

# Eucalyptus Removal on Angel Island

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As part of its mission, California State Parks is required to "preserve the state's extraordinary biological diversity, protecting its most valued natural and cultural resources." Sometimes eucalyptus trees have historical significance and must be preserved, but in settings where natural values predominate, removal is clearly called for. The case for removal was strong on Angel Island but the project proved to be controversial. Eucalyptus removal was finally completed in 1996, approximately ten years after planning for the project began. Active restoration work continues to date on the sites previously occupied by these trees.

## Impacts of Eucalyptus

By the mid 1980s, when plans to control eucalyptus on the island were being developed, there were approximately 86 acres of bluegum eucalyptus, *Eucalyptus globulus*, in the park. Small groves, which totaled only 24 acres, had been planted by the military. These original groves had expanded over time as native plant communities were invaded by new seedlings. Native plants and the wildlife habitat that they provided disappeared as eucalyptus trees began to dominate large portions of the landscape. Coastal scrub and grassland were primarily lost but areas of mixed evergreen forest were also affected.

In addition, the bluegum species of eucalyptus created an extreme fire hazard compared to the native plant communities of the island. The fire danger produced by eucalyptus was dramatically observed during the Oakland Hills fire of 1991. A wildfire in bluegum eucalyptus burns with tremendous intensity, and under severe weather conditions (e.g. hot and windy) can produce drifting burning material which has great potential to ignite spot fires. Because their stringy bark is carried away while burning, eucalyptus forests are considered the worst in the world for producing this type of fire spread. While the native plant communities of the island would be affected by wildfire, their general health would not be jeopardized. Only the visual impacts of charred trees in a park with high visitor use would be detrimental. The historic structures on the island, however, could easily be lost due to the hazard posed by eucalyptus trees.

## Public Reaction

Because Angel Island is visible from many vantage points around San Francisco Bay, public reaction was expected to be considerable. This proved to be the case, with strong opinions expressed by both supporters and opponents. In general, with some reservations, the conservation organizations were in favor of the removal. A small number of very concerned citizens, however, formed a group called P.O.E.T. (Preserve Our Eucalyptus Trees) that was dedicated to stopping the project.

At the suggestion of the Marin Conservation League, California State Parks prepared a Focused Environmental Study which attempted to address all of the concerns that were raised, as well as to provide the background information and reasons why this natural area restoration was appropriate. Under contract, the University of California at Berkeley conducted studies concerning the effects of eucalyptus removal on elements of the environment, including native plant communities, wildlife habitat, soil characteristics and erosion, fuel conditions, and aesthetics. A restoration plan was also included. This 290-page document was circulated and a public meeting was held to explain its conclusions. Media attention was strong. Many letters were written, both in favor of and in opposition to the project. P.O.E.T. attempted to exert political pressure and finally was able to obtain a court injunction stopping the project until an Environmental Impact Report (EIR) was completed. The environmental consulting firm, Jones and Stokes, wrote the EIR and the project was cleared to begin in 1990, about four years after restoration plans were first made public. Eighty acres of eucalyptus were to be removed, leaving 6 acres of historically significant trees.

Once these steps had been taken, organized opposition disappeared. During the course of the subsequent logging, letters and phone calls were received, some in strong disagreement with the project, but the level of concern never put the removal in jeopardy. Most media coverage was objective.

Without the help of supporters to respond to its opponents, the project would have been abandoned. California State Parks maintained its resolve in the face of both public and political opposition. This resolve was crucial.

### Methods

The first phase of removal took place in 1990. Trees from 16 acres (3,800 tons of material), were removed by helicopter. This method of logging was welcomed but not required by the state. Eucalyptus only had value for use in power generating plants at that time, so the costs of logging were not significantly offset by the value of the wood.

Helicopter logging produced excellent results. Ground disturbance was avoided and complete trees were removed, including limbs and branches. After logging, woody forest debris and sections of tree butts resulting from stump lowering were piled and burned by inmates from Delta Conservation Camp, operated by the California Department of Forestry and Fire Protection.

The decision to fund this phase of the project, despite its high cost, was based on the importance of the project and the availability of funds at the time. When this phase was completed it was feared that future removal might be postponed indefinitely. A source of funds that could continue this expensive work was not available.

In 1993, however, California State Parks learned that a Japanese market for eucalyptus pulp chips was being developed. This meant eucalyptus removal costs to the state would be dramatically reduced. A contract with Planned Sierra Resources was made and in the fall of 1995 logging operations were resumed using standard logging methods. Skidding was done primarily with rubber-tired grapple skidders. Logs were transported from the island on a Navy LST, a World War II vessel equipped with a ramp and designed to be loaded and unloaded from a beach. This barge held 1,500 tons of logs. Unfortunately, the first time it was loaded it was damaged through contact with rocks. Bottom repairs were made allowing its continued use as a log barge but beach loading was no longer possible. This created a major crisis. An alternative method was developed, however, and loading was accomplished using a derrick barge moored to a sea wall on the east side of the island. The derrick barge was moved by tugboat to the island for each barge load. Only logs were barged from the island. Consequently, all slash was piled by a tractor-mounted brush rake. This resulted in 235 large piles estimated to contain a total of 14,000 cubic yards of woody debris.

