Appendix B

Ohlone Tiger Beetle Habitat Assessment

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18 February 2002

Cheryl Tillotson, Esq.
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RE: UCSC Campus-Wide Habitat Assessment for the Ohlone Tiger Beetle

Dear Cheryl:

This letter describes the findings of my recently completed surveys at the University of California's Santa Cruz (UCSC) campus to evaluate existing habitats there for the endangered Ohlone Tiger beetle, *Cicindela ohlone* (Coleoptera: Cicindelidae). This campus-wide habitat assessment expands upon several prior surveys that I have conducted for UCSC in smaller portions of the campus.

Briefly, I can state that known populations of the beetle, commonly referred to as OTB, occur in meadows of the upper campus at Marshall Field and in the lower campus in Inclusion Area A (i.e., open meadows west of Empire Grade). Based on the results of my campus-wide habitat assessment surveys, additional meadows in the upper campus and lower campus represent potential habitat for the OTB. Potential habitat also occurs at the university's Long Marine Lab facility at Terrace Point. At this time, the vegetation growing in most of these meadows, which I've indicated are potential habitat, is probably too dense to favor the OTB as it prefers barren or sparsely vegetated ground. Within these grasslands of potential habitat, small patches of bare ground were noted as trails or trail shoulders and in other scattered locations, which may possibly support the OTB.

Background Information.

The proposed and final rulemakings discuss the known distribution and natural history of the OTB (U.S. Fish & Wildlife Service 2000 and 2001). For this reason, I will not repeat that information herein and refer you to these publications.

The OTB is associated with grassland habitats, especially those remnants where native bunch grasses are prevalent. In the greater Santa Cruz area, such native grasslands often occur on old marine terraces and are referred to as coastal terrace prairies. Within the prairies, OTB prefers barren or sparsely-vegetated areas that bask in sunlight throughout most of the daytime. Larvae burrow into the soil and prey on ants and other invertebrates that wander by their burrows. Adults actively hunt on the surface of the ground for a variety of prey items.

Various species of tiger beetles are often associated with specific edaphic conditions. To the best of my knowledge, all locations where OTB have been observed (Santa Cruz Gardens, Poliski-Gross, UCSC-Marshall Field and Inclusion Area A, Wilder State Park, Pogonip Park, Vine Hill School, plus the Moore Creek Open Space and adjacent private ranches) are mapped as Watsonville loams (Bowman 1980 *et al.*). This soil type also occurs as an inclusion in other soils that are known from the vicinity of the UCSC campus.

It is possible that the OTB occurs in association with other soil types, but to-date this has not been well documented. For example, Ray Collett, of the UCSC Arboretum indicated (pers. comm.) that over a number of years he has seen OTB adults on the trails at the arboretum. I have seen a few adults along the trail immediately north of the arboretum that intersects Empire Grade, but no larval burrows. Every year I hear one or more reports of the OTB at other locations on the UCSC campus and elsewhere, but upon further investigation I usually decide that the identification of the OTB is questionable or some other aspect of the observation is unreliable. Nonetheless, it is certainly possible, and even likely that adult OTBs would at least transiently visit meadow areas that are not characterized by Watsonville loams as they disperse between meadows growing on Watsonville loams.

Survey Methods.

Dean Fitch, of UCSC, kindly provided me with electronic CAD files and hard copies of 28 aerial photographs that provide coverage for all lands that comprise the entire 2000-acre campus. The boundaries of these 28 photographs are identified in the irregular photo grid as 01A to LL02 on Figure 1.

As stated earlier, all known locations of the OTB have been found at locations mapped by Bowman *et al.* (1980) as Watsonville loams. Bowman *et al.* (1980) identified and mapped seven series of Watsonville loams, and used the sequential numbers 174-181 to identify their polygons mapped as this soil type in Santa Cruz County. Several features are used to differentiate the various Watsonville loams in this series, including but not limited to soil depth, slope, and vegetation cover.

The U.S. Dept. of Agriculture's Natural Resource Conservation Service (NRCS) has digitized the soil maps published in Bowman *et al.* (1980). I obtained an electronic file of the soils for Santa Cruz County from NRCS. Using the GIS program ArcView, I extracted all layers identified as Watsonville loams and overlaid them on the aerial photographs for the UCSC campus provided by Dean Fitch. Figure 2 is an example of a portion of two aerial photographs (08B and 09B – a portion of Inclusion Area A) that illustrates the resulting product.

