

# Condition and Management of Monterey Cypress on Coastal Bluffs at The Sea Ranch



Joe R. McBride  
Consulting Forester  
Berkeley, CA

December 27, 2008

## **Introduction**

The purpose of this report is to evaluate the condition of Monterey cypress stands occurring along the coastal bluffs and propose management strategies for these stands. Coastal bluff erosion and growth of trees in these stands have created problems of visual access to the ocean, encroachment onto the bluff trail, and tree fall hazards. The report will suggest management strategies for dealing with these issues. These strategies will be based on an examination of Monterey cypress on coastal bluffs at four locations at the Sea Ranch. These sites typify the variety of conditions encountered in bluff cypress stands.

Previous reports by McBride and Gerhard (1991), Geddes (1995), Konigsmark, (1998), BACE Geotechnical (1999, 2005) and Cleveland (2004) have addressed various aspects of the management of the bluff cypress and the coastal bluffs at The Sea Ranch. Erosion of the public access bluff top trail was the subject of a hearing by Sonoma County Regional Parks in 2007. These reports have provided valuable insights for understanding the scope of the problem and developing management strategies for the bluff cypress.

## **Coastal Bluff Erosion**

The Sea Ranch is located along approximately 9 miles of coastal bluffs overlooking the Pacific Ocean. These bluffs extend to heights of 30 feet or more above the sea and have been formed by erosion of German Rancho Formation (Paleocene), Gualala Formation (Cretaceous), and Pleistocene alluvial and marine deposits. Rocks in these formations and deposits vary from sand and poorly cemented sandstones and shales to erosion resistant basalt. The weaker of these geologic materials are subject to coastal erosion due to the combination of wave actions that undermines the bluffs and overland flow that erodes the surface of the bluffs. Ground water movement along the contact between the surficial Pleistocene deposits and the older sandstone and shale also contributes to the erosion problem. Konigsmark (1998) reported bluff erosion of more than 3 feet at 12 locations as a result of the 1997/98 winter storms. Erosion in that winter, combined with erosion from previous years has resulted in the loss of portions of the public access easement bluff top trail at Del Mar Point, Sea Pine Beach, Main Sail and Rock Cod sections of the coastal bluffs. Konigsmark estimated erosion rates from 1"/year to 6"/years along the bluffs at The Sea Ranch. Vegetation cover at the 32 areas of bluff erosion identified in Konigsmark's report was identified on Google Earth imagery (Table 1). Only three of these sites supported Monterey cypress immediately adjacent to the area of erosion. Of these three, only at one site did Konigsmark report trees to have fallen due to collapse of the bluffs. Coastal scrub and/or grassland occurred at 29 of the bluff erosion sites.

The role of Monterey cypress trees in preventing coastal bluff erosion is difficult to measure without detailed information of the geology underlying the individual cypress stands. It is known that ranchers dumped Monterey cypress prunings over the bluffs in an effort to control bluff erosion. Some Monterey cypress was also planted for

control erosion. Nine percent of the sites of bluff erosion during the winter of 1997-98 were occupied by Monterey cypress, 16% by coastal shrub, 16% by coastal

Table 1. Erosion rates, bluff-top vegetation, and Monterey cypress lost to coastal erosion in the winter of 1997/98.

Bluff Erosion Site*	Rate of Bluff Erosion**	Bluff-top Vegetation	Monterey Cypress Lost in 1997/98
Leeward	Moderate	Monterey Cypress	yes
Broad Reach A	Moderate to fast	Coastal scrub/grass (Monterey cypress not on immediate edge)	Not adjacent
Broad Reach B	Moderate to fast	Coastal scrub/grass	Not adjacent
Broad Reach C	Moderate to fast	Coastal scrub	Not adjacent
Broad Reach D	Slow	Coastal scrub/grass	Not adjacent
Rock Cod	Moderate to fast	Coastal scrub/grass	Not adjacent
Main Sail A	Moderate to fast	Coastal scrub	Not adjacent
Main Sail B	Moderate	Coastal scrub	Not adjacent
Fish Rock	Slow to moderate	Grassland	Not adjacent
Del Mar Point	Slow to moderate	Grassland/Monterey cypress hedgerow	no
Del Mar Ecological Reserve	No indication of bluff Erosion; cited by Konigsmark for erosion of a trench	Coastal scrub	Not adjacent
Sounding A	Slow to moderate	Grassland	Not adjacent
Sounding B	Slow to moderate	Coastal scrub	Not adjacent
Solstice A	Moderate to slow	Grassland	Not adjacent
Solstice B	Slow to moderate	Grassland	Not adjacent
Solstice C	Moderate	Grassland	Not adjacent
Tide Pool A	Slow to moderate	Grassland	Not adjacent
Tide Pool B	Moderate	Grassland	Not adjacent
Sea Drift	Slow to moderate	Grassland	Not adjacent
Foremast A	Slow to moderate	Grassland	Not adjacent
Foremast B	Moderate	Grassland	Not adjacent
Pelican	Moderate	Grassland	Not adjacent
Sea Pine Reach A	Moderate	Grassland	Not adjacent
Sea Pine reach B	Moderate	Grassland	Not adjacent
Walk-on Beach A	Slow to moderate	Grassland/Coastal scrub	Not adjacent
Walk-on Beach B	unranked	Coastal scrub/grassland	Not adjacent
Land's End	Slow to moderate	Grassland	Not adjacent
Breaker Reach A	Slow to moderate	Grassland	Not adjacent

