Overview of the Prehistoric and Historic Grasslands of the North Fork Basin of the Eel River

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Authors Note:

I have posted this paper on my web site www.solararch.org to make it more readily available for researchers and to the general public. I wrote this paper during the winter of 1989. It was at the dawn of the personal computer era. At that time the Forest Service had Data General Computers and some now long forgotten word processing program. For that reason it was necessary to use an OCR program to move this paper into a MS Word document. I have made some minor editing changes and have included some additional comments within text boxes or brackets.

This paper was incorporated into my book *Environmental and Cultural Ecology of the North Fork Eel River Basin, California* published in 1995. See also Keter and Busam 1997.

Introduction

This paper is one in a series of studies on the past environment, land-use activities, and cultural history of the North Fork of the Eel River basin (north of the confluence of Hulls Creek) in southwestern Trinity County (Map 1). Too often archaeological studies present overly simplistic descriptions of the environments for the sites they are studying. Sometimes these "environmental descriptions" are little more than checklists of vegetation and wildlife and perhaps, might include their relative abundance within the study area. There appears to be an increasing recognition within the anthropological community (see for example Schalk 1977:207-211) that detailed studies of the past environment are necessary. To better interpret the prehistoric record, one must first understand the local ecosystem and the constraints and opportunities it provided the human population.

Insights into settlement patterns and site function are not possible without placing cultural materials into the proper spatial and temporal contexts of the local environment. The environment of the North Fork basin has changed over time (Keter 1988) reflecting both the effects of natural variables such as climate and human land-use patterns.

Resources available to the Aboriginal population within the basin were a product of this dynamic relationship between natural processes and human land-use practices. Studies to date (Keter 1985, 1986, 1987, 1988, range studies in progress) indicate that not only historic but prehistoric residents of the North Fork basin greatly influenced the internal dynamics and ecological processes taking place. The result of this dynamic interaction between the environment and the aboriginal population is that sites are not located randomly across the basin. In hunting and gathering groups, site location and function result in large measure from resource availability and other environmental factors.

Grasslands (savannas) and the grasses and other herbaceous plants associated with the oak woodlands provided important plant resources for both the human and local wildlife populations. The goal of this portion of the research project on the North Fork basin is to describe the extent and composition of grasses and forbs within the study area and to document changes which have occurred over time due to both prehistoric and historic effects of land-use. In addition, any study of the changes that have occurred to the grasslands of the North Fork basin since the beginning of the historic period would not be complete without an understanding of the livestock industry. The radically different land-use patterns of the historic population transformed almost overnight the environment of the basin [Keter 1990]. A complete overview of the livestock industry and the boom times of the Ranching Period (1865-1905) will be presented in a separate research paper [see Keter 1994].

When the preliminary study of the past environment of the North Fork basin is complete, prehistoric, ethnographic, and historic data will be placed within this environmental context. Finally, it is important to note that this study is focused on the North Fork basin and is not applicable except in a more general way to regions located even adjacent to the study area.

Grasslands of the North Fork Basin

Since the beginning of the historic period, one of the most dramatic yet least understood and documented changes to the grasslands/savanna vegetation communities of California has occurred as the result of exotic introduced plant species that have replaced or greatly diminished in number the native plant species. These changes were due not only to the fact that exotic species of plant life migrated or were brought into the region during the historic period by farmers and ranchers, but also because of changes in land-use patterns; from hunter and gather groups to ranching (with intensive livestock grazing) and homesteading. As noted elsewhere (Keter 1987, 1988 [1995, 1997]), the distribution and areal extent of tree species has also changed dramatically within the North Fork basin since the contact period. Changing land-use patterns during the early historic period and the lack of burning, as practiced by the aboriginal population, resulted in a dramatic increase in the distribution of Douglas-fir (*Puseudotsuga menziesii*) and a corresponding decrease in oak woodlands and the associated forbs and grasses. Open grasslands have remained relatively stable in areal extent with only a small percentage lost to Douglas-fir encroachment (Keter 1987, 1988). Heady (1977:501) indicates that grasslands have remained relatively stable throughout California in general.

The most profound changes to vegetation species appear to be in the areas of the open grasslands and the grasses and forbs associated with oak woodlands and brush lands. While no exotic tree species have become established, a large number of non-native grasses and forbs now dominate the grasslands.

In the North Fork study area (approximately 93,000 acres [Map 1]) grasslands comprised approximately 23,126 acres (25%) of the basin in 1855 (considered the beginning of the Historic Period see Keter 1985). Today that figure is approximately 18,263 acres' (21%) (see Graphs and 2). Vegetation surveys indicate that only in the northwest portion of the basin (mostly above 4,000'), and the drainages of this area (Bradford, Salt, and Bluff Creeks) and some eastern and north facing slopes, has there been much encroachment by Douglas-fir into grasslands (see for example open areas along Double Gate Road east of Zenia).

Today, grasslands within the North Fork region, like those throughout much of California, are dominated by annual grasses. The majority of these plant species are not endemic to the state (Burcham 1981:173). In the Yolla Bolly country, few perennials are evident in the rangelands (Personal Communication Janice Stevenson Range Biologist MRRD). Native species of grasses and forbs could not compete against the introduced species. As Burcham (1981:173) points out, in some areas of California "it is possible to work on range surveys for several days at a time without recording a single native perennial herb." This replacement of native forbs and grasses occurred so suddenly and completely that there is little documentation of the grassland vegetation associations prior to the Contact Period (Heady 1977:493).

