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Fish Remains from an "Open" Archaeological Site in the Fort Rock Basin, South-Central Oregon

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Archaeological field studies in the Great Basin traditionally have focused on the excavation of caves and rockshelters containing stratified cultural deposits and well-preserved organic remains. A more recent emphasis on investigating "open" sites has primarily involved the examination of surficial archaeological characteristics, since it is often assumed that such sites lack significant subsurface cultural deposits with little or no preservation of organic materials.

This report presents results of test excavations at 35LK1016, an open archaeological site in Fort Rock Basin on the northwestern margin of the Great Basin.[1] Found below the surface at the site, in association with chipped and ground stone tools and debitage, were substantial quantities of fish bone and other faunal remains. This collection of fish bone is the largest yet reported from an archaeological site in Fort Rock Basin. The findings made at 35LK1016 provide an example of the scientific potential of open sites in the Great Basin.

SITE LOCATION

The site is located in Silver Lake Valley, the southwestern lobe of the three valleys that comprise Fort Rock Basin, Lake County, south-central Oregon (Fig. 1). Fort Rock Basin has been the scene of archaeological

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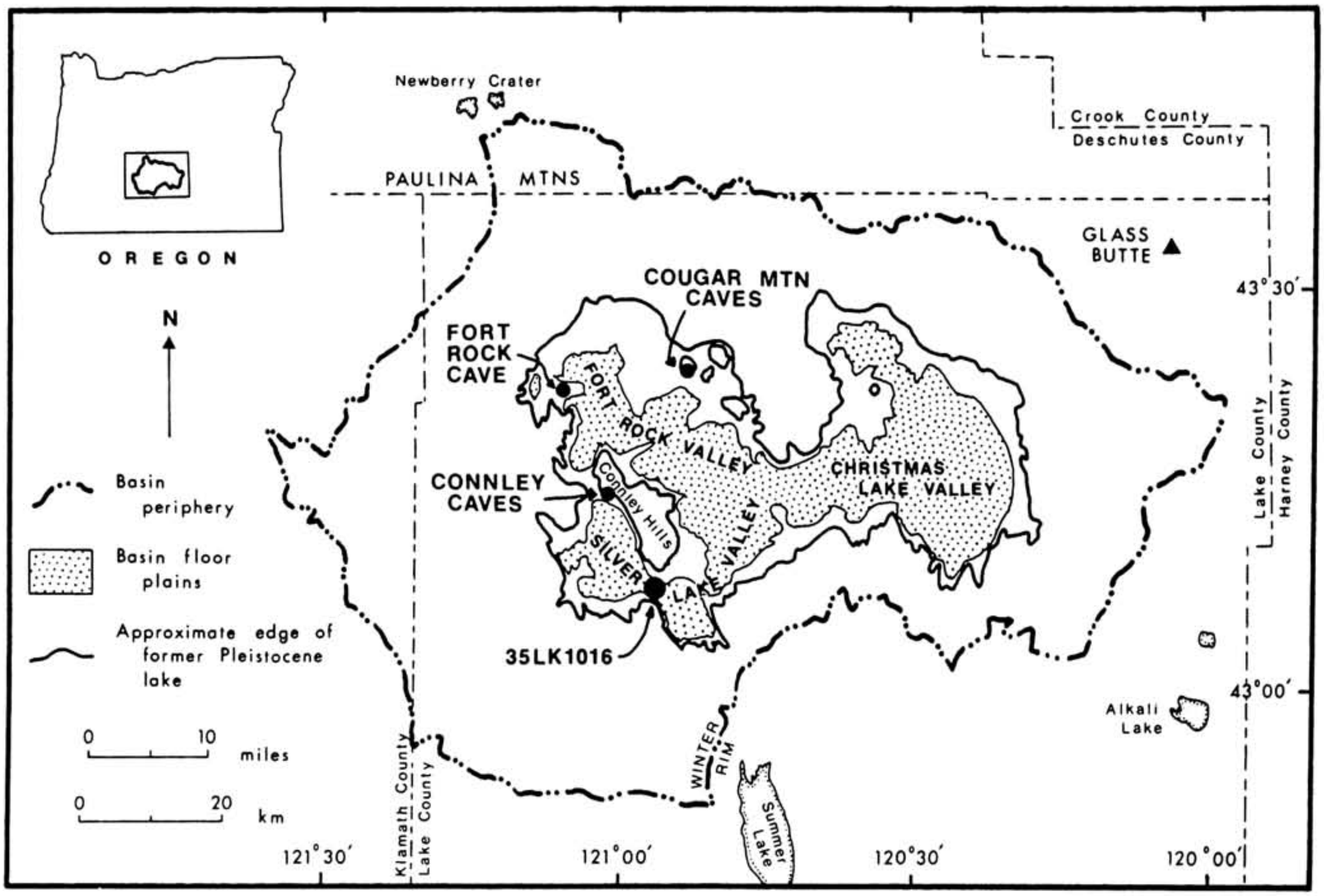

