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**Executive Summary of 2003**  
**Corvid Monitoring Surveys**  
**In The Santa Cruz Mountains**

Prepared for

**Command Oil Spill Trustee Council**  
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## INTRODUCTION

Corvid monitoring surveys conducted in 2003 for the Command Oil Spill Trustee Council (COSTC) at Big Basin Redwoods State Park, Portola Redwoods State Park, Butano State Park, and San Mateo County Memorial Park (Figure 1). These surveys were commissioned to assist the COSTC in restoration planning for potential projects benefiting the marbled murrelet (*Brachyramphus marmoratus*), including corvid management.

This study compares corvid populations in murrelet nesting habitat within campgrounds (treatment areas) to corvid populations in such habitat in areas located away from campgrounds (control areas). It also provides a baseline from which to judge future changes in numbers related to corvid management projects.

## METHODS

Seven treatment areas and 12 control areas were established in each park (Table 1; Figures 2 to 5). Survey areas were in coast redwood forest known to support use by marbled murrelets, with nesting known or suspected to occur either in or immediately adjacent to the survey area. Treatment areas included standard campgrounds and their immediate surroundings. Control areas were located a minimum of 300 meters from any campground, picnic area, or residential community.

Four surveys were conducted in each area, with one survey in June, two in July, and one in August. Surveys occurred from 35 minutes after sunrise up to four hours after sunrise. Each area was surveyed using the total area search method. The search area at the campgrounds included the entire area of campsites and extended outward 50 meters from the edge of those uses. Control areas were established along roads and trails, and the search area extended outward for 50 meters from the center of the road or trail. David Suddjian conducted all the surveys. Surveys were done by walking slowly through the survey area and pausing often for brief periods, listening for vocalizations and making visual scans to detect corvids. Each jay and raven was recorded, indicating its age if known. Behavior of jays and ravens was recorded in notes, particularly as it related to foraging.

Analyses comparing treatment and control areas used only the maximum number of corvids detected on any of the four surveys of each area

## **RESULTS**

### **STELLER'S JAY**

Survey results and statistical comparisons for each park are given on Tables 2 and 3. Steller's jays were recorded in all survey areas. They were particularly ubiquitous in treatment areas, where overall they were 10.0 times more numerous than in control areas, with the difference being highly significant (Table 3). The higher numbers in treatment areas compared to controls was significant for each park (Table 3). Jay density was positively correlated with the total number of sites in a campground, and the number of sites that were occupied during the surveys.

Jays were observed taking advantage of spilled garbage, stealing unattended food in camps, and being fed directly by campers. Most campers stored food properly in containers and storage lockers, but improper storage or spilled trash were everyday occurrences in the campgrounds. People were seen feeding the jays (and squirrels and chipmunks) everyday in camp, although it was uncommon during the early morning surveys. Jays were seen eating a wide variety of human food.

Jay productivity appeared to be below normal in all of the surveys areas in 2003, and juveniles did not appear until late in the season. The seasonal increase in juvenile jays in the campgrounds was statistically significant, but no significant increase was evident in the control areas. Similarly, jay density increased over the season at all campgrounds, but densities in control areas showed no consistent pattern among sites. It is likely that the seasonal increase at campgrounds was due to adults and juveniles congregating at those areas, after leaving breeding and natal territories located away from campgrounds.

### **COMMON RAVEN**

Survey results and statistical comparisons for each park are given on Tables 4 and 5. Common ravens were recorded in six of the seven treatment areas, but at just 50% of the 12 control areas. Among the treatment areas they were only consistently found at Huckleberry, Portola, and Sequoia Flat. Control areas usually only had ravens detected on just one of the four survey replicates, if at all.

Ravens were generally uncommon. Most surveys recorded only one or two individuals, if any, less frequently three, and rarely four. Overall, they were 2.4 times more numerous at campgrounds than control areas, but the difference was only marginally significant (Table 5). They were statistically more numerous in campgrounds than in control areas at Portola and Memorial, but not at Big Basin or Butano. Unlike the jays, raven density did not increase over the season. This was likely due to decidedly low productivity in 2003.