Grasses and Forbs in the Oak Woodlands

Oak woodlands also contain grasses, forbs, and other important plants utilized by the aboriginal populations. These areas have been significantly reduced in extent by the invasion of Douglas-fir since the beginning of the Historic Period. Oak woodlands in the basin have been reduced in acreage from 33,763 acres (36.5%) in 1855 to 6,001 acres' (6.4%) in 1985 (base year of the study). This reduction in the oak woodland habitat within the basin has had a significant effect on the extent of grazing as well as impacts to wildlife (see Keter, 1988) since the Contact Period. [See Keter and Busam 1997 for updated vegetation distribution data.]

The oak woodlands can be placed on a continuum somewhere between grasslands and montane forests. For purposes of this study the need is to delineate their productive capacity in relation to the other vegetation types outlined above. Because of their capacity to produce acorns as well as grass and forb resources, they were the most productive vegetation association within the basin for both wildlife and the aboriginal inhabitants. The following overview of the oak woodland environment, and the emphasis in this paper, is related primarily to the grasses and other herbaceous plants associated with oak woodlands.

Saenz (1983:7) notes that oak canopies "can alter the environment beneath the trees resulting in changes in the distribution and abundance of species compared to surrounding open areas through a variety of positive and negative feedback systems: " Vegetation related to oak trees can be affected by the alteration of soil properties through decomposition of leaf matter (creating higher humus content than the surrounding soil) and soil temperature differences. Interception of sunlight by the leaf canopy can also affect

temperature humidity and soil moisture content and alter the amount of radiation which the ground receives (Saenz 1983:8).

Recent studies in an oak woodland area of northern Humboldt County (Saenz 1983) where white oak (*Quercus garryana*) predominates as it does in the North Fork basin (although the north county area has a higher moisture gradient) concluded that there is "a marked difference in species composition between grasslands and oak woodlands" (Saenz 1983:28). Davy (1902:27) noted [who visited southern Humboldt County] an example of this in 1902, when he found *Trifolium sorpiodes* growing for the most part under the shade or partial shade of oak trees. In the Saenz study, 30 species of plants were common to both grasslands and oak woodland areas. In addition, heavy grazing altered the species mix and different plants dominated under these conditions. Another conclusion of this study, which has implications for the North Fork basin, is that perennial species of grasses and forbs predominate in oak woodland areas even if they are heavily grazed (by today's standards). In grassland areas, however, annuals predominate in both lightly and heavily grazed areas (Saenz 1983:32). Also, species diversity is greater in areas not grazed. Finally, the study concluded that introduced grasses outnumber native species in both grasslands and oak woodland area while the number of native forbs is greater in all areas except the most heavily grazed grasslands where they are equal.

For the reasons outlined above, the combined oak woodland and grassland environments provided a wide number of species of grasses and forbs available for exploitation by both wildlife and humans. Because of their shading properties and conservation of soil moisture content, grasses and forbs under the oak canopies would have extended their maturing season by several weeks. This can still be seen in late spring when grasslands have already matured and turned gold the grasses and forbs under the oak canopy remain green for about two to three weeks longer. The result would have extended the availability of forage and certain food resources for wildlife in the North fork basin for several weeks.

Historic Background

The first non-native plant species were probably brought into California by the Spanish as early as the 16th century. Most of these early species were related to farming and were not a major factor in the replacement of native species. The plants which began to replace native vegetation were for the most part introduced unintentionally. Most were undesirable as forage and entered the state in the coats of animals, in packing materials, ballast for ships and impurities in crops and grain supplies (Burcham 1981:173).

Sometimes, due to their propagation characteristics of being highly adapted for dissemination through the wind and by animals (such as birds), grasses and forbs often preceded the colonizing of an area. For example, it is believed that three species curly dock (*Rumex crispus*), alfilerilla (also called red stemmed filare (*Erodium cicutarium*), and prickly snow thistle (*Sonchus asper*) were probably established in northern California prior to colonization in 1769 (Burcham 1981:173). It appears likely that the Russian colony at Fort Ross was the first to introduce wild oats (*Avena fatua*) and other plants north of San Francisco. By 1833 wild oats and mustard (*Brassica campestris*) were noted as growing in abundance in the area. During the expedition of Redick McKee in 1851, it was noted that wild oats were common north into the Russian River valley. They did not, however, observe any after they crossed into the Eel river drainage (Burcham 1981:175).

It is not known when the first exotic species were introduced into the North Fork region. It appears, however, that some exotic species preceded the settlement of the region. For example, wild oats (*Avena fatua*) appear to have been exploited by the Northern Pomo long before the settlement of Northern Mendocino and Lake Counties (Chestnut 1974:311). According to ethnographers, the original Pomo name *Bal-lo Kin* for one of their tribes [tribal communities] means "oat valley" and originally probably referred to native California oat grass (*Danthonia californica*) that resembles the wild oat. By the 1890's the plant had disappeared from much of its earlier habitat (Chestnut 1974:311). Essene (1942:55) notes that in the Round Valley region, it is believed wild oats were established by about 1850. Essene (1940:55)) writes that his Round Valley informants believed that wild oats were native and were there before the first ranchers and the army entered the valley. Several early expeditions may have passed through the Round Valley area before 1850 (see Carranco and Beard 1981: 30-34), and some species of grasses and forbs may have been introduced at that time. It is also quite possible that propagation occurred through natural processes such as wind and animals.

