

Pedro Point Headlands 1941 to 2010: A Preliminary Study

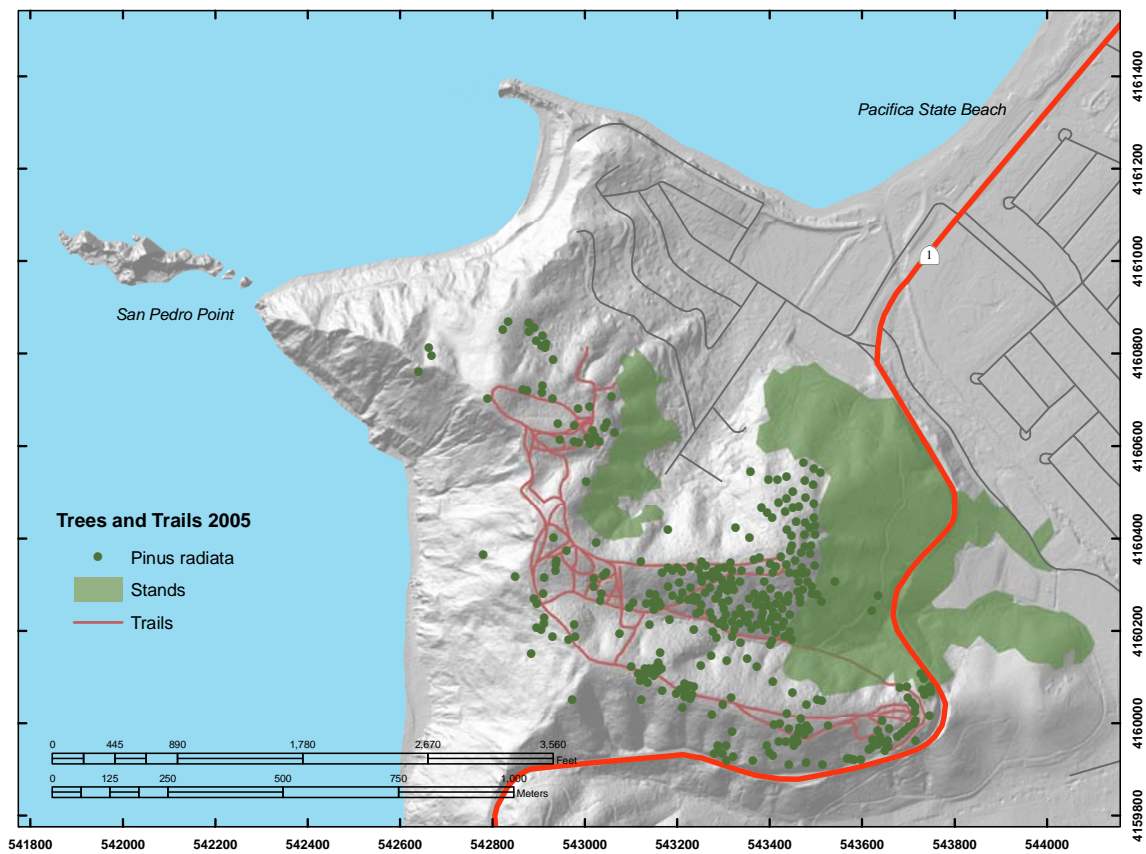
Using
Historical Remote Sensing
and Dendrochronology

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Adam Davis¹
Jerry Davis²
Brian Harvey²



Pedro Point Headlands



Report to the **Pacifica Land Trust** and **California Coastal Conservancy**

¹ Geography, UC Berkeley

² Geography, San Francisco State University

Introduction

This report documents a preliminary study of significant changes to the land use and cover on Pedro Point Headlands from 1941 up to the present, based on historical aerial photography, field observations, and dendrochronology.

The Pedro Point Headlands study site is located immediately to the south of Pacifica, California. Bounded on the west by the Pacific Ocean, to the south and east by California Highway 1, and to the north by private lands, it is land managed by the Pacifica Land Trust and California Coastal Conservancy. Portions of the area are within Pacifica City Limits, but most is in unincorporated San Mateo County (PLT 1999).