Breaker Reach B	Moderate to slow	Grassland	Not adjacent
Green Cove	Slow to moderate	Grassland	Not adjacent
Smuggler's Cove	Slow	Monterey cypress	no
Galleon's Reach	slow	Grassland	Not adjacent

\* (Konigsmark, 1998); \*\* (fast = 6"/yr; moderate = 3"/yr; slow = 1"/yr)

scrub/grassland, and 59% by grassland. When these percentages are compared to percentage of the bluff edge occupied by different vegetation types (Table 2) there is evidence that Monterey cypress trees have prevented coastal bluff erosion.

Table 2. Vegetation Types along the coastal bluff at The Sea Ranch

Vegetation Type	Percent of total bluff edge*	Number of Units	Average length of units (ft.)
Grassland	73	50	696
Monterey Cypress	13	53	113
Scrub/Grassland	6	15	196
Scrub	4	15	143
Bishop pine/Monterey pine	3	3	452
Willow/Myrtle	1	7	40

\* coastal bluff along The Sea Ranch

The effects of Monterey cypress preventing coastal erosion is apparent along the bluff from Konigsmark's Sounding B site to the Soltice A site (Figure 1). Bluff erosion has carved away the bluffs supporting grassland at each site while the area supporting Monterey cypress between the two sites appears to be resisting erosion. This section of the bluff is characterized by thinly bedded sandstone and shale.



Sounding B

Solstice A

Figure 1. Influence of Monterey cypress on coastal bluff erosion between Sounding B site and Solstice A site

### Comparison of Four Coastal Bluff Units

Four units` typical of the range of characteristics found in the bluff cypress stands at the Sea Ranch were examined for this report. The characteristics of the stands in each unit, their role in controlling coastal bluff and sand dune erosion, and specific management recommendations for the stands at these sites are summarized in Table 3 (see appendix). A brief discussion of each unit and its particular management needs are presented in the following paragraphs.

#### Unit #17

The nine Monterey cypress stands in Unit #17 are typical of many bluff cypress stands that are more or less oriented at a right angle to higher velocity accompanying winter storms (Figure 2). These storms combined with prevailing winds from the west have resulted in the development of a wind foil of branches and foliage on the windward side of the stand and the tipping over of trees within the stand. The trunks and branches of tipped over trees have for the most part remained alive and support living foliage. As a result of the wind, the trees have grown toward the coastal trail and at some points attempted to grow over it. Pruning in certain sections has kept the trail

open, but resulted in near tunnel-like sections of the trail (Figure 3). Past pruning has also been used to keep the height of some units of this site low so that adjacent homeowners may see the ocean. Openings cut through what was once a more or less continuous stand have created the nine separate stands currently on the site.



Figure 2. Unit #17





Figure 3. Monterey cypress growing over coastal bluff trail

A series of images available online from the California Coastal Records Project (<http://www.californiacoastline.org>) illustrate the conditions of the coastal bluff and Monterey cypress planted along the bluff in Unit #17. Image numbers (1972) 7210056, (1987) 8715123, (2002) 12206, and (2005) 200504320 trace the history of the Unit #17 Monterey cypress. Image (1972) 7210056 indicates that the unconsolidated sediments overlying the harder rocks of the Gualala Formation was seriously eroded before the Monterey cypress were planted. The trees appear to have been planted at the edge of the eroded sediments in a more or less continuous line. In subsequent photographs (Images numbers (1987) 8715123, (2002) 12206, and (2005) 200504320 there is good evidence that the trees have prevented further erosion of these sediments and that the original planted row of trees was broken up into separate stands.