[See Keter 2013a and 2013b my research calls into question Carranco and Beard's contention on trappers visiting Round Valley in the 1820s. It should also be noted that the Pomo and the Yuki traded extensively prior to the contact period.]

At the turn of the century Joseph Burtt Davy made several trips to the North Coast Ranges documenting range conditions and surveying the species of grasses. One of these trips included discussions with long-time residents and field trips in southeastern Humboldt County and northern Mendocino County. In 1902 he published *Stock Ranges of Northwestern California*; this reference remains the most comprehensive overview of the early grasslands of the North Coast Ranges. The following discussion of grasses in the

North Fork basin is based primarily on Davy's survey. It outlines what can be reconstructed of the changes that have taken place in the grasslands since the contact period in northern Mendocino and southern Humboldt Counties and more specifically the North Fork basin. The basin is located less than five miles from some of the areas that Davy visited in the field and it is likely that the rangelands of both areas were very similar in species composition and were identical in historic land-use patterns.

Before 1855

Prior to the historic era, the local Indian populations had some effect on species composition of the grasslands through such land-use practices as seed gathering and seasonal burning. Fire can create differential nutrient uptake which can alter competitive relationships among different plant species (Ohr and Bragg 1985:113). Therefore, it is likely that prehistoric land-use practices had altered the species mix of the grasslands from what might be considered a "pristine" environment. This conclusion reinforces the view that aboriginal groups had a significant influence on their environment and were far from passive observers of the ecological processes taking place. In addition, wildlife and their exploitation of plant resources also influenced the grasslands. Through time it is likely that a dynamic equilibrium had been achieved and the grassland vegetation associations were relatively stable [see Keter 1995].

The dominating grasses were perennial bunch grasses including species of *Danthonia, Stipa, Melica, Poa, and Festuca* (see Table I). It is quite possible that *Danthonia californica* may have been the grass species predominate within the basin and much of the North Coast Ranges. Davy (1902:26-27) notes that *Danthonia* was considered excellent forage but by the time of his study in 1902 was uncommon; especially in areas to the east of the main Eel River (this would include the North Fork basin). Forbs included wild pea (*Lathyrus* spp.), perennial and annual clovers (*Trifolium* spp.), and wild sunflowers (*Wyethia* spp.) (Davy 1902.38). In addition bulbous plants such as *Camassia leichtlin* (referred to by the Wintun name *Ket'-en-chou* by the Wailaki) were common in some areas of the North Fork basin including Kettenpom and Hoaglin Valleys. A number of other important plant species exploited for food (refer to Tables I-V) and other uses, such as basket making, are associated with the grasslands and oak woodlands. Animals such as deer, bear, rabbits, and rodents would have been plentiful in the rich oak woodland and grassland environment (Keter.1988).

2015 Updated manuscript: use of the term Wailaki Lassik

During my research over the last 35 or so years and in my interactions with numerous Wailaki from southern Humboldt, northern Mendocino, and southwestern Trinity Counties, as well as with Wailaki consultants living in Hulls Valley and Round Valley who had links to what has been delineated by ethnographers as "Lassik Territory"(see Baumhoff 1958), not one individual I have talked to considered themselves to be Lassik but referred to themselves as Wailaki. This included descendants of Lucy Young (who despite being called Lassik by Merriam, Essene and Kroeber insisted that she was Wailaki) and descendants of Mary Major who were two of the principal informants for ethnographers (see Essene and Merriam). For example, Kroeber in his introduction to Essene's (1942) *Culture Element Distributions: XXI Round Valley* writes: "there are indeed old people on the reservation who are listed as Wailaki in agency records and who call themselves Wailaki. Those of them who still had worth-while knowledge to dispense proved however to be Lassik."

I wrote a paper on this subject in 2009 (referenced below) and it is posted on my web site. I have chosen to use the term "Wailaki Lassik" in order to clarify that like the Pitch Wailaki (see Goddard's work on the North Fork) the Wailaki Lassik were a direct offshoot and therefore closely related through language and familial ties with the other Wailaki "triblets" (I prefer the term "communities" see Keter 1991. 1993) but also shared cultural practices as well.

The people living in this region prior to the historic era, referred to themselves collectively with some derivative of the term *ken'-es-ti* (personal communication: Fred Coyote Downey). Merriam (1923:276, field notes) claims that the Southern Athabascans used the term "nongatl" to indicate "the name of their nation--covering all the tribes between Round Valley and Iaqua."

It is clear given the common language and shared cultural beliefs of the Native Americans residing in southern Humboldt, northern Mendocino, and southwestern Trinity Counties during the ethnographic period, that at some higher level than Kroeber's small triblets the Southern Athapascans (ethnographers have named Sinkyone, Eel River Wailaki, Pitch Wailaki, Lassik, and Nongatl) shared a common cultural and linguistic identity.