As can be seen in Figure 1, the UCSC campus is located in a portion of Santa Cruz County where Watsonville loams (green polygons) are prevalent. This figure was created by combining all polygons identified as Watsonville loams (i.e., #174-181) into a composite soil layer and overlaying it onto a Tiger file (i.e., the street-level base map) for this portion of Santa Cruz County. The photo grid for the UCSC campus was overlaid to

illustrate those portions of the campus lands that have soils of the Watsonville loam series.

With these resources in hand, I visited all portions of the UCSC campus mapped as Watsonville loam. I also visited all other portions of the campus, as the other soil types mapped by Bowman *et al.* (1980), namely Aptos loam (#100 and 101), Danville loam (#125), Elkhorn sandy loam (#133 and 134), and Los Osos loam (#147 and 148) may contain inclusions of Watsonville loams.

My surveys were conducted by hiking and driving throughout the campus lands on four dates between late December 2001 and early February 2002. During my surveys, I paid particular attention to the vegetation types evident within each polygon mapped as Watsonville loam and current land uses that might prevent the OTB from using areas characterized by grassland. In grassland areas, the vegetation structure and presence of bare or sparsely-vegetated ground was noted to assess suitability of these areas to support the OTB.

Results and Discussion.

Any portions of the campus that were mapped as Watsonville loams and support grassland habitat were initially identified as potential habitat for the OTB. A few of these areas are not likely to support the OTB at this time because of current land uses. Portions of the campus where Watsonville loams occur, but are characterized by dense forest, scrub, or chaparral vegetation are not considered suitable habitat for the OTB, unless they also support meadows that are large enough to receive sunlight at ground level during most of the daytime hours when OTBs are active. Other grassland portions of the campus that are not mapped as Watsonville loams are also identified as potential habitat for the OTB because Bowman *et al.* (1980) noted that all of the other soil types mapped for the UCSC campus have inclusions of Watsonville loams. Additional studies of the soils at these non-Watsonsville loam locations may be useful to identify specific locations of the inclusions of Watsonville loam and the extent of their occurrence, especially if it can be demonstrated that OTBs will not utilize other soils types that occur on the campus.

Table 1 summarizes the findings of my campus-wide habitat assessment for the OTB. The photo grid cells, as referred to in both Table 1 and Figure 1, are used to summarize my findings.

Prior surveys conducted by other people and me for UCSC have identified the OTB from portions of both the upper and lower campus areas. Specifically, the OTB is known to occur in the meadows of the Marshall Field (Arnold 2000a and 2001a) and Inclusion Area A (Arnold 2001b). These known OTB locations are designated by the letter K in Figure 1.

Portions of the campus that represent potential habitat are designated by the letter P in Figure 1. In the upper campus, potential habitat consists of four small meadows located in otherwise wooded areas (photo grids 03A, 03B, 04B, and 04C). Three of the locations are mapped as Watsonville loams, while the fourth, located in photo grid 04C,

is mapped as a different soil type but supports suitable grassland vegetation with areas of barren soil or sparsely-vegetated conditions.

Potential habitat for OTB within photo grid 06B is a meadow area located west of Porter College. During prior surveys for OTB in 2000 and 2001 (Arnold 2000b and 2001b), I did not find any evidence of OTB occupation in this meadow. However, since the beetle will colonize areas, and it is known from the nearby Inclusion Area A, OTB may possibly occur here at a future date. Although the soils in this area are not mapped by Bowman *et al.* (1980) as Watsonville loams, they may occur here as inclusions in the other soil types. The combination of suitable grassland vegetation and trails in this meadow is my justification to designate this area potential habitat for the OTB.