Historical Events Impacting Pedro Point Headlands

Pedro Point Headlands has been the site for a sequence of land uses, dating from the Ohlones as evidenced by a nearby shell mound near the mouth San Pedro Creek and a preponderance of mollisol soils indicative of a long-term burning regimen. The first fairly certain European documentation of the headlands was as part of the Portola expedition of 1769, which appears to have camped in San Pedro Valley, described it as a lush valley surrounded by tall hills, and noted the practice of burning (Miller 1971). With the 1782 establishment in San Pedro Valley of an *asistencia* for San Francisco's Mission Dolores (Collins, Amato and Morton 2001) and later use as a Mexican rancho, the valley and hillsides would have been subject to extensive cattle grazing. This may have led to soil compaction and erosion and possibly gully development on hillsides.

The Ocean Shore Railroad followed the edge of the headlands, with a tunnel through its promontory, from 1907 until 1920 (VanderWerf 1994), when it was closed due to lack of funding, partially due to the high cost of maintenance of this landslide-prone route along the coastal cliffs.

Starting in 1970, the Pedro Point Motorcycle Club used this site heavily, and the scars left by off-road motorcycling mark perhaps the greatest single land use impact on the site (Fig. 1). In 1988, the City of Pacifica's Open Space Task Force noted the need to preserve this site, and this eventually led to the establishment of the Pacifica Land Trust, which completed its acquisition of the property in 1995, following a three-year phasing out of motorcycle use (PLT 1999).



Figure 1. Scars created by off-road motorcycle use. Photo by J. Davis 2002.

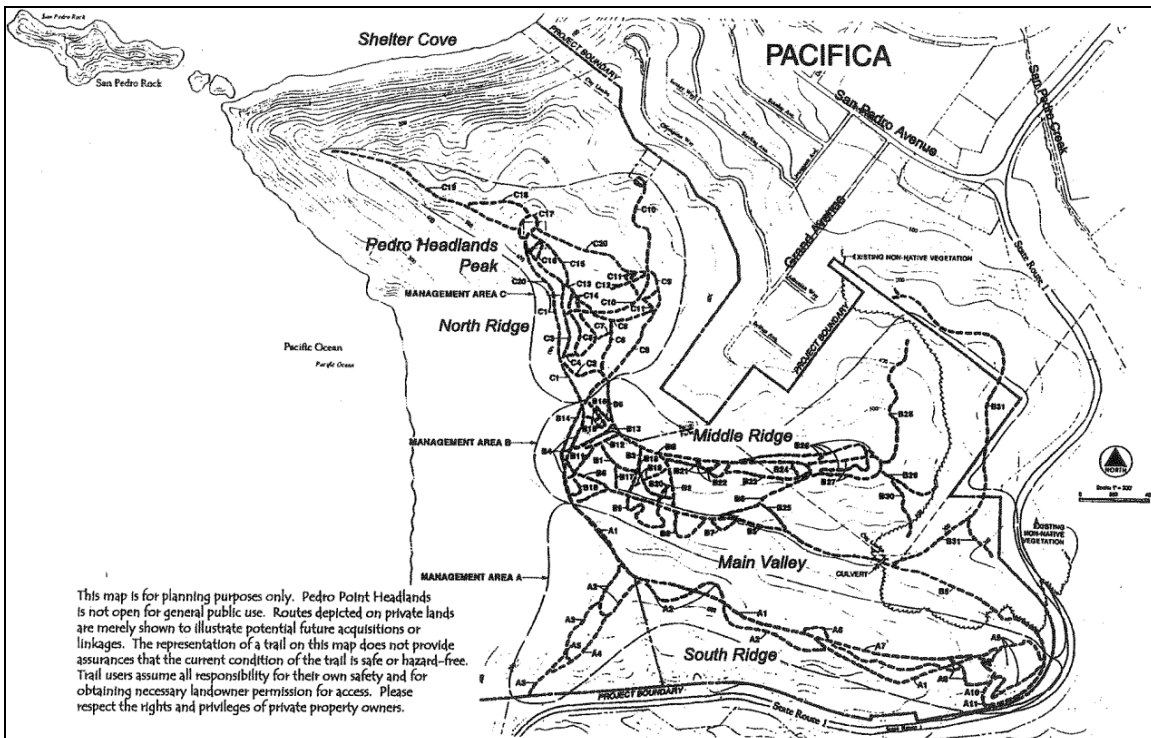


Figure 2. Management Area Plan. From Pacifica Land Trust (1999).