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2009 All Those Things that You're Liable to Read in the Ethnographic Literature They Ain't Necessarily So Paper presented to the Society for Archaeology, Modesto, CA

PDF at: www.SolarArch.org

The Historic Record

1855-1865 Conflict and Settlement Period [see Keter 1990]

It appears that replacement of native perennials by introduced annuals took place in stages as historic development took place (Heady 1977:493, Davy 1902.36). While some changes in northern California may have begun during the Spanish era they were greatly accelerated after 1855. The first changes to the grasslands occurred with the introduction of exotic species of grasses and forbs. As noted earlier, the first exotic species in the basin may have become established shortly before the historic era. In addition to wild oats, this may also have included red stemmed filare (*Erodium cicutarium*) (Davy 1902.38). After 1855 and the introduction of livestock and feral pigs, perennial species began to decline and native annuals increased in number. With the rapid growth of the livestock industry (refer to Range section), towards the end of the period there was an increase in numbers and predominance of exotic species and an accelerated decrease of native annuals. During this period, feral pigs also contributed to the decline of native grasses and impacted the bulbs, clovers, and other resources which the Pitch Wailaki and Lassik depended on.

1865-1905 Ranching Period

[See Keter 1994: *The Ranching Period in the North Fork Eel River Basin* 1865-1905 on the web at solararch.org]

It was during this era when extensive grazing (and overgrazing) of the North Fork basin occurred that the greatest changes to the grasslands took place. One researcher noted in 1864 that:

> ...less than ten years ago, the traveler [in the grasslands of Northern California] would ride for days through wild oats tall enough to tie across his saddle, now dwindled down to stunted growth of six to ten inches with wide reaches of utterly barren land (Heady 1977:497).

When interviewed by Davy, one resident of southeast Humboldt County noted that the species mix of the grasslands had changed several times during the twenty-seven years that he had lived there. It is likely that overgrazing coupled with continued introduction of exotic species were responsible for these changes. Davy interviewed a resident of Sherwood Valley, located about 50 miles southwest of the North Fork basin, who entered the area in 1853. He indicated that California oat grass (*Danthonia c*.) was the most abundant plant in the open areas at that time. After fifty years of intensive grazing the

predominate species had changed to introduced annuals and weedy species (Davy 1902:21).

Small barley grass (*flordeum* spp.) and soft chess (*Bromus mollis*) were introduced into the west Yolla Bolly country sometime after 1860 and *Festuca myuros* (locally called squirrel-tail or poverty grass) after 1865. One resident informed Davy (1902:36) that he believed small barley grass entered the area in the wool of sheep and was first observed along the trails leading into the region (this also is noted to have occurred with Mediterranean barley (*Hordeum hystrix*) in the 1880's see Chestnut 1974-313). The early settlement and grazing of the grasslands was followed by a second stage beginning in about 1870 (during the boom years of the livestock industry [Keter 1994]). By that time introduced annuals dominated the grasslands. By the mid-1870s when the numbers of cattle and sheep peaked on the Yolla Bolly ranges, native perennials and annuals were becoming rare. The less palatable fox-tail and squirrel-tail began to dominate the grasslands. Soft chess somewhat less palatable to cattle (although considered nutritious forage) did not spread as rapidly across the ranges (Davy 1902:38). These exotic annuals were able to out compete the native grasses as well as wild oats.

By the end of the Ranching Period in 1905 (the decline began in the 1890's) the grasslands were badly depleted of native species and the ranges were in extremely poor condition. At the time of Davy's study in the 1890's (1902:38), a type of alfilerilla (*Erodium circutarium*) and a number of grasses including Brocho grass (*Bromus rigidus*), barley grass (*Hordeum marium*) and bur clover (*Medicago denticulate*) were becoming dominant in the rangelands. Davy also noted that he did observe some perennial bunch grasses but they were rare except in the more remote areas.

Post 1905 Homesteading Period to Present

Today the rangelands of the North Fork basin have recovered somewhat from the overgrazing of the Ranching Period. The carrying capacity of the rangelands is better understood and the number of livestock utilizing these lands is only a fraction of that in the boom times of the 1870's. Today overgrazing is still evident and one interviewee (1379) noted that Medusahead (*Elymus caput-medusa*) and tar weed (*Hemizonia* spp. probably *tracyi*) both considered noxious weeds are still common in the basin. It is apparent from Davy's account that these species have become increasingly dominant since the turn of the century. Also noted during field surveys (personal observation) was an apparent increase in the number of wild oats (*Avena* spp.) since Davy's survey. A list of grasses noted in the basin during a recent botanical survey is presented in Tables I and II.

Today, there are few native perennials in the grasslands of the North Fork basin. There are some native annuals and some introduced perennials. Introduced annuals, however, predominate. The next section of this paper outlines what is known of the causes for this dramatic change in the grasslands of the basin.

Reasons for Domination of the Grasslands by Non-native Species

It is not completely understood why introduced grasses and forbs came to dominate endemic species in the California grasslands, nor all of the successional processes which took place. One thing is clear, however, there are few if any locations in the world where there has been such a rapid and complete replacement of native plant communities by introduced species (Burcham 1981:185). Burcham (1981:176) outlines a number of factors which are believed to have contributed to these changes:

1. The composition of the original plant cover.
2. The adaptations of the introduced species for dissemination and survival.
3. Grazing and agricultural practices employed during development of the livestock industry.
4. The climate of California rangelands.

Severe impacts due to intensive grazing (leading to reduction of ground cover) and the harmful effects of hooved animals to the steep mountain sides increased compaction and erosion in the highly erodible Franciscan soils causing rapid and irreversible changes to the grasslands habitat and a number of environmental problems (for example, increased sediment loads for creeks and rivers). It can be reasonably concluded the establishment and succession of introduced species of grasses that came to dominate the North Fork basin appear to be related most directly to livestock and overgrazing.