Special felling methods were used on numerous trees growing near historic structures. Trees were climbed and felled. This allowed the direction of fall to be controlled by a tractor. Stump heights were kept low and were generally cut at the same angle as the slope of the surrounding terrain. Garlon 4 herbicide (80% with oil) was applied to the outside circumference of the stump surfaces. Trees less than 5 inches diameter were felled by a separate contractor. This contractor also reapplied the same herbicide mixture to stumps that continued to sprout. This follow-up treatment took place during fall, 1996 and will again occur in fall, 1997.

This final removal phase, during which approximately 24,000 tons of logs were removed, was completed in July, 1996. The slash piles were burned during the following winter. Inmate crews from San Quentin State Prison were used to stack the slash that remained after these piles were burned. This clean-up work continued until spring, 1997 and will be resumed the following winter.

### Discussion

The eucalyptus trees have been successfully removed, eliminating their threat to the integrity of the island's natural areas. Expansive views of Golden Gate Bridge, San Francisco, and the East Bay are once more available to park visitors. Most slash disposal work has been accomplished. The challenges that remain center on improving the quality of these sites as natural areas. The immediate need is to control weed invasion. Invasion of Italian thistle (*Carduus pycnocephalus*) on portions of the 16-acre site logged in 1990 has been

severe. These populations have not diminished, so it is clear that management actions must be taken to prevent occupation by this weed in newly logged areas. The populations that have appeared on the recently cleared sites are somewhat localized. Two heavily invaded sites were mowed in early summer to prevent seed production. Plans call for burning to remove mulch, in preparation for pre-and post-emergent herbicide application. Grass will be seeded to provide competition for weeds and to serve as fuel for early summer burning.

After the remaining slash is burned it will be possible to safely conduct summer grassland burns. Other weeds, such as French broom (*Genista monspessulana*) will be controlled by this burning. Eucalyptus seedlings are currently not widespread, but where they do occur, burning or herbicide treatment will provide control. Ice plant (*Carpobrotus edulis*) is a growing threat in the removal sites. It will be necessary to treat this plant with herbicide. There are, of course, a number of other weeds present in the treated sites as well as on the island as a whole. Those with potential to dominate sites will require special attention; others will continue to persist as they do in many wildland settings.

There are excellent stands of native plants on the island including mixed evergreen forest, coastal shrubland, and perennial grassland. The goal is to restore the sites degraded by eucalyptus to the quality of these undisturbed natural areas. Left alone, natives will reoccupy these sites to varying degrees, especially if weed control is successful. A number of stands of bush lupine (*Lupinus arboreus*) immediately became established on the recent removal sites. Some native grasses also appeared.

After the 1990 removal of eucalyptus from 16 acres, almost 62,000 container-grown native grasses and shrubs were planted without any attempt at weed control. The success rate was poor except in areas of shallow soil where competition from non-native annual grasses was limited. In 1996, transect results indicated that the percent cover of natives varied between 11% and 65%, with the average for the entire area estimated to be closer to the high figure. This relatively high percentage of natives is primarily due to increases in coyote brush (*Baccharis pilularis*). Although this was one of the species planted, coyote brush invasion is occurring independent of planting.

Adequate control of exotic annual grasses to allow survival of planted native perennial grasses is very difficult. The cost of planting and of weed control, along with the probable low rate of success, makes this effort unattractive on a site this large. An alternative is to rely on fire as a major tool to help achieve native plant restoration. It should be remembered that burning has benefits that go beyond the control of exotic plants. Native grassland plant communities are very well adapted to fire. A long-term prescribed burn program, coupled with direct seeding, has potential to result in the restoration of a grassland with a high representation of native species. Burning on the island is not without intrinsic difficulties, however. Smoke management is essential to avoid impacts to surrounding cities. Windy weather alleviates smoke problems but adds fire control concerns. This practice is certainly feasible but must be carefully managed.

All but 12 acres of the removal sites were grassland or shrubland prior to eucalyptus establishment. These 12 acres, on the east side of the island, were part of the extensive mixed evergreen forest which currently occupies all but the park's south-facing slopes. Fire may be used for several years to control weeds on this location, but ultimately, after burning is discontinued, native trees will be established.

The short-term quality of the eucalyptus removal sites as natural areas will be determined by the level of management attention they are given. The actions that are planned will greatly accelerate natural restorative processes. After several years it should be difficult to differentiate these cleared locations from the remainder of the island.

### Literature Cited

California Department of Parks and Recreation. 1988. Focused Environmental Study, Restoration of Angel Island Natural Areas Affected by Eucalyptus. 290 pp.

Jones & Stokes Assoc., Inc.. 1989. Draft and Final Environmental Impact Report. Restoration of Angel Island Natural Areas Affected by Eucalyptus.