Methods

The primary methods used to interpret changes in tree cover and trail creation were: (1) field observation of trees and trails; (2) interpretation of orthorectified historical aerial photographs; and (3) dendrochronological methods using cores of selected Monterey pines (*Pinus radiata*).

Field Observation was used to observe the current condition of trails, and the species, health and size of individual trees and tree stands. A submeter GPS (Trimble GeoXH with Zephyr antenna) was used along with a laser rangefinder (MDL LaserAce) to map selected tree locations, DBH (Diameter at Breast Height), heights and stand character.

Interpretation of orthorectified historical aerial photography was used as the primary source of mapping changes in trails and tree distribution (Fig. 3). A 2005 NAIP Color Orthoimage was downloaded from Cal-Atlas (<http://www.atlas.ca.gov>) and was used for the most recent mapping and as an image source for orthorectification of black and white photography from 1941, 1955, 1963, 1975, and 1985 using ERDAS LPS. A 1928 aerial photograph was not able to be orthorectified and was not used.

Mapping Trees and Trails on 2005 Orthoimagery



Figure 3. Trails and Trees mapped from Orthoimagery.

Dendrochronological methods were used to estimate year of establishment for selected *Pinus radiata* trees. This was used in concert with field observations and aerial photography interpretation to more accurately determine conditions at the sequence of years documented by the photography. Cores were collected using Hagl f increment borers (Fig. 3), and processed in the SFSU Physical Geography Lab according to methods documented in Speer 2009, and new methods developed by Brian Harvey and Brian Crowley, SFSU Geography graduate students, in 2009.



Figure 4. Increment boring of a *Pinus radiata*.

Results

The results of this study are presented as a series of maps illustrating conditions of trails and trees that we interpret to have existed at the various times documented in the aerial photographs of 1941, 1955, 1963, 1975, 1985, and 2005. For cartographic purposes, isolated trees are mapped as individual points, while stands (of mostly blue-gum Eucalyptus trees) are mapped as polygons.