Ravens were most frequently seen perched, or patrolling along roads and through the campgrounds. They visited open and spilled trashcans at Memorial CP, and were often present where trash was spilled from dumpsters by squirrels at Big Basin. They routinely searched through campsites shortly after campers vacated them, but avoided people and handouts.

## **DISCUSSION AND RECOMMENDATIONS**

Future survey efforts should at least match those of 2003, with four surveys from June to August.

A similar corvid survey program, using the same methods and sampling the same areas, was undertaken in 2002. Ravens were three times more numerous in 2002 than in 2003, with most of the difference evident in treatment areas. Raven productivity was much greater in 2002, when all pairs fledged three or four young. Jays were similarly numerous in both years, in both treatment and control areas.

Trash management was best at Portola Redwoods SP, and worst at Memorial County Park. Behavior of campers was similar in all the parks, and food is essentially continually available at campgrounds. All the parks provide information to campers to encourage them to properly store food and not to feed the wildlife, but this educational effort was generally passive. A much more intensive educational program to ensure proper care of trash and food waste, food storage, and to curtail wildlife feeding should be developed and implemented.

**Table 1. Attributes of the corvid survey areas.**

Survey Area	Type	Human	Access <sup>1</sup>	Area (ha)	Slope Position <sup>2</sup>	Approx. Elevation	<i>Canopy Composition</i> <sup>3</sup>					
		Use					RW	DF	TO	ILO	MA	Other
<i>Big Basin Redwoods SP</i>												
Blooms Creek	Treatment	Camp	1	15.7	B	900–1,120'	1	2	1	2	3	3
Sempervirens	Treatment	Camp	1	7.2	B	960-1,080'	1	2	1	2	3	--
Huckleberry	Treatment	Camp	1,2	13.4	B	980-1,160'	1	2	1	1	2	--
Wastahi	Treatment	Camp	1,3	7.2	B	1,020-1,250'	1	2	1	--	--	--
Opal Creek 1	Treatment	Picnic	1	24.1	B	950-1,180'	1	2	1	2	3	3
Opal Creek 2	Control	Hiking	1	10.2	B	1,050-1,180'	1	2	1	3	3	3
Opal Creek 3	Control	Hiking	3	6.6	B	1,075-1,225'	1	2	1	3	3	3
Gazos Creek Road 1	Control	Hiking	2	9.4	S	1,120-1,280'	1	2	1	2	2	--
Gazos Creek Road 2	Control	Hiking	2	6.7	S	1,240-1,350'	1	1	1	2	2	--
Gazos Creek Road 3	Control	Hiking	2	7.5	S	1,140-1,320'	1	2	1	2	2	--
Gazos Creek Road 4	Control	Hiking	2	7.5	S	960-1,180'	1	2	1	2	2	--
<i>Portola Redwoods SP</i>												
Portola	Treatment	Camp	1	8.4	B	350-560'	1	2	1	1	3	3
Peters Creek	Control	Hiking	1,3	7.7	B	400-600'	1	2	1	2	3	3
Iverson Trail 1	Control	Hiking	3	7.1	B	320-520'	1	2	1	2	2	3
Iverson Trail 2	Control	Hiking	2,3	6.9	B	350-520'	1	2	1	3	3	3

*Continued on next page,*

*Table 1, continued*

Survey Area	Type	Human Use	Access <sup>1</sup>	Area (ha)	Slope Position <sup>2</sup>	Approx. Elevation	<u>Canopy Composition</u> <sup>3</sup>					
							RW	DF	TO	ILO	MA	Other
<b><i>Butano SP</i></b>												
Ben Ries	Treatment	Camp	1,3	9.6	B	400-650'	1	2	1	3	3	--
Butano Service Road	Control	Hiking	2	8.1	B	500-670'	1	2	1	3	3	3
Goat Hill Trail	Control	Hiking	3	3.2	S	620-840'	1	2	1	2	3	--
Doe Ridge Trail	Control	Hiking	3	15.7	S	880-1,120'	1	1	1	2	3	--
<b><i>Memorial CP</i></b>												
Sequoia Flat	Treatment	Camp	1	12.6	B	180-280'	1	2	1	2	--	2
Tan Oak Flat	Treatment	Picnic	1	7.9	B	200-280'	1	2	2	1	3	3