Fig. 1. Location of project area within the Fort Rock Basin.

research for nearly fifty years. Until 1970, excavations in the basin concentrated on such sites as Fort Rock Cave and the Connley and Cougar Mountain caves (Cressman, Williams, and Krieger 1940; Cressman 1942; Cowles 1960; Bedwell 1970, 1973; Bedwell and Cressman 1971). During the past decade, however, federal agencies have sponsored a number of archaeological surveys which have resulted in the recording of hundreds of open scatters of lithic tools and debitage (for reviews of archaeological work in Fort Rock Basin, see Toepel, Minor, and Willingham [1980] and Toepel and Beckham [1981]). Relatively few of these sites have been tested for the presence of subsurface cultural deposits and, in general, subsurface investigations of open sites in the northern Great Basin to date have been quite limited (e.g., Fagan 1974; Pettigrew 1985).

Measuring approximately 700 m. north-south by more than 200 m. east-west, 35LK1016 is the largest site thus far recorded in Silver Lake Valley. This vast scatter of obsidian flakes, chipped stone tools, and ground stone fragments is located on fairly level terrain on the south side of the Silver Lake narrows, an intermittent drainage that connects Paulina Marsh with Silver Lake. Surface elevations of the site range from 4,318 to 4,323 ft., 8 to 13 ft. above the lowest (4,310 ft.) point of the nearby narrows (Fig. 2). Shallow, standing water occurs over much of the floor of the narrows, encompassing portions of 35LK1016, during the moist spring season. Consequently, given the wet-