Trees and Trails 1941

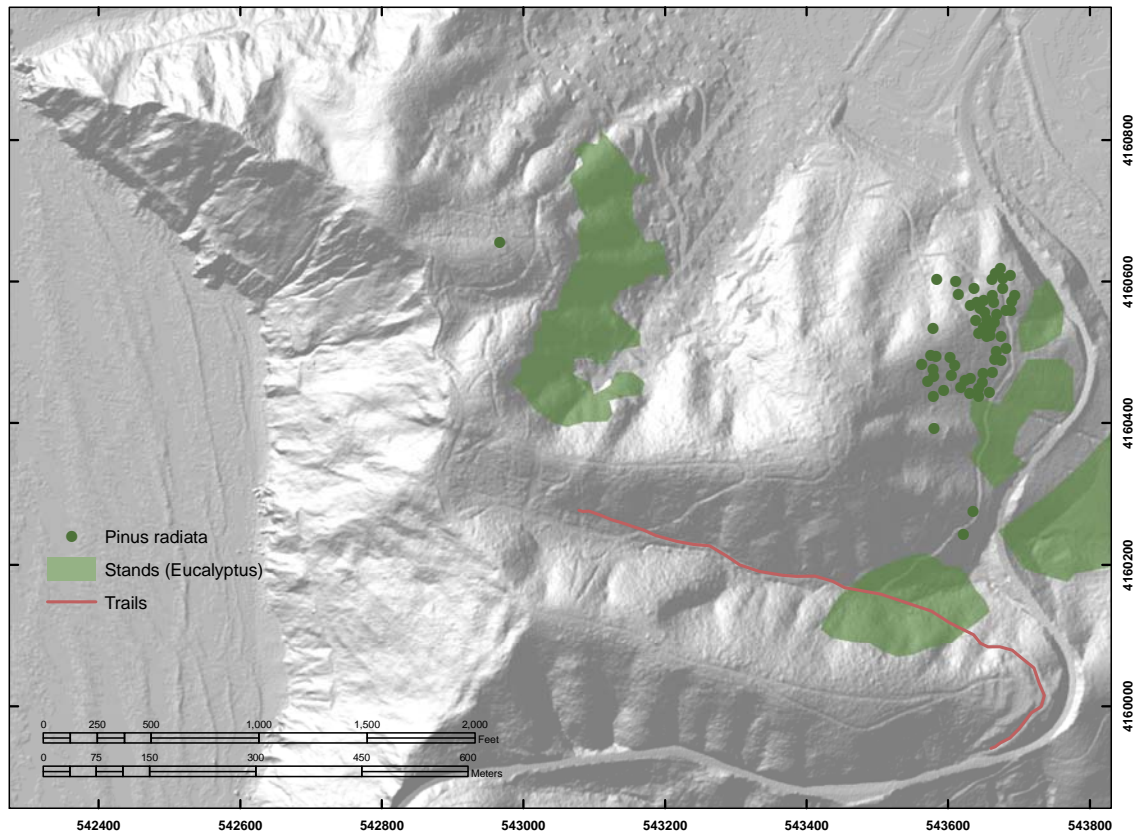


Figure 5. Trees and Trails 1941.

In 1941, we see a minimal amount of trail development, and stands primarily of blue gum eucalyptus (*Eucalyptus globulus*). Note: while the image from 1928 was not able to be orthorectified, the conditions appear little different from what is apparent in this image, though with perhaps less extensive tree cover.