For similar reasons, the meadow that is part of Inclusion Area D, i.e., located between the eucalyptus grove and the southern entrance to campus in the southwestern corner of photo grid 09D, represents potential habitat for the OTB. Although I had previously identified this area as potential OTB habitat (Arnold 2001c), I did not observe any OTB adults or burrows at that time. Compared to other mapped areas of Watsonville loams in the lower campus that are located between Empire Grade and Glenn Coolidge Drive, this meadow has not been as disturbed by development (such as other portions of photo grid 09D), become dominated by non-native or other plants (such as the farm plots, arboretum and eucalyptus grove in photo grids 08C, 08D, 09C, and 09D), and does not appear to be as heavily utilized and eroded by bicyclists as many of the other grasslands in the lower campus. If the OTB will not utilize soil types other than Watsonville loams, then this meadow may serve as an important stepping-stone for dispersal of OTB (see further discussion in next paragraph).

Small portions of the grasslands of the lower campus between Empire Grade and Glenn Coolidge Drive (photo grids 06B, 06C, 07B, 07C, 07D, 08C, 08D, and 09D) are mapped as Watsonville loams, while larger portions are mapped as other soil types that may have inclusions of Watsonville loams. As such, all of the grassland dominated areas within this sector of the campus represent potential habitat of the OTB; however, I did not find any evidence of actual occupation during my habitat assessment survey. During my prior surveys of the Moore Creek remediation project site (Arnold 2001d), which is part of the grasslands of the lower campus, I did not observe OTBs. At the times of my survey visits for the campus-wide habitat assessment, OTB burrows at known locations were plugged, so it is possible that beetle burrows were not detected that may occur in the grasslands of the lower campus. In general, the density of grasses and other herbaceous vegetation is too dense to favor OTB. Barren areas are primarily restricted to the heavily utilized bike and hiking trails, uses that are not always favorable for OTB. A change in management of this sector could provide better quality habitat for the OTB and may encourage the beetle to use this sector of the campus. This would be desirable to shorten the distance between populations that occur in Inclusion Area A and Marshall Field on the UCSC campus, with those at the neighboring Pogonip Park (City of Santa Cruz), located east of Glenn Coolidge Drive.

Watsonville loams occur throughout large portions of the Long Marine Lab facilities and adjacent areas (Figure 1). Some of this area has been converted to agricultural use and is tilled routinely, while another portion is part of or immediately adjacent to a lagoon and marsh complex. A swath of Watsonville loam occurs on the terrace immediately above the ocean (SE portion of photo grid LL02), but approximately one-half of this area has been developed for the current museum and parking lot. The remaining area as well as the northeastern portion of photo grid LL01 are undeveloped, but appear to have been disturbed by prior land uses. During surveys of the Long Marine Lab in 2001 (Arnold, in prep.), I did not observe OTB adults or burrows at any of these areas surrounding the lab facilities.

Recommendations.

Additional analyses of soils in the grassland portions of the lower UCSC campus may be useful to identify the locations and extent of inclusions of Watsonville loams that that in other mapped (Bowman *et al.* 1980) soil types This information would be useful to identify areas that might best support the OTB within this portion of the campus, not only to evaluate potential impacts of current and future projects proposed by the university, but also to identify portions of the campus that may be used for habitat management and restoration activities to benefit the OTB and mitigate for potential indirect and direct impacts of current or proposed projects.

In addition, I recommend that all of the portions of the UCSC campus that I've identified as potential habitat for the OTB, be surveyed during its 2002 activity period. With the listing of the OTB as endangered, the U.S. Fish & Wildlife Service will want to have the most current information about the beetle's presence or absence in any parts of the campus that could support the beetle, especially where projects are planned. The Service may also want this information to evaluate impacts of current land uses and the need for an incidental take permit for compliance with the Endangered Species Act.

References Cited.

Arnold, R.A. 2000a. Letter re: Ohlone Tiger beetle and controlled burning of Marshall Field at UCSC campus. Dated 23 May 2000 and addressed to Colleen Sculley, U.S. Fish & Wildlife Service. 4 pp. & attachments.

Arnold, R.A. 2000b. Letter re: UCSC – infill housing project for Cowell, Stevenson and Porter Colleges, Ohlone Tiger beetle habitat assessment. Dated 21 September 2000 and addressed to Bill Davilla, Principal of EcoSystems West Consulting Group. 2 pp. & maps.