Tree branches forming the outer edge of the wind foil are in contact with the ground and have protected the unconsolidated sediments (Figure 4). One can anticipate further erosion of the unconsolidated sediments on top of the bluffs if the protective cover of the Monterey cypress were to be removed and not replaced with appropriate species to protect the surface deposits. Planting a mixture of dwarf coyote brush (*Baccharis pilularis*), bush lupine (*Lupinus arboreus*), coast buckwheat (*Eriogonum latifolium*), wooly sunflower (*Eriophyllum lanatum var. arachnoideum*), California blackberry (*Rubus ursinus*) and beach strawberry (*Fragaria chiloensis*) on two foot centers

will provide a rapidly developing ground cover to protect surface deposits from erosion.



Figure 4. Eroding layer of unconsolidated sediments between the Monterey cypress and the coastal bluff in Unit # 17.

The gaps cut in the original bluff cypress stand has exposed trees adjacent to these openings to the direct effects of the wind. Foliage mortality is evident on many trees at the edges of these openings. This results in an unsightly appearance of the trees and a reduction in their vigor. The gaps between the stands generally support grasses and some coastal shrubs. One often sees, for example in the opening between stands 4 and 5, Monterey cypress saplings that have become established on the exposed unconsolidated sediments. These are growing up and will eventually block the views through the gaps (Figure 5).

In other portion of the Unit #17 bluff cypress site one can observe in-growth into openings by Monterey cypress that will eventually lead to the closure of the openings (Figure 6). This lateral growth of tree branches is not common to all gaps but is found in those smaller gaps at the south end of the site where the orientation of the stands and the small size of the gaps has provided some wind protection to the adjacent trees. These two conditions, growth of Monterey cypress volunteers below the bluff edge and in-growth from trees adjacent to gaps, will lead to the filling of the gaps and the



elimination views out to the ocean. If these gaps are to continue to function, periodic pruning and removal of volunteer saplings will be required.



Figure 5. Monterey cypress volunteers growing on slope below opening in bluff cypress stands.



Figure 6. Closure of gap between stands in Unit #17 due to in-growth by Monterey cypress and growth of volunteer sapling below bluff edge.

The stands of Monterey cypress in Unit #17 provide valuable wind protection for people walking along the coast. The Public Access Trail connects Pebble Beach to Highway 1 and residents of the Sea Ranch who live in Unit #17, as well as other units of The Sea Ranch, use the Coastal Bluff Top Trail. Winds can often exceed 20 mile per hour along the coastal bluff. The respite from the wind offered by these stands is one of their important functions. Removal of these stands would change the experience of the trail not only in terms of some relief from the wind, but also in terms of the visual experience. The sequence of stand openings with their individual views of the ocean contributes variety to the experience of hiking the trails.

A list of 221 birds has been compiled for The Sea Ranch (<http://www.tsra.org/Birds.htm>). Mammals common to the north coast of California also are found at The Sea Ranch. Some of these birds and mammals utilize the stands of bluff cypress in Unit # 17 as well as other units for nesting and protective cover. Some species also derive sources of food from the trees. A more detailed analysis of the habitat value of the bluff cypress would no doubt substantiate the value of these stands as wildlife habitat. Wildlife habitat value should be considered in any decisions concerning the future removal of specific stands.

Where larger stands of bluff cypress in Unit #17, as well as in other units, are encroaching on the bluff trail it is recommended that a more aggressive cutting back of the inland edge of the stands be undertaken. These stands could effectively be hedged back on the landside as much as ½ of their width without compromising their capacity to protect the bluff top from erosion and provide habitat for wildlife. Such removal would not affect the important wind foil on the seaward side of the stands. Within a few years sprouting of the landward side of the stands would restore the green wall which characterizes these bluff

cypress stands. Removal of  $\frac{1}{2}$  of the width of these larger stands would allow for the relocation of the bluff trail away from private property boundaries.