1. Access: 1 (paved road), 2 (unpaved road), 3 (trail).

2. Slope position: B (bottom of valley), S (mid-slope), R (ridgeline).

3. Approximate canopy cover by each tree species, classed as 1 (50-100%), 2 (11-49%), 3 (1-10%). Tree species: RW (coast redwood), DF (Douglas-fir), TO (tan oak), ILO (interior live oak), MA (madrone), other (includes California bay, red alder, white alder, and big leaf maple)

**Table 2. Number of Steller's jays per hectare on the 2003 surveys.**

<b>Survey Area</b>	<b>Run 1</b>	<b>Run 2</b>	<b>Run 3</b>	<b>Run 4</b>	<b>Max</b>	<b>Avg</b>	
<i>Big Basin Redwoods SP</i>							
Blooms		1.59	2.99	3.63	5.92	5.92	3.54
Sempervirens		1.53	3.47	4.58	7.50	7.50	4.27
Huckleberry							3.06

	3.36
	3.58
	7.61
	<i>7.61</i>
	4.40
Wastahi	
	1.39
	0.28
	0.56
	3.19
	<i>3.19</i>
	1.35
Opal 1	
	0.71
	0.50
	0.21
	0.87
	<i>0.87</i>
	0.57
Opal 2	
	0.29
	0.29
	0.20
	0.10
	<i>0.29</i>
	0.22
Opal 3	
	0.61
	0.00
	0.30
	0.00
	<i>0.61</i>
	0.23
Gazos 1	
	0.43
	0.43
	0.32
	0.11
	<i>0.43</i>
	0.32

Gazos 2

0.00  
0.30  
0.30  
0.15  
*0.30*  
*0.19*

Gazos 3

0.13  
0.53  
0.40  
0.00  
*0.53*  
*0.27*

Gazos 4

0.40  
0.27  
0.27  
0.40  
*0.40*  
*0.33*

*Portola Redwoods SP*

Portola

0.83  
2.86  
2.86  
4.40  
*4.40*

	2.74
Peters	0.39
	0.52
	0.39
	0.39
	0.52
	0.42
Iverson 1	1.13
	0.70
	0.85
	0.85
	1.13
	0.88
Iverson 2	0.43
	0.29
	0.72
	0.29
	0.72
	0.43
<i>Butano SP</i>	
Ben Ries	2.29
	3.33
	3.65

	4.69
	4.69
	3.49
Service	
	0.49
	0.99
	0.37
	0.49
	0.99
	0.59
Goat Hill	
	1.25
	0.94
	0.63
	0.94
	1.25
	0.94
Doe Ridge	
	0.38
	0.76
	0.32
	0.32
	0.76
	0.45
<i>Memorial CP</i>	
Sequoia	
	3.65

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	<del>5.63</del>
	8.49
	14.21
	<i>14.21</i>
	8.00

Tan Oak

- 1.39
- 1.01
- 1.90
- 0.89
- 1.90*
- 1.30*

**Table 3. Comparison of numbers of Steller's jays between treatment and control areas.**

Survey Area	Avg/ha <sup>1</sup>	S.E.	N	Statistical Significance
<b><i>All parks combined</i></b>				
Treatment	6.8	3.7	7	t = 5.9, p <sup>(1-tailed)</sup> < 0.0001
Control	0.7	0.3	12	
<b><i>Big Basin Redwoods SP</i></b>				
Treatment	6.1	2.1	4	t = 3.4, p <sup>(1-tailed)</sup> = 0.004
Control	0.4	0.1	6	
<b><i>Portola Redwoods SP</i></b>				
Treatment	4.4	0.0	1	t = 10.1, p <sup>(1-tailed)</sup> = 0.005
Control	0.8	0.3	3	
<b><i>Butano SP</i></b>				
Treatment	4.7	0.0	1	t = 13.0, p <sup>(1-tailed)</sup> = 0.002
Control	1.0	0.2	3	
<b><i>Memorial CP</i></b>				
Treatment	14.2	0.0	1	t = 130, p <sup>(1-tailed)</sup> < 0.0001
Control <sup>2</sup>	0.4	0.1	4	