Trees and Trails 1955

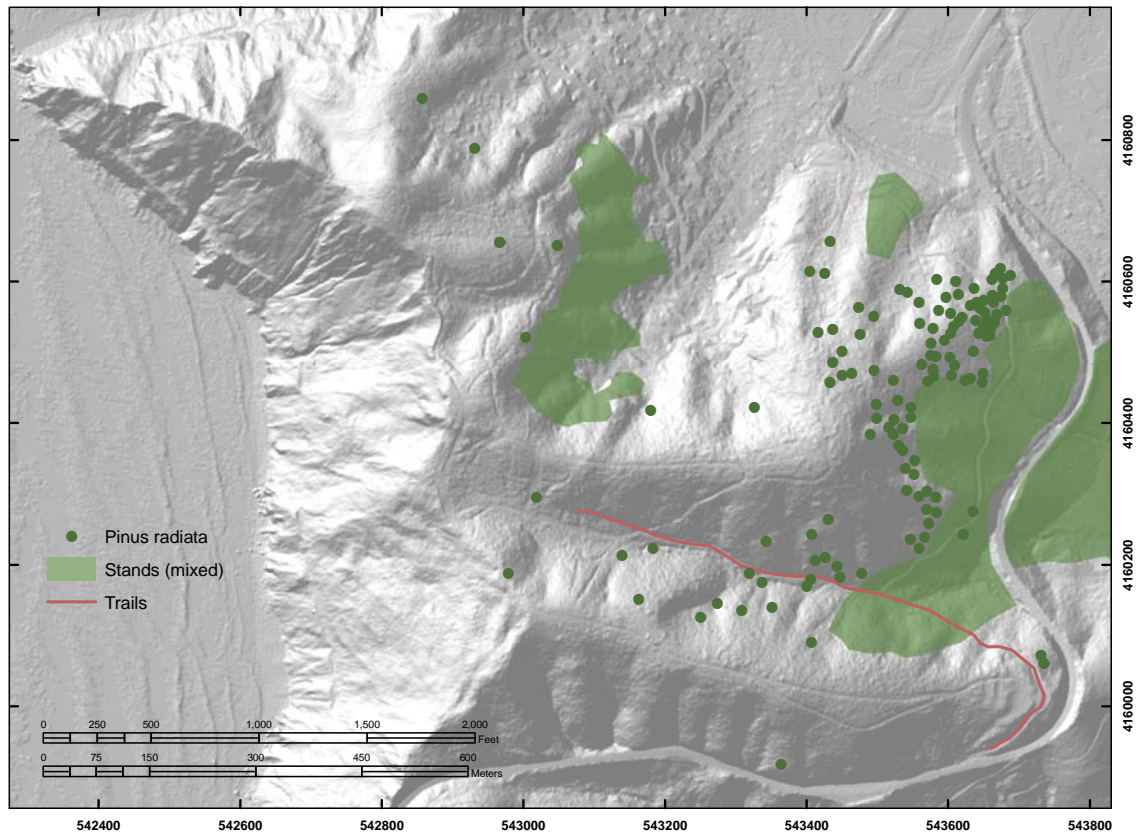


Figure 6. Trees and Trails, 1955.

By 1955, stands of Eucalyptus had expanded from their original more linear stands. Near Highway 1 stands are mixed with pines, not easily distinguished in the black & white photography. Almost all individual trees are pines.

Trees and Trails 1963

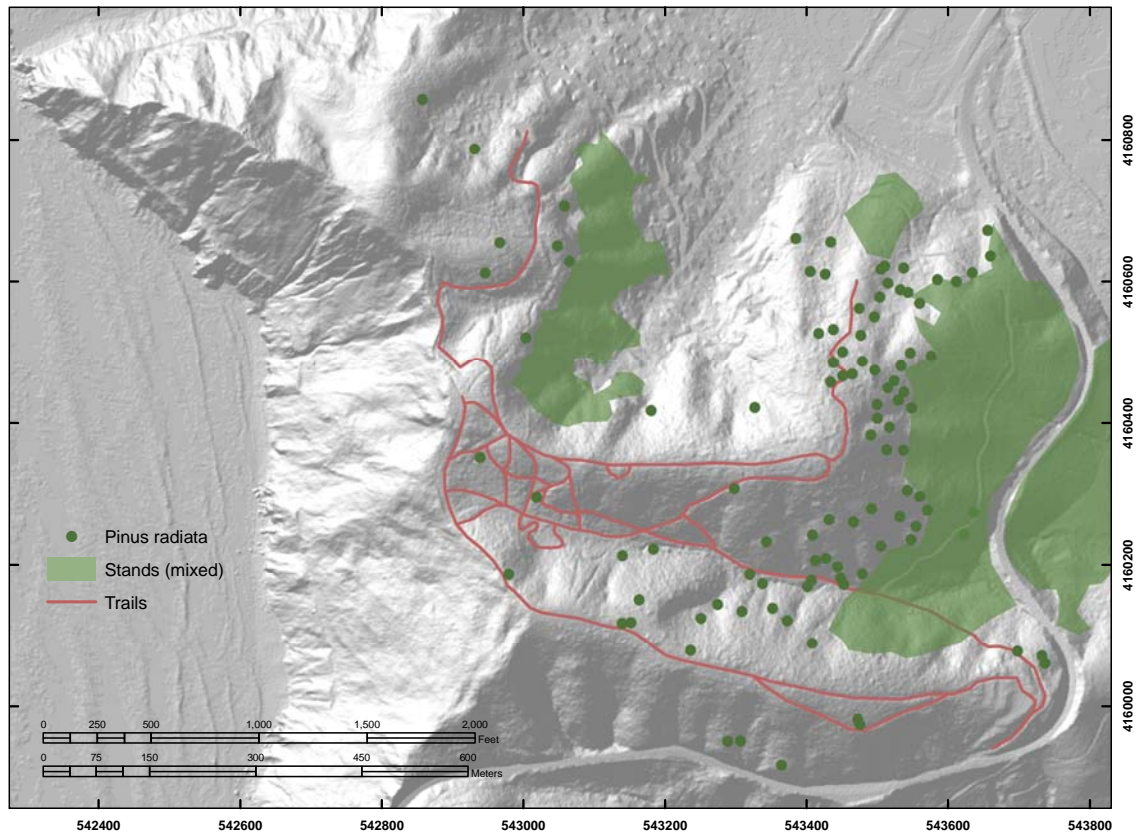


Figure 7. Trees and Trails, 1963.