Arnold, R.A. 2001a. Letter re: Marshall Fields at UCSC Campus - Ohlone Tiger beetle survey in 2001. Dated 29 June 2000 and addressed to Dean Raven, Physical Plant, UCSC. 4 pp. & attachments.

Arnold, R.A. 2001b. Letter re: UCSC Infill Housing Project. Dated 16 May 2001 and addressed to William Davilla, Principal of EcoSystems West Consulting Group. 2 pp.

Arnold, R.A. 2001c. Letter re: UCSC Inclusion Area D Project – report on Ohlone Tiger beetle survey. Dated 16 May 2001 and addressed to William Davilla, Principal of EcoSystems West Consulting Group. 2 pp.

Arnold, R.A. 2001d. Letter re: Moore Creek Remediation Project – report on Ohlone Tiger beetle survey. Dated 11 May 2001 and addressed to Henry Salameh, Work Management Group, UCSC. 2 pp.

Arnold, R.A.. in prep. Report on habitat assessment and status surveys for special-status invertebrate species for the Long Marine Lab portion of the UCSC campus.

Bowman, R.H., D.C. Estrada, C.S. Beutler, T.D. Thorson, and L.W. Williams. 1980. Soil survey of Santa Cruz County, California. U.S. Dept. of Agriculture, Soil Conservation Service. 148 pp. & maps.

U.S. Fish & Wildlife Service. 2000. Endangered and threatened wildlife and plants: endangered status for the Ohlone Tiger beetle (*Cicindela ohlone*). Federal Register 65:6952-6960.

U.S. Fish & Wildlife Service. 2001. Endangered and threatened wildlife and plants: endangered status for the Ohlone Tiger beetle (*Cicindela ohlone*). Federal Register 66:50340-50349.

If you have any questions about my survey report, please contact me.

Sincerely,

Richard A. Arnold

Richard A. Arnold, Ph.D.
President

Attachments

Table 1. Summary of OTB Habitat Assessment for the UCSC Campus and Long Marine Lab			
Photo Grid Id	Vegetation Types	Watsonville Loam	Status or Potential of OTB
01A	Forest and meadows	Present	Known from meadows
01B	Forest	Present	Unlikely
02A	Forest and meadows	Present	Known from meadows, primarily east of Empire Grade
02B	Forest and meadows	Present	Known from meadows
03A	Forest and meadows	Present	Possible in meadow in NE corner
03B	Forest, chaparral, and small meadows	Present	Possible in small meadows
03C	Forest	Present in SW corner only	Unlikely
03D	Forest	Possible inclusions in other mapped soils	Unlikely
04B	Forest, chaparral, and small meadows	Present	Possible only in south central meadow
04C	Forest, chaparral, and small meadows	Present	Possible in small meadows along trail, especially in SE corner
04D	Forest	Present	Unlikely
05B	Forest and chaparral	Present	Unlikely
05C	Forest and landscaping	Possible inclusions in other mapped soils	Unlikely
05D	Forest and landscaping	Possible inclusions in other mapped soils	Unlikely
06B	Forest and meadows	Present	Possible in meadows west of Porter College, but not observed during prior survey
06C	Forest, landscaping, and meadows	Present	Possible in meadows NW and south of Porter College, but not observed during prior survey; possible in SE meadow
06D	Forest and meadows	Present only in extreme SW	Possible along trails and meadows between Hagar and Coolidge, but

		corner	heavy pedestrian and bicycle use; not observed during prior survey of Cowell College
07B	Landscaping N of Heller, meadows and scrub S of Heller	Present, but restricted to developed or disturbed areas	Unlikely N of Heller, as remaining open areas are heavily utilized or disturbed; possible south of Heller, but not observed during prior survey for Moore Creek remediation project
07C	Landscaping, forest, meadows, and scrub	Present, but restricted to NW corner where developed	Unlikely N of W Remote Parking Lot; possible in meadows south of lot, but not observed during prior survey; possible in meadows W of Hagar, but heavy use of trails
07D	Forest, scrub, and meadows	Possible inclusions in other mapped soils	Possible along trails and meadows E of Hagar, especially south of E Remote Parking Lot
08B	Forest and meadows	Present	Known along trails and meadows
08C	Forest and meadows	Present, primarily W of Empire Grade	Known along trails and meadows W of Empire Grade, also along trail N of Arboretum; possible in meadows N of Arboretum
08D	Meadow, scrub, and landscaping	Possible inclusions in other mapped soils	Possible along trails and in meadows between Hagar and Coolidge, and E of Coolidge
09B	Forest and meadows	Present	Known along trails and meadows
09C	Forest, Eucalyptus grove, and meadows	Present	Known along trails and meadows W of Empire Grade; possible in seepy meadow SE of Eucalyptus, but not observed during prior survey
09D	Landscaping and meadow	Present	Possible in seepy meadow W of South entrance, but not observed during prior survey
LL01	Scrub and meadow	Present	Possible in northern meadow, but not observed during prior survey
LL02	Scrub and meadow	Present	Possible in southern meadow, but not observed during prior survey