1. Average of maximum counts from each survey area.
2. Controls for Memorial CP were located in Big Basin Redwoods SP.

**Table 4. Number of common ravens per hectare on the 2003 surveys.**

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<b>Survey Area</b>	<b>Run 1</b>	<b>Run 2</b>	<b>Run 3</b>	<b>Run 4</b>	<b>Max</b>	<b>Avg</b>
<b><i>Big Basin Redwoods SP</i></b>						
Blooms	0.19	0.19	0.00	0.00	0.19	0.10
Sempervirens	0.14	0.00	0.00	0.00	0.14	0.03
Huckleberry	0.22	0.22	0.22	0.22	0.22	0.22
Wastahi	0.00	0.00	0.00	0.00	0.00	0.00
Opal 1	0.17	0.12	0.12	0.04	0.17	0.11
Opal 2	0.00	0.00	0.10	0.00	0.10	0.02
Opal 3	0.00	0.45	0.00	0.00	0.45	0.11
Gazos 1	0.00	0.00	0.00	0.00	0.00	0.00
Gazos 2	0.00	0.00	0.00	0.00	0.00	0.00
Gazos 3	0.00	0.13	0.13	0.00	0.13	0.07
Gazos 4	0.00	0.00	0.00	0.00	0.00	0.00
<b><i>Portola Redwoods SP</i></b>						
Portola	0.00	0.48	0.36	0.36	0.48	0.30
Peters	0.00	0.13	0.00	0.00	0.13	0.03
Iverson 1	0.00	0.00	0.14	0.00	0.14	0.04
Iverson 2	0.00	0.00	0.00	0.00	0.00	0.00
<b><i>Butano SP</i></b>						
Ben Ries	0.10	0.00	0.00	0.10	0.10	0.05
Service	0.12	0.12	0.00	0.00	0.12	0.06
Goat Hill	0.00	0.00	0.00	0.00	0.00	0.00
Doe Ridge	0.00	0.00	0.00	0.00	0.00	0.00
<b><i>Memorial CP</i></b>						
Sequoia	0.16	0.24	0.32	0.40	0.40	0.28
Tan Oak	0.25	0.38	0.25	0.25	0.38	0.28

