grove	7	7	6	1	1
Water Canyon Out & Back	8	12	12	11	11
Jalachichi Overnight	9	8	8	2	2
Jalachichi Lollipop	10	11	11	8	8
Jalachichi Loop	11	10	10	10	10
Jalachichi Pond	12	9	9	9	9

Impact Level: Low | Moderate | Moderately High | High

Trail ecological impact depends on seasonality and TNC's conservation priorities.

CONSERVING NATIVE BIODIVERSITY WHILE PROVIDING ENVIRONMENTAL EDUCATION OPPORTUNITIES

We developed a management tool for The Nature Conservancy to use when determining where to place education programming in order to reduce ecological impacts while facilitating education opportunities. This interactive web app provides an interface to assess the tradeoffs between conservation and education, which enables preserve managers to easily make informed decisions regarding programming on the Dangermond Preserve.The app factors in school group needs, scenic landmarks, number of vegetation communities, and ecological impact of each trail.

Coastal Bluff Trail

Trail Length: 1 mile

Landmarks: Government Point, Point Conception

Vegetation Communities: 4

Ecological Impact: Low

Army Camp Loop 1 Trail

Trail Length: 4.5 miles

Landmarks: Wells

Vegetation Communities: 7

Ecological Impact: Moderate

Figure 3. Example trail options for a fall environmental education program on the Dangermond Preserve. The Coastal Bluff Trail has a lower ecological impact and more education opportunities than Army Camp Loop 1 trail, but it may not be suitable for students who need a longer trip and have greater physical endurance.

Tradeoffs must be made to meet conservation and education goals.

LESSONS LEARNED FOR MANAGING ENVIRONMENTAL EDUCATION

I ***CONSIDER SEASONALITY***

Assign weights to all Conservation Criteria based on the time of year to explore how seasonality affects trail impacts.

II ***ESTABLISH NEW TRAILS IN LOW ECOLOGICAL IMPACT AREAS***

Before siting any new trails, run an MCA incorporating Conservation Criteria management priorities and anticipated user group capabilities to place trails in ecologically low impact areas.

III ***IMPLEMENT DECISION-MAKING STRATEGY***

For best management practices, use a management tool for decision-making regarding program development and monitoring. The interactive web app we created is one such tool designed to be easily modified for other preserves to use.

A CASE STUDY: BALANCING ENVIRONMENTAL EDUCATION TRADEOFFS WITH NATIVE BIODIVERSITY

Balancing ecological conservation with human impacts on nature preserves is a challenge for land managers globally. Although the Dangermond Preserve is a unique area, the methods used in this project offer an approach that land managers elsewhere can use to balance the tradeoffs between environmental education and the conservation of biodiversity in protected areas.

CONTACT INFORMATION

Website: https://dangernerds.wixsite.com/mysite **Email:** gp-dangernerds@bren.ucsb.edu

ACKNOWLEDGEMENTS

We would like to extend our deepest appreciation to Sarah Anderson, Frank Davis, Kelsey Jack, Kelley Caylor, James Frew, Ashley Larsen, and Allison Horst at the Bren School for assisting us with this project. In addition, we are grateful for the support from our clients Mark Reynolds, Moses Katkowski, Brea Jones, Karin Lin, and Kelly Easterday at The Nature Conservancy. This project was made possible in part with funding from the James S. Bower Foundation.

The Nature Conservancy

James S. Bower Foundation