The 1963 aerial photograph documents that off-road motorcycle use started well before 1970, cutting a dramatically expanded network of trails. Eucalyptus stands have expanded slightly, as have pines, with the latter expanding further afield.

Trees and Trails 1975

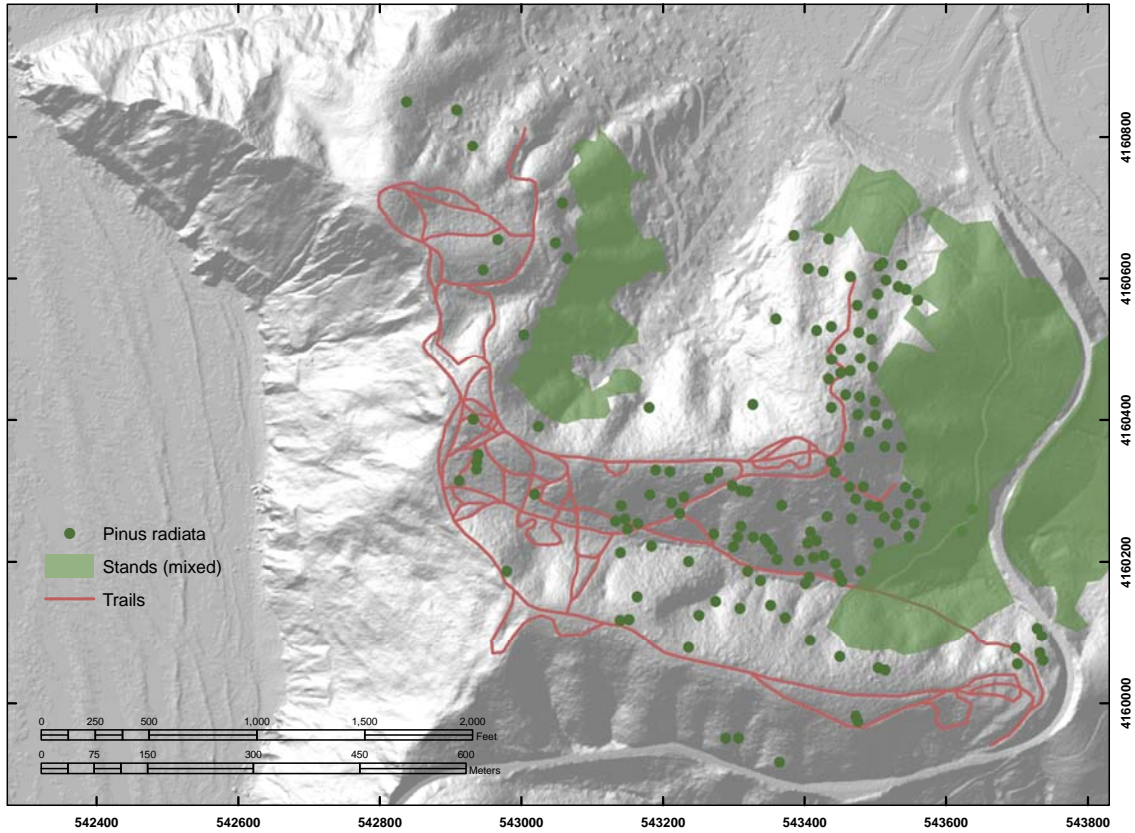


Figure 8. Trees and Trails, 1975.

The image from 1975 shows an even more developed network of trails. Note the distribution of trees alongside some of the major trails. Tree-ring data suggest that many of the trees in this area date from the early 1970s, which supports what this image shows. It is likely that some of the pines were planted, as was done by the Coastside Motorcycle Club alongside trails at nearby Mori Point (Pacifica Tribune 1973). Trail alignment of trees is especially apparent on Middle Ridge and its trails extending into the valleys to the south.



Figure 9. Pines along Middle Ridge.