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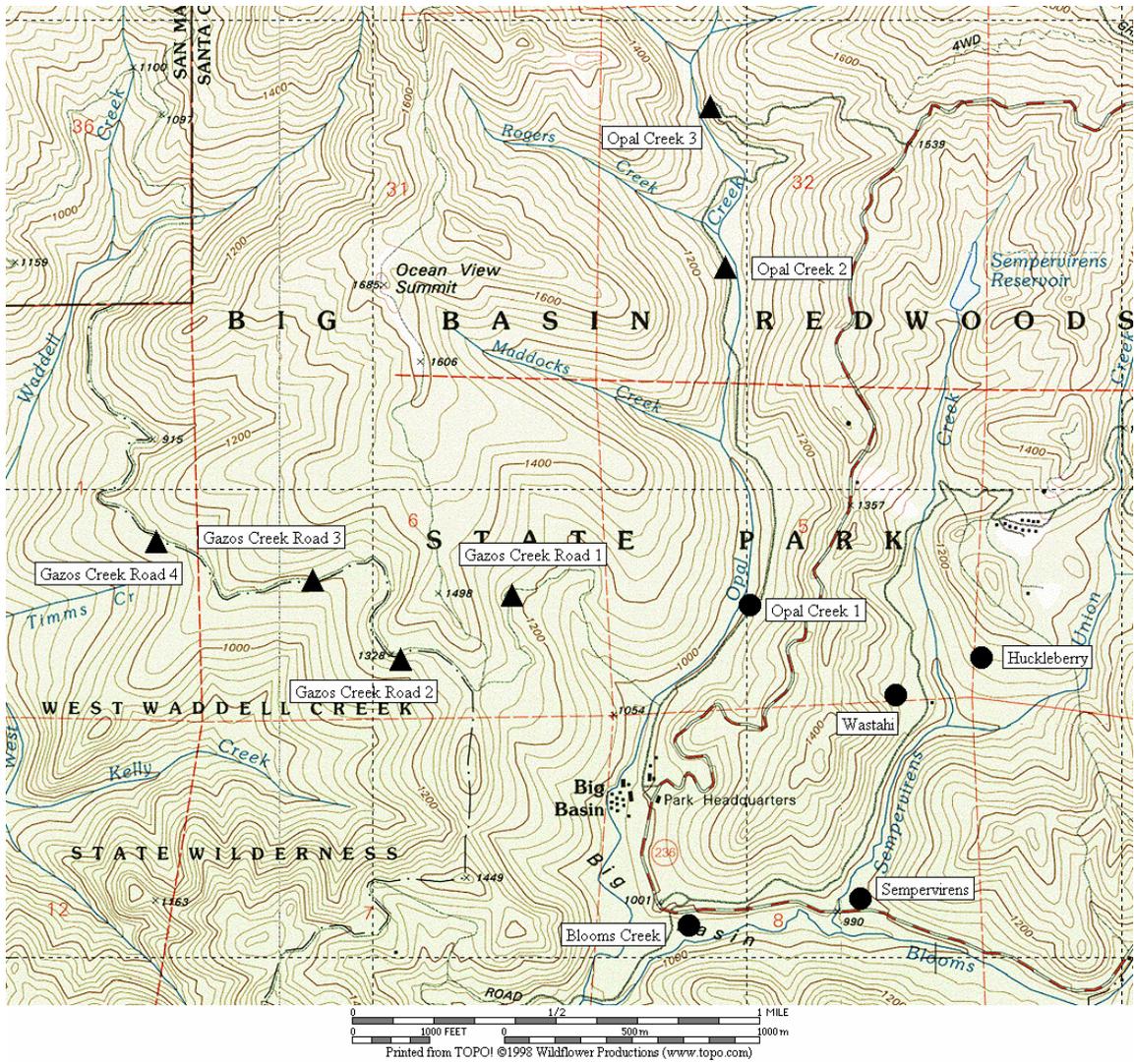
**Table 5. Comparison of numbers of common ravens between treatment and control areas.**

Survey Area	Avg/ha <sup>1</sup>	S.E.	N	Statistical Significance
<b><i>All parks combined</i></b>				
Treatment	0.22	0.16	7	t = 1.9, p <sup>(1-tailed)</sup> = 0.077
Control	0.09	0.14	12	
<b><i>Big Basin Redwoods SP</i></b>				
Treatment	0.14	0.10	4	t = 0.4, p <sup>(1-tailed)</sup> = 0.968
Control	0.11	0.18	6	
<b><i>Portola Redwoods SP</i></b>				
Treatment	0.48	0.0	1	t = 4.3, p <sup>(1-tailed)</sup> = 0.025
Control	0.09	0.08	3	
<b><i>Butano SP</i></b>				
Treatment	0.1	0.0	1	t = 0.8, p <sup>(1-tailed)</sup> = 0.266
Control	0.04	0.07	3	
<b><i>Memorial CP</i></b>				
Treatment	0.4	0.0	1	t = 15.6, p <sup>(1-tailed)</sup> <0.007
Control <sup>2</sup>	0.03	0.07	4	