#### Unit#24

The Monterey cypress bluff stands in Unit#24 are characterized by much taller trees than those observed in Unit #17 and by less evidence of trees being toppled by the wind until fairly recently (Figure 7). These stands are oriented parallel to the stronger



Figure 7. Monterey cypress stands along the coastal bluff in Unit #24 (The white line on the photo represents 100' on the ground. Note the wide area of exposed Gualala Formation sandstone and shale between the Monterey cypress and the ocean)

winds and as a result exhibit few horizontal branches that lay on the ground as is the case in the stands in Unit # 17. Trees located in the southernmost portions stands #1 and #4, which wrap around the coastal bluff, have large horizontal branches resembling the trees in Unit#17. The southern portions of these two stands experience wind that is at a right angle to the row of planted trees, as opposed the other trees in these stands that are oriented parallel to the direction of the higher velocity winds. There is evidence of past pruning of some lower branches in these stands (Figure 8).





Figure 8. Pruning scars on trees in Unit # 24.

Comparison of images available from the California Coastal Records Project [images 721004 (1972), 7917065 (1979), 8715222 (1987), 12173 (2002), and 200504284 (2005)] indicate pruning of the stands took place between 1979 and 1987. These photos show that erosion of the unconsolidated sediments has occurred where drainages reach the edge of the coastal terrace, but evidence of erosion adjacent to the Monterey cypress trees is difficult to detect.

The combination of orientation to the wind and past pruning practices has shaped the stands in Unit # 24 into tall stately rows of trees. As these trees reach the age of over maturity for the species (ca. 150 years) one can expect increasing wind throw and wind breakage.

One tree in Unit # 24 was observed to have been undermined by erosion of the unconsolidated sediments on the coastal terrace and has toppled down onto the consolidated sandstones and shale of the Gualala Formation. The coastal bluff in Unit # 24 contrasts with that in Unit # 17 by lack of an abrupt edge to the consolidated rock beneath the unconsolidated sediments (Figure 9). The exposed sandstone and shales of the Gualala Formation form a relatively gentle slope, nearly 100' wide at some locations, from the unconsolidated sediments down to the water. One sees more of a vertical escarpment at the edge of the unconsolidated sediments than one sees in the exposed sandstone and shale beds (Figure 9). The exposure of tree roots along the edge of the

unconsolidated sediments indicates the trees have been undermined by erosion of these sediments and not by a collapse of the coastal bluff due to the erosion of rocks in the Gualala Formation. Trees in the stands have not formed a wind foil over the edge of the sediments, as is the case in Unit # 17, due to wind direction. Without this wind foil to protect the edge of the unconsolidated sediments one can expect further undermining



Figure 9. Variation in steepness of unconsolidated sediments and consolidated beds of sandstone and shale in the Gualala Formation

by wave action during violent storms. In the gap between stands # 4 and 5 in Unit # 24 a dense cover of lupine and baccharis covers the ground surface and has prevented the erosion of the unconsolidated sediments. This suggests native shrub species can function to provide erosion control along the top of the bluffs.

A potential exists for encroachment of the limbs of a few trees in Unit #24 onto the coastal bluff trail. A few trees have branches lying on the ground and these will eventually reach out to the trail.

Tree thinning and pruning have opened up filtered views through some of the stands in Unit # 24 (Figure 10). Tree vigor has not been impaired by this action because of the size of the trees and their orientation to the wind. The amenity and wildlife





Figure 10. Stand thinned and pruned to provide filtered view of the ocean in Unit # 24

values described for stands in Unit #17 are applicable to the stands in Unit #24. Excessive pruning and tree thinning can compromise these values.

### Unit # 28

The Monterey cypress stands in Unit # 28 were planted to control the movement of sand dunes on the coastal terrace (Figure 11). The stands, therefore, differ from those in Units # 17 and # 24 due to their positions further inland from the coastal bluffs



Figure 11. Unit # 28.

and the sand that has accumulated under the trees. This sand has blown in from Walk-On Beach at the northern end of the site. Four stands in this unit were examined for this report because of the role in controlling sand movement. All of these stands have been successful in arresting sand movement. Comparison of California Coastal Records Project images [721042 (1972), 7917059 (1979), 8715226 (1987), 12160 (2002), 200504269 to 200504271 (2005)] indicate that stands 1A, 1B, and 8 had been planted prior to 1972. At that time they were smaller in extent than at present and the trees were much shorter. The 1972 image clearly shows the area of sand that these and subsequent stands of Monterey cypress were planted to control. The most recent image (2005) available from



the California Coastal Records Project illustrates the success of these stands in controlling sand movement. The areas of sand shown in the 1972 image that are leeward of the stands of Monterey cypress are now for the most part covered with lupine.