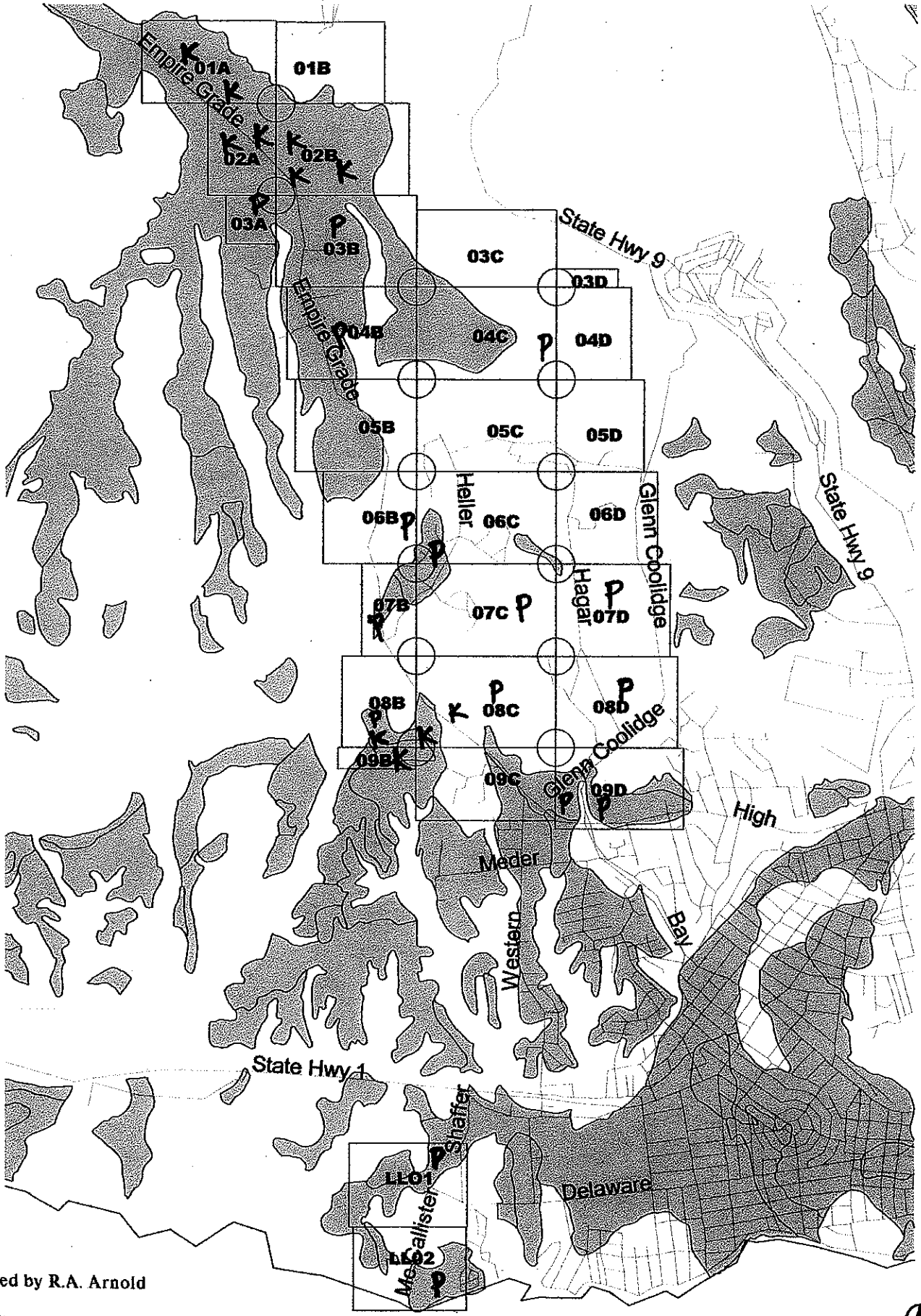