1. Average of maximum counts from each survey area.
2. Controls for Memorial CP were located in Big Basin Redwoods SP.

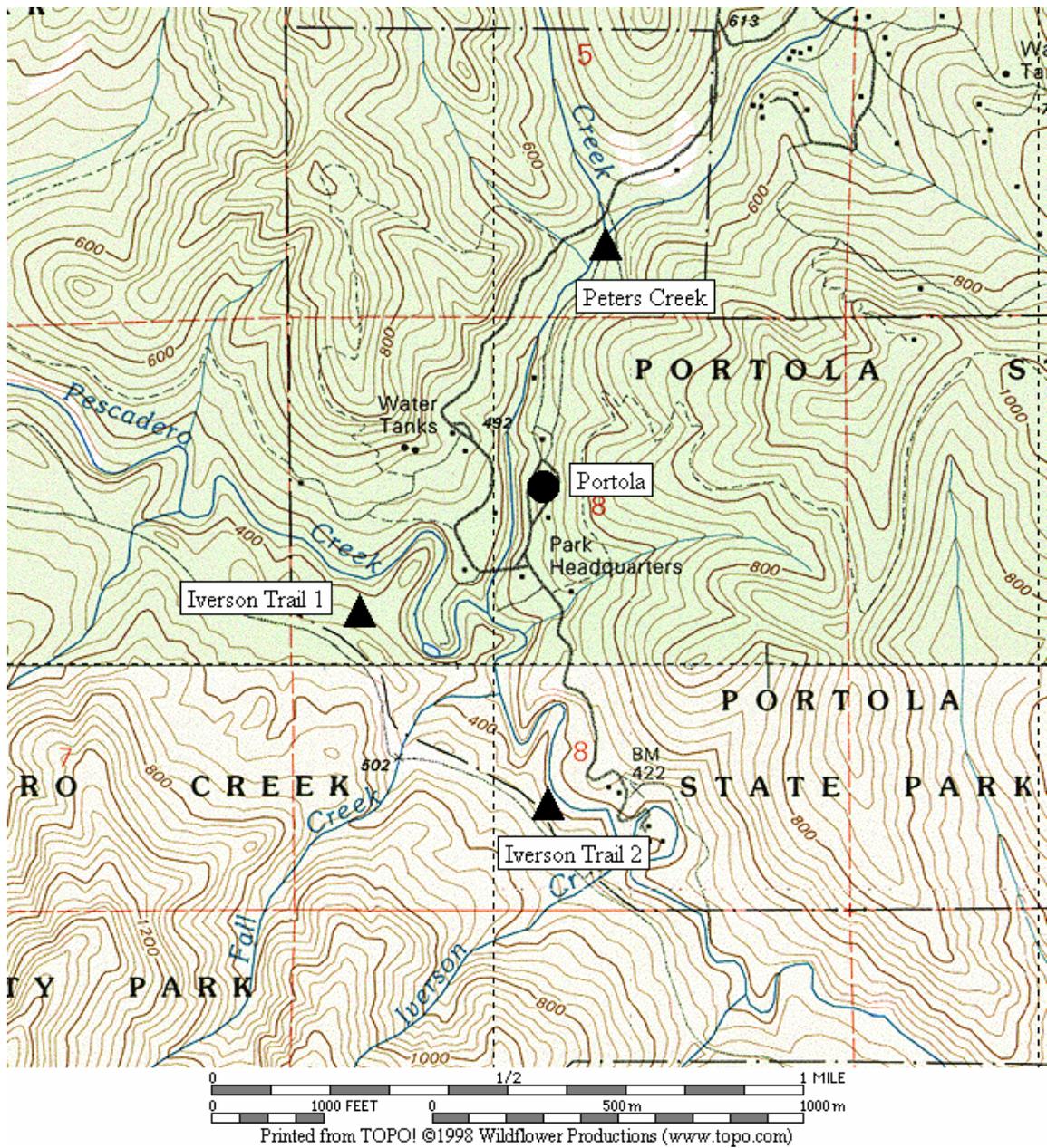