There are a number of effects which occur to the native vegetation when grazing begins. First, there is a change in the dynamic equilibrium of the native plant species with their environment. In California a high percentage of the native plant cover was palatable to domestic livestock resulting in a decrease in the occurrence of these plant species due to overgrazing (in the North Fork basin severe overgrazing took place a relatively short time after introduction of livestock). The initial result was probably an increase in the abundance of native annual species which are more adapted to disturbance. Also, for the most part, they are somewhat less palatable than perennials. Further, annuals can pass the long dry summers in the seed stage giving them a further advantage over perennials

(Heady 1974:499). In effect, weed species came to dominate the grasslands by monopolizing the overgrazed and bare ground (Davy 1902:42). Perennial species must mature and produce seed before grazing takes place. Although they may come back a second or even third year, they will eventually die out if over grazing continues (Chadwick 1989:77).

These conditions proved favorable to non-native species, especially annuals. In addition, the successful invasion of grasses, predominately of European origin, requires that the species be preadapted to the environmental conditions of the new region (Jackson 1985:349). Many of the introduced species came from areas with a Mediterranean climate similar to California. Over centuries, they had adapted on lands heavily grazed by livestock (Burcham 1981.177).

Another reason that annuals may come to dominate grasslands dominated by perennials is that they tend to deplete water resources (soil moisture content) before peak growth of the perennials (Jackson 1985-359). For this reason, it is possible a significant impact to the native perennial grasses would have occurred even if overgrazing had not taken place. In the Mediterranean basin annual grasses are generally of minor importance and perennials still dominate. Most grasslands, however, have been created through deforestation and are not true savanna grasslands (Jackson 1985-357). For the reasons outlined above it appears that the annual grass species introduced into California were pre-adapted to the heavily disturbed conditions of the grasslands in Europe and that it was severe overgrazing in California that most likely led to their establishment. Even with the cessation of overgrazing, however, the slightly different climatic regime of California encourages their dominance and reduces the possibility of successful competition of native perennials (Jackson 1985-357).

One other factor that may have significantly affected the grassland communities is the change in fire regime from the aboriginal period (Keter 1987, Clark 1956:749). While fire was used during the historic period (prior to 1905) [when the Trinity National Forest was created], the time of year, the types of fires, and fuels loads (light versus heavy] were significantly different from the fires of aboriginal times. [See Keter 1988, 1995] It should also be noted that introduced species of grasses tend to cure (dry out) earlier in the year than native grasses especially perennials (Personal communication, Ron Masterogesippie, Ecologist, Redwood National Park).

The effects of fire to grasslands are not well understood and there have been few studies on this subject. A study by Ohr and Bragg (1985), in Nebraska, found that the effects of burning to grasslands varied depending on fire frequency and how long ago a fire had

occurred. The conclusion of this study was that soil nutrients, with the exception of phosphorous, were increased by burning and that the short-term effects of fire were to increase available plant nutrients. Although the long term effects of a cyclical fire pattern (similar to the prehistoric regime in the basin) were not studied, the authors suggested that the long term effects of nutrient uptake may influence long term changes in species composition (Ohr and Bragg 1985:113).

To summarize this section, it seems appropriate to quote Professor Harold Heady (1974:493) who wrote the section on grasslands in *Terrestrial Vegetation of California*:

> "History has not recorded the vegetational dynamics of the pristine California prairie. After 25 yr [sic] of studying this grassland, I believe that the plant succession tended toward perennial bunch grass dominants on nearly all well-drained upland sites, that numerous annual species were present, and that they dominated intermediate and low successional stages, just as they do in many other grasslands. Also, I believe that introduced annual plants prevent many perennial grasses from attaining their dominance, that annuals are now a large part of the climax on many sites (if not all), and that alien species should be considered as new and permanent members of the grasslands rather than as aliens. Their elimination from the California prairie is inconceivable."

Prehistoric Grasslands and Cultural Ecology

It can be concluded from the ethnographic literature (which will be presented in another section of this research project) that the distribution of grasses and forbs within the grassland/savanna and oak woodland vegetation associations provided significant seed, bulbous, and other plant subsistence resources to the native population. In some cases, it appears there are minimal energetic gains over metabolic cost (Simms 1985:124) in seed collecting. In the North Fork basin and areas to the south in the North Coast Ranges, however, the quantities collected for consumption appear to have well exceeded metabolic energy expended for their collection. Even if this was not the case, one of the most important properties of seeds is their storability. Storage of resources available in the fall which can be consumed in the winter when few other food resources are available can be considered a form of resource banking Resource banking was an important part of the southern Athabascans resource exploitation strategy (Hamman n.d. :16). In addition, it is quite likely that certain vitamins and other nutrients contained in grasses and forbs may

have been essential for a balanced and healthy diet. For example, clover contains vitamin C which would have been lacking in the winter diet of stored meats, seeds, and acorns. Vegetation studies in the North Fork basin (Keter 1986, 1987, 1988) clearly show that the grasslands and oak woodlands occupied a major portion of the basin (refer to Graphs 1-2). [See Keter 1995, 1997 for updated data on vegetation distributions within the basin.] The potential resources from these lands are significant. In addition to aboriginal use, wildlife species were greatly dependent on the vegetal resources provided by these lands and in turn these animals (deer for example) provided a significant portion of the resource base of the local inhabitants.