Trees and Trails 1983

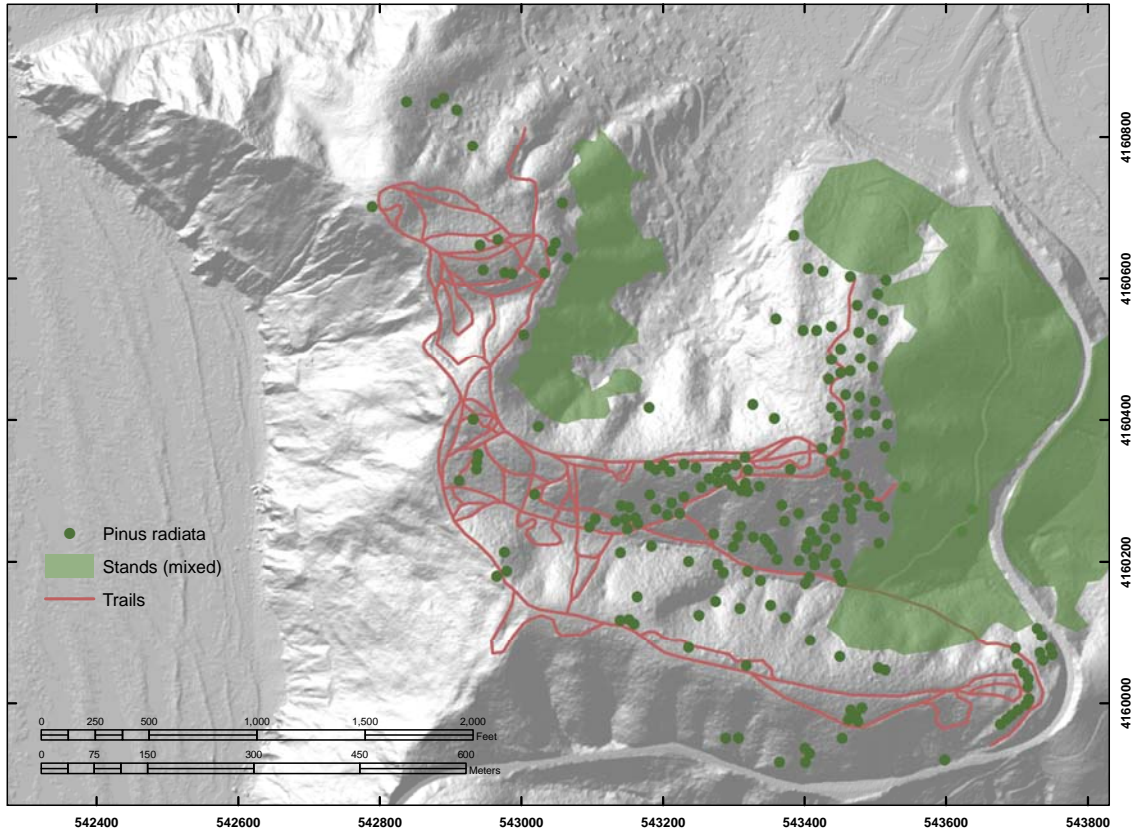


Figure 10. Trees and Trails, 1983.

By 1983, more trees are apparent, and may either have been planted or grown up from seedlings not apparent in the 1975 image. This represents a continuation of what we saw in the previous decade. One large tree cored in the Middle Ridge area dates from the 1980s, suggesting that the expansion of *Pinus radiata* continued throughout this period.



Figure 11. Pines along trail between Middle Ridge and Main Valley.