**Figure 1. General location of survey areas.**



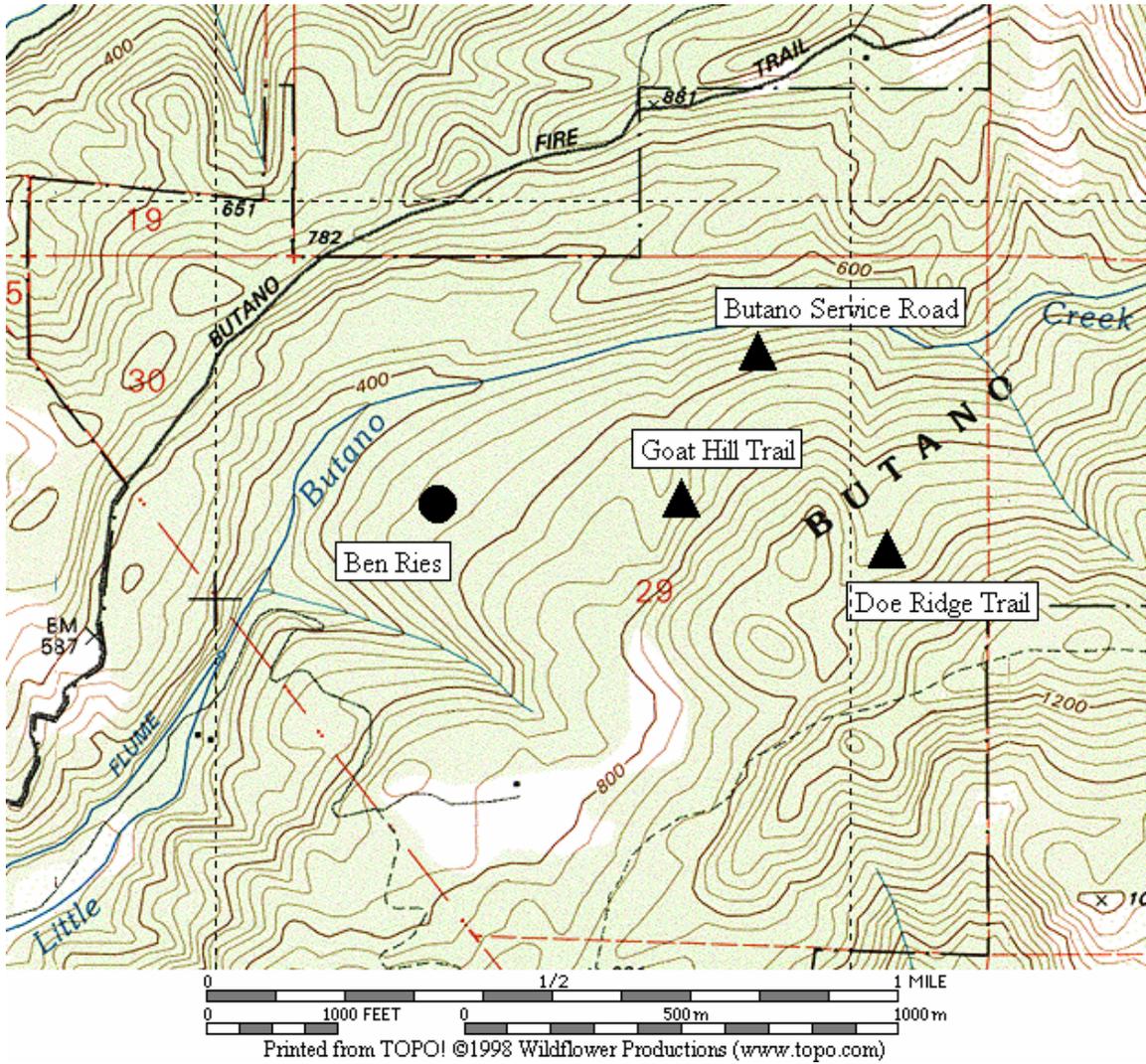
**Figure 2. General location of corvid surveys area at Big Basin Redwoods State Park.**