The influx of settlers and the grazing (and overgrazing) of livestock affected not only the natural vegetation but the local Indian population as well. With the introduction of livestock after 1855, the vegetal resources of the North Fork basin were rapidly depleted. This was one of the factors which led to widespread starvation among the Wailaki-Lassik and Pitch Wailaki. In 1860 a commission was created to look into the conditions of the Round Valley Indian Reservation and of the Indians in the surrounding area of northern Mendocino County. Testimony before the Special Joint Committee on the Mendocino War determined that: "The stock...consuming the clover, grass, acorns and wild oats, which they have hitherto subsisted on...there is hardly any food in the mountains the Indians can get" (Herbert et al n.d..47). While the ranchers could see that the local Indian populations could not sustain themselves on their traditional diet of seeds, clovers, and acorns, they preferred the Indians starve rather than limit the number of livestock they grazed (Caranco and Beard 1981:55). [See Keter 1990, 1994]

In discussions with some botanists during research for this paper, it was learned that in general the size of seeds for introduced grasses (for example *Avena* spp.) are larger than those of the native bunch grasses (for example *Danthonia c.*). Although this may appear to provide an advantage to seed gatherers this is not the case. Botanist Edith Murphy who worked in the Voila Bolly region in the 1920's documented this fact. One of her informants, Lucy Young (then in her mid 90's), a Wailaki-Lassik [see Keter 2009 for a discussion of the term Wailaki-Lassik], indicated that in addition to the impacts to seed resources from livestock grazing the elimination of native grasses with seeds more significantly rich in protein was one of the reasons for widespread starvation among the Indians of the region during the early contact period (Hammon n.d.:16). This difference in the nutritive value between native and introduced species is also reflected in the livestock carrying capacity of the rangelands and is discussed in the range portion of this study [Keter 1994]. During the initial phase of livestock introduction, native grasses supported a significantly greater number of livestock than was supported after introduction of exotic annuals.

As will be outlined in another portion of this research project, after a number of violent encounters between the native population and the ranchers [Keter 1990] most of the surviving Indians of the Yolla Bolly country were placed on the Round Valley Reservation and other reservations. After that time (about 1865), grazing and other land-use activities such as homesteading were to play the major role in how the grasses and forbs of the region survived and propagated.

Appendix I outlines the types of vegetal resources available to prehistoric populations in the grasslands and oak woodlands of the basin. Some of these species occur in other vegetation types (for example, Douglas-fir forests, bushlands, etc.). For the most part, however, these other vegetation types are not productive of grasses and forbs to any significant extent. In addition, grasses and other plants introduced into the area are also presented (Table II). It should be pointed out that these lists are incomplete and preliminary. Further work including examination of Edith Murphy's field notes is planned before generalizations on seasonality of resources is formulated and the relative significance of resources is estimated. Acorns and some other plant resources will be considered separately because of their importance.

Notes

1. See Keter 1986, 1987, 1988 [1995, 1997] for a discussion on how these figures were formulated.

2. The "Burr [burl clover" (*Medicago denticulata*) to which Powers refers in his text is an introduced annual.

Appendix I

Preliminary Overview of Food Resources within the Grasslands and Oak Woodlands

Seed resources Table I, Table II [These table are also included in Keter 1995]

The grasses of the North Fork basin would have been a rich source of seeds. It is likely that several perennial bunchgrasses were abundant including California oat grass (*Danthonia californica*), and some species of *Poas* (perhaps *P.scarbrel*), *Stipas, Melicas, and Festucas*. A large number of other plant species also provided a rich source of seeds (refer to table II). Sunflower seeds (w*yethia* spp.) were also collected (Curtin 1957:11, Chestnut 1974-397). They were collected in the fall and were then dried, pounded, and winnowed in a flat basket. Often, they were parched and blended with other grass seeds for *pinole* (Curtin 1957:11). Lucy Young indicated that the harvest of seeds was extremely important to provide a winter reserve of storable food supplies (Hamman n.d.:16) Many other plants provided important seed resources. A number of these species are outlined in Table I. As studies within the basin continue, it is likely that this list will increase significantly. Although this section of the study is limited to grasslands, a few other species are noted which were important to local subsistence and are included in the local ethnobotanical studies.

Clovers and Greens Table III

The ethnographic literature (Chestnut 1974:322, Parker 3:1988) notes that the collection of clover in the early spring was one of the most notable times of the year for resource collection. Clover actually was a general term used by the Indians to refer to a number of herbaceous plants (Chestnut 1974:359). Table III refers to a list of likely plants harvested in the North Fork basin under this classification. The emergence of clover after the long winter provided a much anticipated food resource. Most clovers were eaten raw as greens, some were steamed (Curtin 1957:14). Stephen Powers (1976:235) noted that; "Clover is eaten in great quantities in the season of blossoms. You will sometimes see whole villages squatted in a lush clover-meadow snipping it off by hooking the forefinger around it and making it into little balls."

The Wailaki held a Clover Dance each year. It was performed during the early spring (Power 1976:118), Chestnut 1974:360). When Chestnut (1974:360) visited the Round Valley Indian Reservation in the 1890's to record plant use by the local Indian population, clover was still an important food resource. Frank Essene (1942:84) noted that during his research in Round Valley he was told that "the earliest clover is eagerly gathered as greens have been a conspicuously absent dietary item during the past season."

