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Vegetation Monitoring After Wild Pig Removal at Pinnacles National Monument

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The Question: *What is the baseline condition of vegetation at the time of wild pig eradication at Pinnacles National Monument? What methods can be developed to continue monitoring the vegetation as it recovers?*

Prior to 2003, feral pigs ranged throughout Pinnacles National Monument (PINN), causing substantial ecological damage along sensitive riparian areas, in oak grasslands and in California's nationally unique oak woodlands. Wild pigs churn up vast tracts of soil as they root with their snouts in the ground for food. The landscape they impact shapes the plant communities in the park. Because pigs eat acorns, oaks cannot regenerate. Rooting may alter nutrient cycles and dry the soil of water necessary for plant growth. Nonnative plant seeds germinate on the exposed soil. While wild pigs most visibly disturb vegetation, the pigs also consume food native wildlife needs, like acorns and worms, and they can infect wildlife with disease. The damage wreaked by pigs was so substantial that in 1985 PINN began building a fence around the park to keep out wild pigs.



Rick Sweitzer

Wild pigs sift through huge amounts of soil to find nuggets of food. The ground they leave behind looks like it was churned by machinery.

By fall 2003, PINN completed the specialized exclusionary fence. It is 24.3 miles long and encompasses 14,500 acres of the park. The last wild pig was removed from within the fenced area in 2006. PINN invested an enormous amount of time and funding to complete this project. After a project of this magnitude, park managers wanted objective data to assess the recovery of native plant communities. In 2003, researchers from the University of North Dakota began a two year study to evaluate the vegetation and soil condition at the time of pig removal and to develop methods that the park can use to continue monitoring the vegetation recovery.

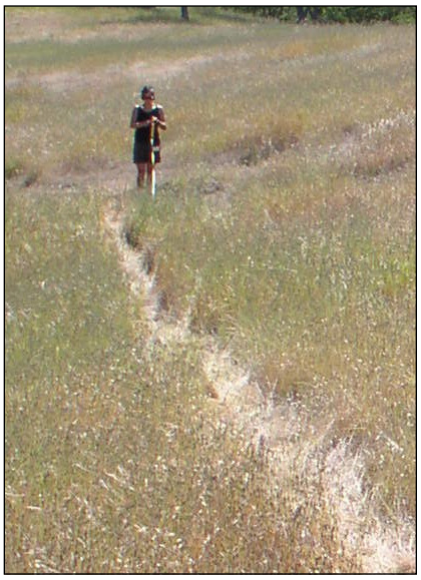


Blake McCann

Pinnacles National Monument built a fence enclosing a large portion of the park to protect its ecosystems from wild pigs.

The Project: *Quantify the extent of rooting disturbance, assess seedling regeneration potential and describe vegetation composition in areas disturbed by wild pigs.*

Researchers used a combination of fieldwork and statistical modeling to quantify rooting disturbance, seedling regeneration potential and vegetation composition in three key habitats preferred by wild pigs - oak grassland, oak woodlands and riparian areas. To estimate the extent of rooting damage, the researchers used GIS software to randomly generate points to start line transects. In five randomly placed plots around the line transect, they noted presence and absence of rooting and the estimated percent of rooting disturbance in the total area sampled around each transect.



Rick Sweitzer

Researchers walked three kinds of vegetation transects and measured along each parameters that describe plant communities and soil disturbances.

The Project (*continued*)

In the oak woodlands, researchers established 30 randomly located seedling transects. Along each, they counted and measured the height of each tree seedling, the amount of soil disturbance and which animal caused the disturbance.

The biologists established permanent vegetation transects to monitor plant community characteristics in the three habitats. At 100 points evenly spaced every 30cm along each 30m transect, biologists recorded the height of the tallest plant, substrate type and the plant species present. From these data, they calculated mean plant height, mean percent plant cover, native and non-native abundance (number of individuals of each species), richness (number of species) and species diversity (number of species weighted by the numbers of individuals).

The Results: *Wild pigs substantially damaged the vegetation, especially in oak woodlands.*

This study provides a snapshot of the condition of plant communities after decades of wild pig disturbance. By using the same protocols for follow-up monitoring, PINN will be able to document objectively how the vegetation is recovering over time.

At the time the fence was completed, the researchers found that rooting had caused significant damage to soils and vegetation within PINN. The most pronounced damage occurred in oak woodland areas. Rooting by wild pigs caused 98% of all recorded soil disturbances along seedling transects. High levels of rooting also contributed to increased non-native plant cover. There were fewer tree seedlings in the highly disturbed areas, most likely because the wild pigs eat acorns and uproot seedlings and also because removing litter and topsoil layers beneath oak canopies disrupts nutrient cycling necessary for healthy growth.

This study established 43 permanent vegetation transects to assess plant community characteristics and 30 semi-permanent oak seedling transects. PINN plans to use these transects and the protocols designed by the University of North Dakota researchers to continue monitoring the vegetation in the future.

Additional Resources:

Wild Pigs at Pinnacles National Monument website
http://www.nps.gov/pinn/naturescience/wildpigs.htm

For More Information:

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Kelly Reeves

This study provides evidence that rooting by wild pigs prevents oaks from regenerating. Pinnacles National Monument plans to continue monitoring oak seedlings to determine whether oaks will recover from the decades of disturbance.

The Pacific Coast Science and Learning Center is one of 17 centers across the country working to increase the effectiveness and communication of research and science results in the national parks by facilitating the use of parks for scientific inquiry, supporting science-informed decision making, communicating relevance and providing access to research knowledge, and promoting resource stewardship through partnerships.