● treatment sites    ▲ control sites



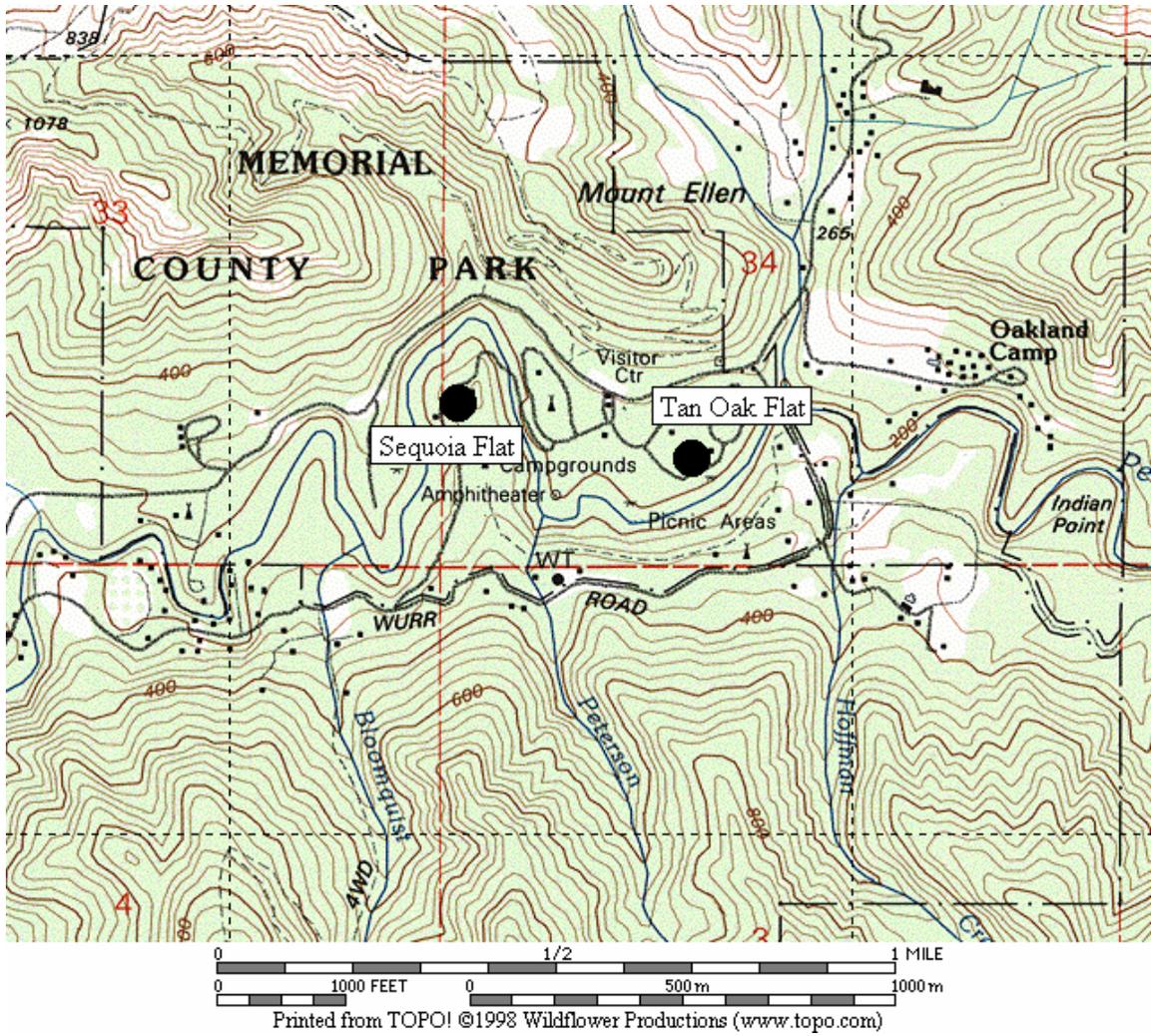
**Figure 3. General location of corvid surveys area at Portola Redwoods State Park.**

● treatment sites    ▲ control sites



**Figure 4. General location of corvid surveys area at Butano State Park.**

● treatment sites    ▲ control sites



**Figure 5. General location of corvid surveys area at San Mateo County Memorial Park.**

● treatment sites