Pruning or thinning these stands should be held to a minimum in order not to lose the control these stands have over sand movement. It would be possible to remove the stand (#1A) farther to the north and replace it with lupines or wax myrtle to provide wind protection to the sandy area leeward of this stand. Because of the height of the sand dunes adjacent to the other stands in Unit # 28 it would be difficult to replace the Monterey cypress with either lupine or wax myrtle and get successful erosion control. The depth to water table beneath here is too great for the establishment of the shrub species and the height of the dune puts it into higher velocity winds.

### Unit # 35E

A hedgerow was planted by the rancher at what is now the northern end of The Sea Ranch is the focus of Unit 35E (Figure 12). Examination of images available from the California Coastal Records Project [ 7210029 (1972), 7917040 (1979), 8715238 (1987), 12117 (2002), 200504218 (2005)] suggests the western-most trees in this hedgerow were planted within about 6 feet of the edge of the bluff. An additional row of young cypress appears in the 1972 image along the edge of the bluff to the south of the Hedgerow. Some bluff erosion occurred, but none of hedgerow trees appear to have been



Figure 12. Hedgerow at north end of Unit # 35E

undermined in the 1987 photographs. In the winter of 1997/98 trees at the end of hedgerow were reported by Konigsmark to have fallen as a result of a 30' long section

of the bluff being undermined. The rocks forming the consolidated formation along the bluff are thick sandstone beds in the German Ranch Formation. Collapse of the bluff at this location has been exacerbated by the presence of a fault zone occurring at the border of The Sea Ranch property.

It should be noted that 24 of the 32 locations where coastal bluff erosion occurred in 1997/89 were on the German Ranch Formation. These suggest that coastal bluff cypress stands on this formation may be more vulnerable to being undermined than stands on the Gualala Formation.

Management of the trees at the outer edges of Monterey cypress hedgerows or in coastal bluff stands situated on the more vulnerable German Ranch Formation probably will not influence the stability of these trees. The wind foil edges of these stands will protect the unconsolidated sediments on the top of the bluffs from eroding, but will not prevent the undermining the bluffs in the German Ranch Formation. Tree removal might be in order at these locations to prevent the trees from tearing out sections of the unconsolidated sediments on top of the bluff when they fall into the ocean or onto the rocks at the base of the bluffs. Protection of the trees in such locations would require mechanical solutions, such as sea walls of concrete or gabions that shore up the bluffs. However, I do not recommend that The Sea Ranch pursue this direction in coastal bluff management. It would be best of recognize the weakness of the bluffs in the German Ranch Formation and be prepared to move the coastal trail inland as erosion proceeds. Some existing Monterey cypress will be lost to the erosion, but the cost of building and maintaining of sea walls will never prove cost effective.

### **Long-term Strategies for Managing Coastal Bluff Cypress Stands**

The Sea Ranch should adopt a long-term strategy for the management of the coastal bluff cypress stands. With time the functional value of individual stands will diminish as trees become over mature and are damaged by storms. Once the integrity of a stand is compromised by the death of one or more critically located trees the entire windbreak will begin to fall apart. Although individual Monterey cypress trees have reportedly lived to an age of 375 years (Green, 1997), one would not expect tree in the coastal bluff stands to attain such an old age. The current trees that were planted by local ranchers are probably going to be functional for windbreaks, erosion control, and wildlife habitat for about 20 to 50 more years. Because of the value of the existing stands in protecting the unconsolidated materials on top of the bluff from erosion they should be replanted over time.

Replacement planting should follow the removal of existing trees and the protection of the soil at the margins of the coastal bluffs with jute matting. One to three gallon-sized trees should be planted in the jute matting on six-foot center in offset rows. No more than four rows of trees should be planted even though existing stands may be more than 24 feet wide. Wind screening of planted trees with geo-fabric will be required during the establishment phase of tree growth. Irrigation will also be required during the first few growing seasons.

Windbreak function of Monterey cypress windbreaks begins to deteriorate after 50 years due to the natural pruning of the lower branches of the trees. A rotation age of 50 years is, therefore, recommended for the bluff cypress stands at The Sea Ranch. Since there are now 53 bluff cypress stands present, one or more stands could be cut down and replanted each year for 50 years. Then the process could be repeated. This would tend to equalize the cost and effort in managing the stands over the long run, although differences in the size of the stands would influence the annual removal and planting costs.