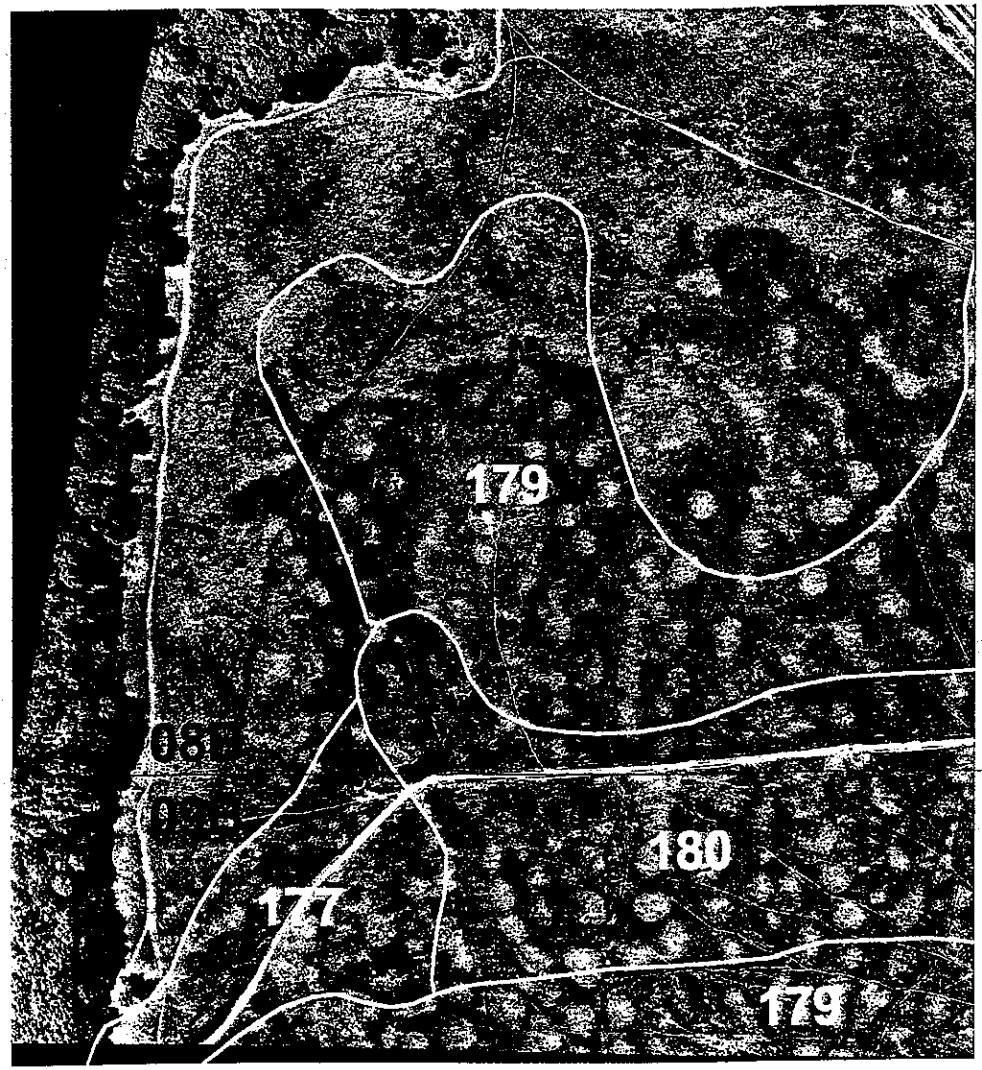