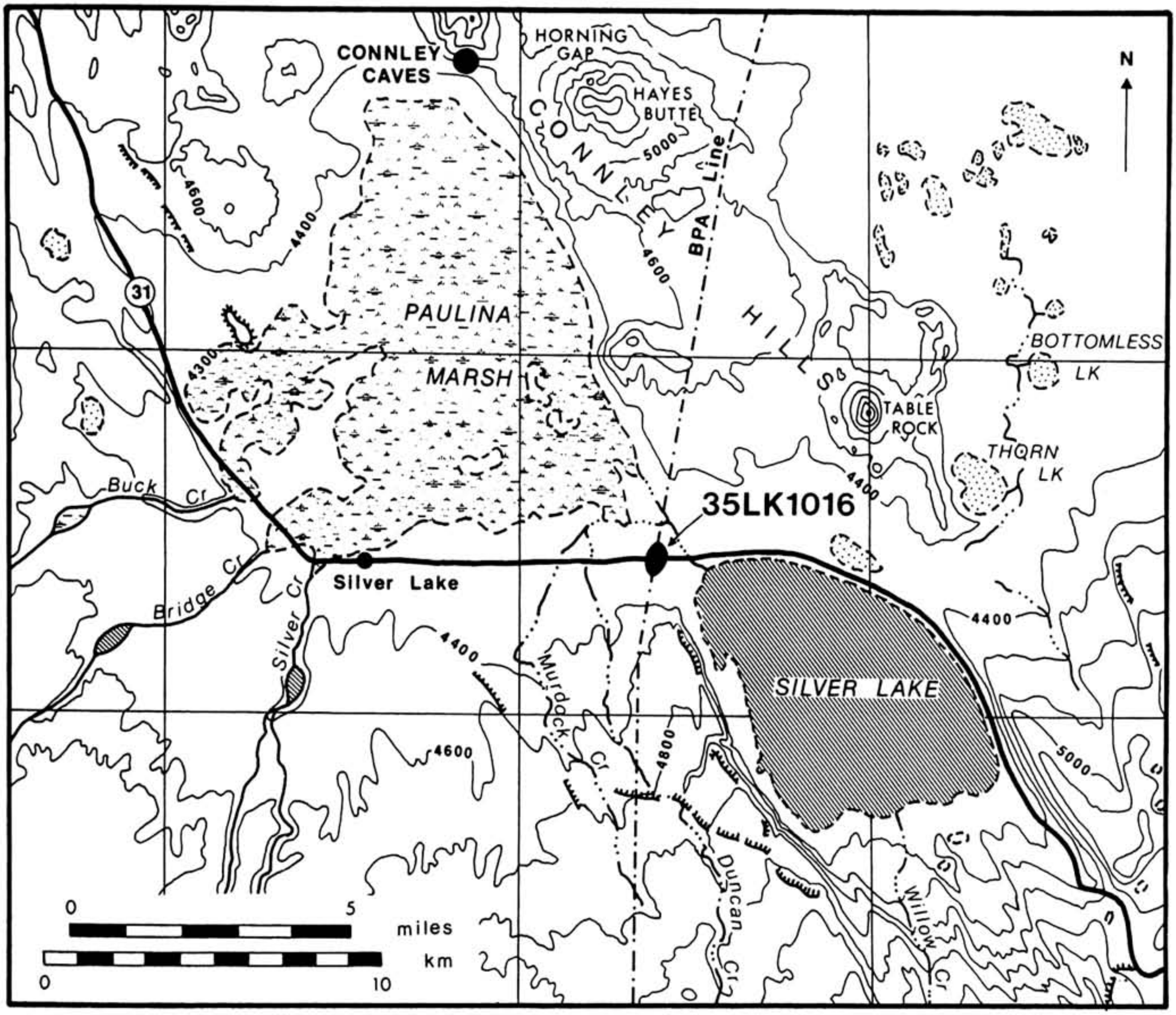

Fig. 2. Location of 35LK1016 at the narrows in Silver Lake Valley.

dry cycle to which sediments in the area are subjected, it was not anticipated that preserved, much less identifiable, faunal remains would be encountered during the test excavations.

TESTING RESULTS

Three 1 x 2-m. units were excavated at 35LK1016 in May, 1980, to test for the presence of subsurface cultural deposits. Each unit was excavated in arbitrary 10-cm. levels, and the fill was screened through ¼-in. mesh. The units were located some distance apart in order to test two different areas of this extensive site.

Units 1 and 2 were located on the edge of a swale near the northern edge of the site at an elevation of 4,318 ft. Somewhat unexpectedly, both units proved to contain definite subsurface cultural deposits that did not appear to be the result of natural sediment movement or filtering processes. Located only 20 m. apart, these units exhibited a similar stratigraphy consisting of two strata. The upper stratum of silty clay, which roughly corresponded to the cultural deposit, was underlain by a culturally sterile, hard-packed silty clay loam that may represent the floor of the former pluvial lake.

Unit 1, placed next to a dense cluster of ground stone fragments, contained 105 obsidian flakes. Six of the flakes were found on the surface, and 91 were located in the upper 30 cm. of the deposit (Table 1). Faunal remains were limited to one hare (*Lepus* sp.) element, found within 10 cm. of the surface, and one fish (*Gila bicolor*) element recovered from the 10- to 20-cm. level.

Eight flakes were visible on the surface of Unit 2, and another 83 flakes and tools were recovered during unit excavation (Table 1). Notably, the scattered remains of a firepit were encountered in the western half of the unit between 15 and 50 cm. below the surface. This feature was defined primarily on the basis of small charcoal bits, a difference in sediment color and texture, fragments of thermally altered rock, and a concentration of well-preserved and apparently charred faunal remains.