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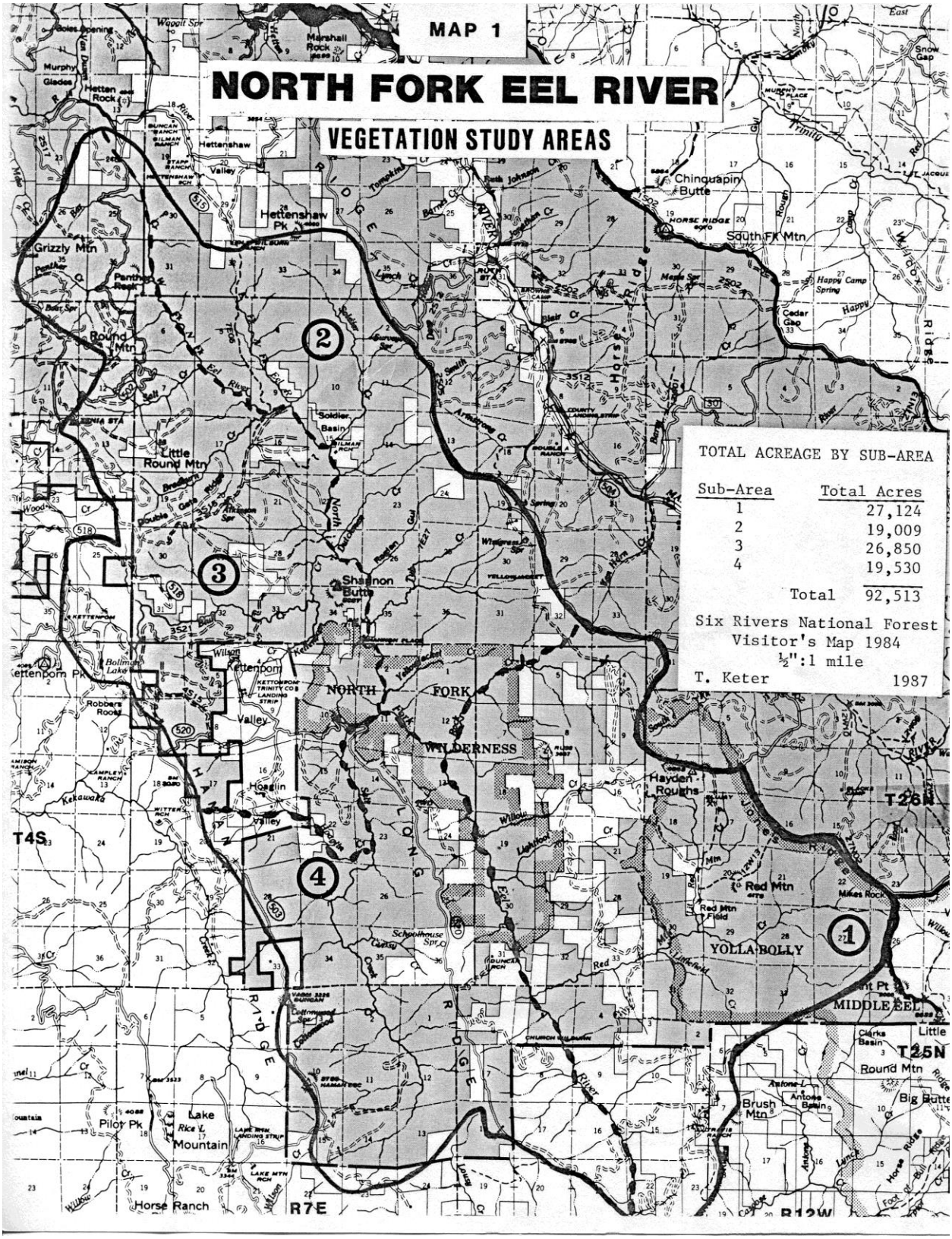
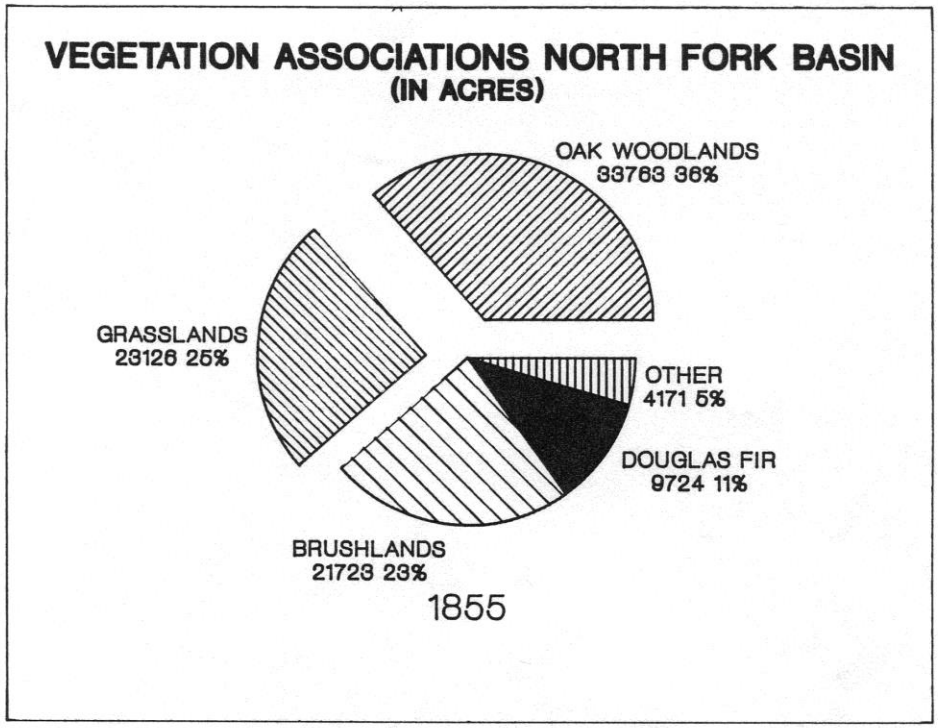