Figure 1. Locations of known (K) or potential (P) habitat for the OTB at UCSC.



Prepared by R.A. Arnold

200 0 200 400 600 800 1000 Feet

08B
&
09B

Figure 2. Occurrence of Watsonville loam series at Inclusion Area A of UCSC.

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27 October 2003

Dean Fitch
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Physical Planning & Construction
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Re: Ohlone Tiger Beetle Monitoring for 2003 in Inclusion Areas A and D

Dear Dean:

This letter summarizes the findings of my monitoring activities on the Ohlone tiger beetle (*Cicindela ohlone*) (OTB)[1] at Inclusion Area A and Inclusion Area D of the UCSC campus lands[2]. Monitoring activities occurred between January 2003 and October 2003. In summary, no life stages or burrows of the OTB were observed in Inclusion Area D (IAD), while limited numbers of egg, larval and adult life stages of the beetle were observed in Inclusion Area A (IAA).

SURVEY METHODS AND RESULTS

Adult OTB Counts.

Recording of observed adult OTB was performed during monitoring activities on 10 different days between January 31st and April 17th 2003. Observations were conducted for IAA while walking along six trail segments as illustrated in Figure 1. These trail segments were selected for the 2003 adult survey because OTBs have previously been observed along these same segments in prior years. The survey dates were January 31st, February 4th, 9th, 18th, March 6th, 8th, 23rd, and 28th, April 6th, and April 17th 2003. Dr. Barry Knisley, Randoph-Macon College, assisted with the monitoring surveys on March 6th and 28th.

A total of 75 adult OTBs were observed on the first nine survey dates. No adult OTBs were observed during the last survey date. The lowest count was 2 adults on April 6th and the peak count was 14 adults on Feburary 18th. Adult OTBs were not captured, marked, or otherwise handled, so some beetles may have been observed more than once on a particular survey date or on different survey dates. Observations for OTB were also

[1] OTB is was listed in 2001 in the Federal Register of Endangered and Threatened Wildlife and Plants as endangered pursuant to the Endangered Species Act 1973, as amended.
[2] Five Inclusion Areas on the UCSC campus are described in the UCSC 1988 Long Range Development Plan. Inclusion Areas A and D occur in the southern portion of the main campus.

conducted on IAD on the same aforementioned dates and no adults were observed at IAD in 2003.

Larval Burrows.

The same six trail segments in IAA that were used for the adult surveys were checked for egg and larval burrows. In addition to the trail segments, surveys of barren or sparsely vegetated areas throughout the adjacent grassland were also checked for burrows. During the surveys, egg and larval burrows of the OTB were marked in the field with nails when they were first observed. A total of 84 burrows were identified with nails. These burrows were rechecked during subsequent site visits during the adult flight season and then once a month during May through October 2003. During July and August visits, 15 larval burrows that supported active larvae were marked with pre-numbered aluminum tags and positional coordinates for every burrow were obtained using a Trimble GPS unit. All of these burrows supported mature, third instar larvae of the OTB, with burrow diameters ranging from 5.0 to 6.5 mm. Most of these larvae remained active through the October site visit. Five larvae had plugged their burrows presumably to pupate. The locations of these 15 larval burrows are illustrated in Figure 1. (NOT INCLUDED IN HCP APPENDIX)

Surveys for larval burrows were also conducted at Inclusion Area D during the months of May through October. No larval burrows of the OTB were observed at IAD in 2003.

DISCUSSION

The findings of the 2003 monitoring surveys indicate that very few OTBs complete their full life cycle (i.e., egg, 3 larval instars, pupae, and adult life stages) at Inclusion Area A. Indeed, adult OTBs were five times more abundant than mature 3rd instar larvae. This observation suggests that adults are immigrating into IAA from other nearby locations and that early stages of the OTB are developing primarily at other locations than IAA. Much of the ground in IAA, such as the seeps and the wallows between the mima mounds, remains saturated throughout most of the adult activity period. Portions of IAA with drier soils at this time of year (January through May) generally support a dense cover of herbaceous vegetation. Thus, the areas available for larval burrows in IAA appear to be primarily limited to drier portions of the trails.

If you have any questions about my report, please contact me.

Sincerely,

Richard A. Arnold

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President

Attachment: Figure 1