Cultural materials associated with this feature included a small obsidian Rose Spring series projectile point, a number of unmodified obsidian flakes, a basalt bifacial mano fragment, and an unshaped pestle, also of basalt. Associated faunal remains included rodent bones, a rib and mandible fragment from a pronghorn (*Antilocapra americana*), and many darkened fish bones identified as *Gila bicolor* or tui chub (Table 1). Charcoal recovered from 30 to 40 cm. below the surface, in association with the bulk of the fish bone, was dated at 1,400 ± 70 radiocarbon years before present (DIC-1831). This age is consistent with the general time-span of Rose Spring points in the Great Basin (Heizer and Hester 1978: 8-9; cf. Thomas 1981: 30-31).

Unit 3 was located at a higher elevation (4,321 ft.), approximately 200 m. south of units 1 and 2 near the center of the site. Cultural materials were found in only the uppermost 20 cm. (Table 1). Eighty-nine obsidian flakes and a single, probably intru-

Table 1

CULTURAL MATERIALS RECOVERED FROM TEST UNITS AT 35LK1016

Unit	Depth Below Surface (cm.)	Description	N
1	surface	obsidian flakes	6
	0-10	obsidian flakes	34
		obsidian used flake	1
		bone (*Lepus* sp.)	1
	10-20	obsidian flakes	36
		bone (*Gila bicolor*)	1
	20-30	obsidian flakes	20
	30-40	obsidian flakes	3
	40-50	obsidian flake	1
	50-60	obsidian flakes	4
	Total		107
2	surface	obsidian flakes	7
		obsidian retouched flake	1
	0-10	obsidian flakes	23
		mano fragment	1
		pestle fragments	3
		obsidian retouched flakes	2
		unidentifiable bone	1
	10-20	obsidian flakes	21
		bone (*Thomomys* sp.)	2
		unidentifiable bone	5
	20-30	obsidian flakes	6
		bone (*Gila bicolor*)	52
		bone (rodent)	3
		bone (*Antilocapra americana*)	1
		unidentifiable bone	46
	30-40	obsidian Rose Spring point	1
		obsidian flakes	14
		bone (*Gila bicolor*)	97
		bone (*Sylvilagus* sp.)	3
		bone (*Antilocapraa americana*)	1
		bone (rodent)	7
		unidentifiable bone	16
	40-50	obsidian flakes	7
		bone (*Gila bicolor*)	13
		unidentifiable bone	14
	Total		347
3	surface	obsidian flakes	5
	0-10	obsidian flakes	70
	10-20	obsidian flakes	14
		bone (*Thomomys* sp.)	1
	Total		90

sive, skeletal element from a pocket gopher (*Thomomys* sp.) were recovered. The hard-packed, silty clay soil stratum was encountered at 25 cm. depth in Unit 3.

DESCRIPTION OF FISH REMAINS

Preservation of delicate fish bones, particularly in Unit 2, was excellent and allowed for the identification of 163 elements (Table 2). All of the identifiable fish remains represent tui chub (*Gila bicolor*), a member of the Cyprinidae, or minnow, family.

The tui chub is a relatively large minnow, not uncommonly reaching a length of 300 to 350 mm. (12 to 14 in.) (Snyder 1917: 62). The maximum size reported is 409 mm. (Carlander 1969: 394; Kimsey 1954); however, specimens from the Silver Lake Basin examined by Snyder (1908: 90) averaged only 94 mm. Highly adaptable, the tui chub can successfully occupy a variety of habitats, including lakes, streams, and springs. Its range covers drainages on both sides of the Sierra Nevada, and includes the Columbia, Klamath, and Sacramento river systems, the inland basins of southeastern Oregon, and the Lahontan Basin.

The distribution and identification of fish bones found in Unit 2 are summarized in Tables 2 and 3. The 94 specimens for which skeletal elements could be determined included whole or fragmentary pharyngeals, opercles, preopercles, cleithra, basioccipitals, and hyomandibulars. All of these are bones in the head region of the fish, being part of the neurocranium, branchiocranium, or pectoral girdle. It is worth noting that the recovered elements include no vertebrae or vertebral fragments, which are commonly found in other archaeological sites containing tui chub remains (Greenspan 1985). In the present case it is possible that the lack of vertebral elements is the result of recovery techniques; i.e., the small vertebrae of tui chub could easily have passed through the ¼-in. mesh screen used during the test excavations. Another possible explanation is that the fish were being processed or eaten in a manner that resulted in differential disposal of head and body parts.