As a part of the long-term management of the bluff cypress stands, it would be appropriate to develop neighborhood associations to discuss the management of bluff cypress stands adjacent to their homes. These groups could participate in charrettes to explore alternatives for managing views out to the ocean and ways of financing maintenance of coastal bluff vegetation.

### **Conclusions and Recommendations**

Analysis of Monterey cypress stands in four units along the coastal bluffs at The Sea Ranch indicated that these stands have been effective in controlling erosion of the unconsolidated sediments and sand dunes on the coastal terrace. These stands serve add to the comfort and experience of people hiking along the coastal bluff trails and provide a varied habitat for wildlife. At the same time the growth of trees in these stands precludes views of the ocean from many houses and in some locations the trees are encroaching on the bluff top trail.

Images from the California Coastal Records Project show that very few houses had been built on the coastal terrace when the first photos were taken in 1972. It is unlikely that many of the houses appearing on the images in 1979 and 1987 would have had a view over the bluff cypress stands except from their second floors. The current requests to top or remove cypress will open views to the ocean. Evidence from the California Coastal Records Project indicates that views did not previously exist from most of the houses that were constructed adjacent to Monterey cypress bluff stands. The cypress trees in the bluff stands have become icons like the Monterey cypress hedgerows at The Sea ranch. Removal, heavy thinning, and/or pruning of trees (to provide views to the ocean) in these stands will diminish their functional values as wildlife habitat and erosion control agents. Hikers who enjoy the protection from the wind and the scenic variety these bluff cypress stands provide, will also be effected by their removal from the bluff.



The Monterey cypress stands should be managed by removal of storm-damaged branches that could potentially fall onto adjacent sections of the coastal trail. Moderate amounts of thinning to reduce competition between trees and pruning to prevent encroachment onto trails should be allowed under supervision. Removal of trees to provide new view corridors should be permitted only in certain locations. These would include sites where the bluff cypress have not formed a wind foil edge that is protecting the unconsolidated sediments on top of the bluff, where additional opening will not fragment the bluff cypress stands into units less than 100 feet long, and where the openings would be served to provide views out to the ocean for more than one dwelling. It will be necessary to prune the edges of stands to keep existing view corridors open, but this pruning should be limited to green materials (leaves and small branches). This work should be done by staff of the Sea Ranch or arborists under the direction of The Sea Ranch. Removal of volunteer cypress saplings will also be required where these are growing up to block views. When saplings are removed the space they occupied should be replanted with dwarf baccharis or lupine to provide erosion protection.

The Monterey cypress trees in the bluff stands are approaching their middle age. They can be expected to survive at least another 50 years. However, many of the stands have decreased windbreak and erosion protection value due to the condition of the trees. A long-range management plan to remove and replant the stands on a 50-year rotation is proposed. The participation of neighborhood groups is encouraged to get an understanding of the management issues regarding coastal bluff vegetation, neighbor input into the planning and management process, and explore ways of financing bluff vegetation management.

### **Literature Cited**

BACE Geotechnical. 1999. Engineering Geologic Evaluation. Phase I: Identification of problem areas, Coastal bluff erosion at the Sea Ranch, California. BACE Geotechnical a division of Brunising Associates. Windsor, CA.

BACE Geotechnical. 2005. Reports concerning five erosion sites at The Sea Ranch (Sites 43A & 43B - Sea Pine Reach, May 20, 2005; Site 60A - Del Mar Point, May 26, 2005; Site 69A - Main Sail, May 24, 2005; Site 72A - Rock Cod, May 25, 2005; Site 74A - Broad Reach May 20, 2005). BACE Geotechnical a division of Brunising Associates. Santa Rosa, CA

Cleveland, M. 2004. Bluff Top Trail and Public Access Easements in The Sea Ranch. Sonoma County Regional Parks. Santa Rosa, CA

Geddes, S. 1995. Visual Analysis of Coastal bluff Cypress stand at the Sea Ranch.

Green, N. 1997. Tree known as 'Grandpa' finally comes down. Los Angeles Times. Pp. B-2. August 5, 1997

Konigsmark, T. 1998. Erosion of The Sea ranch Bluff, a geologic overview. Letter to The Sea Ranch.