Trees and Trails 2005

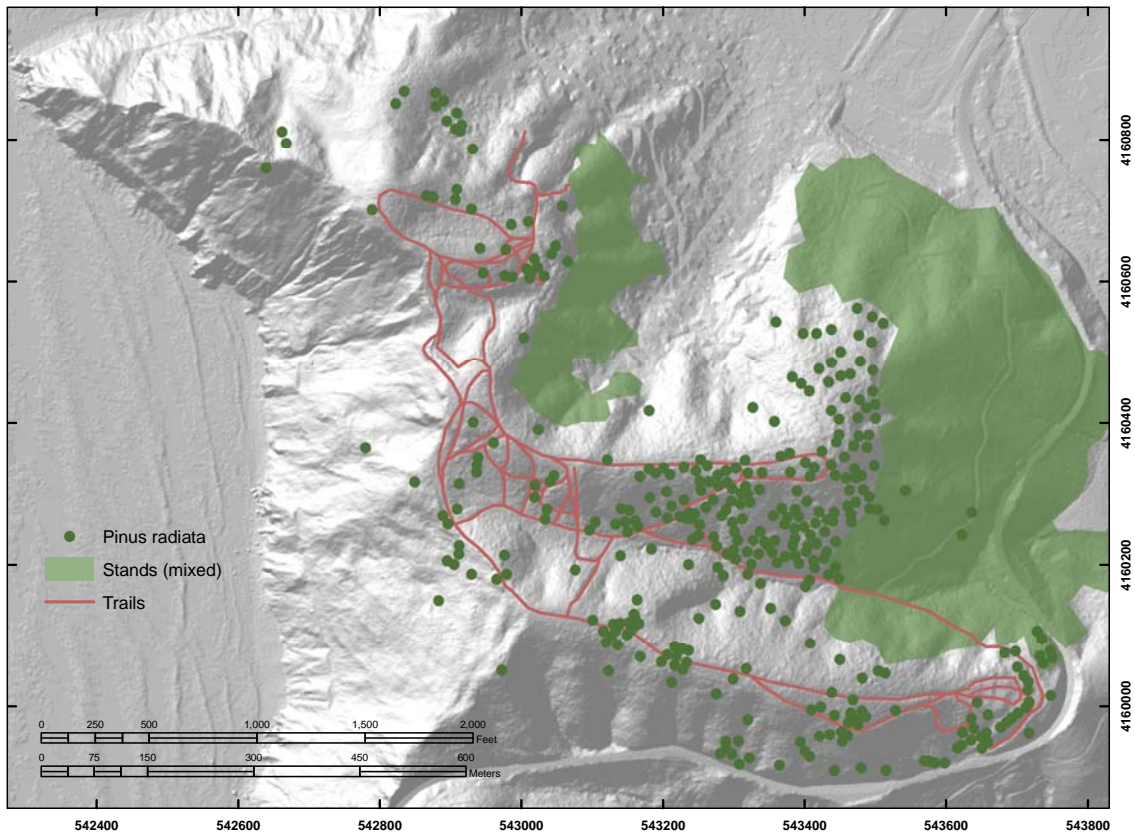


Figure 12. Trees and Trails, 2005.

In recent years, some of the trails have been grown over, and fewer are apparent in the 2005 image than in previous years. This has perhaps been aided by the expansion of poison oak and brambles, which has made passage unappealing. Still, field observations show that even these trails retain their compacted surfaces and can still be explored by the determined fieldworker. Large stands of Eucalyptus are mixed with pines in some areas, and the eastern parts of the area are clearly a forest. The image from this year has also confirmed field observations that many of the older Monterey Pines are in very poor condition, with substantial numbers of dead branches.



Figure 13. Trail partially colonized by vegetation.

Conclusions

While historical off-road motorcycle trails continue to impact the area, mobilizing sediment, some are starting to be reclaimed by scrub vegetation. The presence of poison oak likely has aided this process by deterring people from using the trails. Monterey Pine seedlings were observed in some of the larger trails where scrub has been unable to reestablish.

Eucalyptus forests are expanding very slowly, but do not seem to spread uphill very easily in this study area. In several locations (e.g. Fig. 3 and 14), pines occupy the uplands with Eucalyptus in the valley below. In the denser mixed stands, it is unclear whether Eucalyptus are replacing the dying Pines, but the Eucalyptus do appear to occupy a substantially larger area than they did in the earlier images.

Pines appear to spread much more rapidly, but we may be seeing the legacy of purposeful planting along motorcycle trails. Along Middle Ridge especially, pines appear to have largely expanded from possible plantings along the motorcycle trails as numerous trees occupy areas along trails; both tree-ring data and air photos suggest that these trees are all around the same age, and date from a period (1970s and 1980s) when planting is likely to have been used for erosion control by the motorcycle club.



Figure 14. Main Valley and Middle Ridge, with motorcycle trails and scattered pines, Eucalypts in the background. Photo by J. Davis, 2002.

Sources

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