With only a few exceptions, it was not possible to determine the age classes of the individuals. The few bones that did have

Table 2

IDENTIFICATION OF FISH BONE, UNIT 2, 35LK1016

Depth Below Surface (cm.)	Taxon	N	Element
20-30	*Gila bicolor*	4	right pharyngeals
		3	right opercles
		5	left opercles
		1	opercle fragment
		1	right preopercle
		3	right cleithra
		4	left cleithra
		1	basioccipital
	Undetermined	31	fragments
	Total elements	53	
	Minimum number of individuals	5	
30-40	*Gila bicolor*	5	right pharyngeals
		6	left pharyngeals
		11	right opercles
		11	left opercles
		2	opercle fragments
		1	right preopercle
		12	right cleithra
		12	left cleithra
		1	cleithrum fragment
		1	right hyomandibular
		1	left hyomandibular
		1	basioccipital
	Undetermined	33	fragments
	Total elements	97	
	Minimum number of individuals	12	
40-50	*Gila bicolor*	2	right opercles
		1	left opercle
		3	right cleithra
		1	left cleithrum
		1	right hyomandibular
	Undetermined	5	fragments
	Total elements	13	
	Minimum number of individuals	3	
Unit Totals:	Total Elements	163	
	Minimum Number of Individuals	20	

Table 3
SUMMARY OF RECOVERED
GILA BICOLOR SKELETAL ELEMENTS
FROM UNIT 2 AT 35LK1016

Element	Total Recovered	Percent
Pharyngeal	15	9.2
Opercle	36	22.1
Preopercle	2	1.2
Cleithrum	36	22.1
Basioccipital	2	1.2
Hyomandibular	3	1.8
Unidentified fragment	69	42.4

discernible annuli (annual growth marks) were from mature adults, and all of the bones were within the size range of sexually mature adults. Many of the bones are discolored in a way suggestive of exposure to heat, although none of them is actually charred.

AVAILABILITY OF FISH IN SILVER LAKE VALLEY

Of the three native species of fish extant in Silver Lake Valley, only tui chub has been reported in Silver Lake in historic times; redband trout (*Salmo* sp.) and speckled dace (*Rhinichthys osculus*) have been restricted to the three perennial streams that feed the lake (Silver, Bridge, and Buck creeks). Fossil and archaeological evidence indicate that at various times in the prehistoric past dace and trout have existed in Silver Lake and elsewhere in the Fort Rock Basin. Apparently, conditions in Silver Lake have not been suitable for these species in historic times.

The water level in Silver Lake fluctuates widely, and its total desiccation has been reported several times in the historic past (Phillips and Van Denburgh 1971). At times when the water level is too low or the concentration of dissolved solids too high to support chub, their lake populations die out. However, Silver, Bridge, and Buck creeks apparently have been perennial and have harbored fish throughout the Holocene (Greenspan 1984). When water conditions become suitable, the chub reinvade the lake.

In a lake habitat, tui chub tend to spend winter months in open, deeper waters. In late spring, sexually mature adults migrate to the shallow margins of the lake where they spawn. The young-of-the-year remain in the shallows until the onset of winter, when they migrate to open water. They return to the shallows for their first spawning, usually at two or three years of age (Moyle 1976: 164-168; Kimsey 1954). When not spawning, schools may migrate into the shallows at times, but these movements are unpredictable (Carl Bond, personal communication 1983).

ABORIGINAL USE OF LACUSTRINE RESOURCES AT 35LK1016

According to ethnographic records, Silver Lake Valley was used by the Northern Paiute and perhaps also by the Klamath, both of whom included chub in their diets (Spier 1930: 150; Stewart 1941: 370). No ethnographic information is available concerning how or at what time(s) of the year chub were procured. That chub were a part of the aboriginal diet in prehistoric times is indicated by tui chub bones found during previous excavations at Cougar Mountain Cave No. 2, north of 35LK1016 in Fort Rock Valley, at the Connley caves in Silver Lake Valley, and at an open site, recently investigated by the Bureau of Land Management, in the vicinity of Thorn Lake (Bedwell 1970: 251-252, 256, 257, 259; Mehringer 1983; Greenspan 1984). Remains of tui chub also have been recovered from other open sites in the northern Great Basin, including several in Harney Basin east of Fort Rock Basin (Fagan 1973; Toepel, Minor, and Greenspan 1984; Greenspan 1985; Minor and Greenspan 1985) and in Chewaucan Basin to the south (Greenspan 1985; Pettigrew 1985).