McBride, J. R. and D. Gerhard. 1991. The Sea Ranch Vegetation management Report. McBride and Gerhard. Landscape Ecologists. Albany, CA.

Sonoma County Regional Parks Meeting (2007).

<http://www.tsra.org/BluffTopTrail%20Erosion.htm#other>

<http://www.tsra.org/Birds.htm> (2007). List of birds at The Sea Ranch and Immediate Vicinity.

Appendix: Table 3. Characteristics of bluff cypress stands in Units 17, 24, 28, and 35E

Site	Stand #	Length	Width	Tree Height	Trail Encroachment	Trees blocking view of Ocean	Erosion Control	Tree Condition	Previous Management	Recommendations
Unit 17	1	300'	35-70'	18-20'	yes	Lots 7-3-4 7-3-5	Effective at protecting unconsolidated sediments on top of Gualala formation	Good: Some downed, split trunk in interior, but not dead	Topping: Side pruning	Maintain; stand not being under cut by wave action
	2	40'	30'	10-12'	no	Lots 7-3-4 7-3-3	Compromised by loss of canopy cover	Poor: foliage exposed by pruning is dying	Home owners Pruned trees up 5-6' from ground	Remove trees as they die from pruning exposure
	3	135'	35'	30'	yes	Lots 7-3-3 7-3-2 17-14	Effective at protecting unconsolidated sediments on top of Gualala formation	Good: some downed, split trunk in interior, but not dead	North end of Stand "stair-stepped" by pruning	Remove dead branches over-hanging trail
	4	115	20'	30-35'	yes	Lots 7-3-2 17-13 17-14	Effective at protecting unconsolidated sediments on top of Gualala formation	Good	Pruning to prevent trail encroachment	Prune growth at north end to prevent closure of gap
	5	155'	30'	35'	yes	Lots 17-11 17-12 17-13 17-14	Effective at protecting unconsolidated sediments on top of Gualala formation	Good, downed trunks in stand interior, but still alive. Branches adjacent to north end have dying foliage due to wind exposure by pruning	Tree removal and pruning at north and south ends of stands to open view corridor	Maintain stand as important trail wind break; prune to prevent encroachment on trail
	6	110'	30'	45'	Yes, by horizontal branches	Lots 17-10 17-11 17-12	Trees currently securing edge of bluff, trees in this stand have previously top-pled into the ocean. High	Good	Tree pruned and thinned many years ago	Re-establish stand 20' to the north, cut existing trees along bluff edge to prevent their falling into ocean and





Unit 28	9	100'	80'	17'	yes	Lot 28-89	No, located back from bluff	Good	Trees have been pruned on south end of stand	Do not prune wind fall branches on north and west sides, prune south side no more than 8'	is a key stand along with stand #4 to prevent erosion of cove at end of trail used by homeowners to reach ocean and Shell Beach
	8	150'	80'	55'	Overtops trail	Lots 28-86 28-87 28-88 28-29	No, located back from bluff. Stand has helped to prevent movement of adjacent sand dune onto lots 24-89	Good, downed trunks in stand interior, but still alive. Stand is very dense and could tree vigor could be improved by thinning	Pruning and Clean up operations to maintain trail through stand	Thin trees marked with orange paint. Trail maintenance as necessary to remove tree debris from trail	
	1-B	200'	40'	31'	no	Lots 28-83 28-84 28-85 28-86 28-87 However, the dune on which this stand is growing will obstruct views from the lower floors	Effective in preventing erosion of sand dune and its migration inland	Good, some interior trunks on the ground and wind split trunks, but still supporting live foliage	Some pruning of dead branches	Minimal removal of a few trees and branches to improve tree vigor. Avoid opening stand to provide filtered view corridor	
	1-A	110'	100'	8-10'	no	Lots 28-83 28-84 28-85	Effective in preventing erosion	Good	Top pruned in the past to provide view to	Remove stand and replace with wax myrtle	

Unit 55E	End of Hedge-row	NA	NA	70-80'	Overtops trail	NA	of sand dune and its migration inland	Have not been effective in preventing bluff erosion	Good	ocean	<p>German Ranch Formation at this Location will continue to erode and undermine trees at end of hedgerow. Best tree management would be to remove trees adjacent to bluff to prevent their roots from tearing away bluff when they fall into the ocean</p> <p>Pruned to allow for coastal trail</p>
----------	------------------	----	----	--------	----------------	----	---------------------------------------	---	------	-------	---