Elsewhere in the Great Basin, it has been reported that Northern Paiute groups used gill nets and set lines with gorge or composite hooks in the exploitation of tui chub (Fowler and Bath 1981: 183-184). It should be noted, however, that in the absence of such an elaborate fishing technology, it would be quite easy to scoop up chubs with a dip net or an open-weave basket when the fish spawn near shore.

Relative to 35LK1016, the nearest prehistoric source of tui chub would have been Silver Lake, where this resource was probably most reliable and accessible during the spawning period in May or June. This also would have been an optimal time for root gathering and processing (Couture 1978: 29-30) which, judging by the abundance of grinding tools (Greenspan 1981), were major activities at 35LK1016. Wet conditions in the valley during winter and early spring also may have restricted use of the site area to drier times later in the year.

It is difficult to assess the degree to which predictable availability of tui chub in Silver Lake may have been a critical variable in prehistoric settlement strategies. Based on available archaeological evidence, it appears that exploitation of fish from 35LK1016 was an opportunistic activity, secondary to plant gathering. In any event, tui chub may have been an important, reliable, and easily exploitable resource on a seasonal basis during the spawning period. While tui chub may have been present in lake shallows at other times of the year, their availability would not have been a predictable occurrence.

Catching tui chub in the open water of Silver Lake would have been possible at any time of the year. However, such a strategy represents a much more labor-intensive endeavor than near-shore fishing. Because of the deep water and dispersed distribution of the fish, open-water fishing also would require a more specialized technology, e.g., hook-and-line or large nets. There is no evidence to substantiate that such technologies were employed by the inhabitants of either 35LK1016 or any of the other archaeological sites where fish bone has thus far been found in Fort Rock Basin, although numerous notched stones possibly representing net sinkers have been observed in the vicinity of Thorn Lake (William Cannon, personal communication 1984).

SUMMARY

Test excavations at 35LK1016, an "open" archaeological site in Fort Rock Basin, led to the discovery of associated stone tools and faunal remains in subsurface depositional contexts. The presence of subsurface cultural deposits had not been anticipated, nor was it expected that well-preserved faunal remains would be found in an open site subject to seasonal flooding.

Of particular significance at 35LK1016 was the presence of fish remains, which provide direct evidence of prehistoric exploitation of lacustrine resources. The fish represented were most likely caught along the margins of nearby Silver Lake during the spawning season in late spring or early summer. Their procurement was probably supplemental to the gathering and processing of plant foods carried out at this time of the year.

As a result of archaeological testing of site 35LK1016, new data have been generated on the lifeways of prehistoric inhabitants of Fort Rock Basin. The information obtained pertains to aspects of prehistoric subsistence and settlement that have not been documented by earlier excavations of caves and rockshelters in the region. Although, clearly, not all open sites contain subsurface cultural deposits, the findings made at 35LK1016 underscore the importance of testing open sites in order to evaluate their scientific potential accurately.

NOTE

1. Archaeological fieldwork at site 35LK1016 was carried out during the spring of 1980 under the direction of the senior author as part of a larger

program involving the testing and evaluation of 40 open archaeological sites located along the route of the Bonneville Power Administration's proposed Buckley-Summer Lake 500 kV transmission line in central Oregon.

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Acquisition Cost and Nutritional Data on Great Basin Resources

STEVEN R. SIMMS

As part of an earlier study (Simms 1984), data on the costs and benefits of obtaining native food resources in the Great Basin were generated for use in foraging models developed from evolutionary ecology. Portions of these data are presented here for the benefit of researchers interested in the acquisition costs and nutrition of wild foods.[1]

These data represent handling costs only; that is, the cost of acquisition once a resource has been encountered. They are applicable to a variety of questions, some beyond the goals of the study for which they were collected, involving the addition and deletion of resources to human diets. The accompanying nutritional data should be useful to those interested in the food value of wild plants, and may also prove useful in foraging models requiring the analysis of variables other than energy. On the other hand, data on search

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