Graph 1



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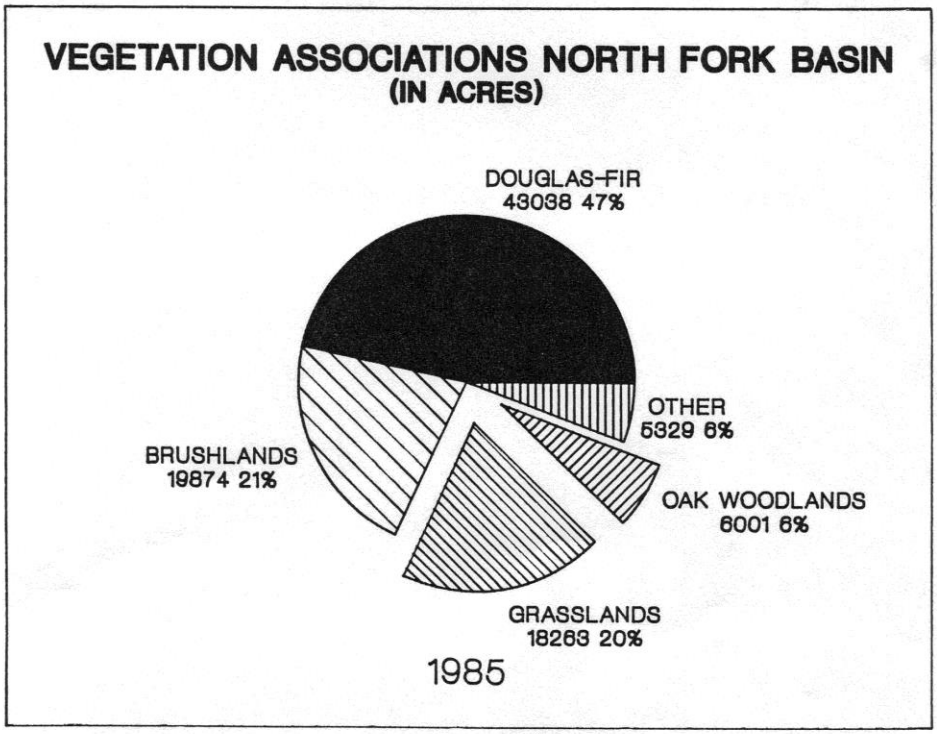

See Keter 1987,1988 for an explanation of Vegetation types

Table I
Native Grasses

Many of these species provided seed resouces Maturation of the majority of these resources occurs in late summer.

Species	Common Name	X	Comments
Bromus marginatus @		P	Chestnut notes native
Danthonia californica@*+	Ca oat grass	P	common pre-Contact
Deschampsia elongata *	slender hair grass	P	
Elymus glaucus *	blue wild rye	P	
E triticoides + @	beardless wild rye	P	squaw grass (locally)
Festuca californica *	Ca fescue	P	
F. Idahoensis	Idaho fescue	P	
F Occidentalis	western fescue	P	
F microstachys		A	rare
F octoflora	six weeks fescue	A	
Melica californica *	Ca melic	P	
Poa scabrella *	pine bluegrass	P	
Sitanion hystrix @	bottlebrush sqrltail	P	also *S. elymoides*
Sitanion jubatum *	big squirreltail	P	
Stipa lemmoni *	lemmon's bunchgrass	P	also l. needlegrass
Stipa pluchra	purple needlegrass	P	

Other Native Seed Resources

Used primarily with grass seeds for pinole and storable for winter use

Achyrachaena mollis @	blow wives	
Boisduvalia densiflora @	dense flowered Boisduvalia	
Ceanothus spp @+	deer brush	Brushland species
Godetia purpurea @	purple Godetia	dry slopes rare today
Hemizonia luzuloefolia @*	hayfield tarweed	
Madia anomala @	plump seed madia	annual grassy slopes
M. sativa @	coal tarweed	annual
Nymphaea polysepala @	Indian pond lily	aquatic numerous seeds
Perideridia kelloggi @	Kellogg's yampah	
Plagiobothrys campestris @	Popcorn flower	young leaves eaten as greens
Pogagyne douglasii @	Douglas' pogpgyne	(var *parviflora*)
Saliva columbariae @		annual
Thysanocarpus curvipes @	(var *elegans*) mustard family	grassy slopes
Verbena hastata +@	blue vervain	
Wyethia angustifolia *	sunflower	
W. longicaulis +	sunflower	used in region

* Identifed North Fork Basin by author or Leitner (1988)
+ Identified Mad River Ranger District Six Rivers National Forest adjacent to basin
@ Chestnut (1974) utilized in or adjacent to basin

X A = annual P = perennial

Table II

Introduced Grasses

Some of these grasses were exploited as food resouces during the historic peroiod.

Species	Common Name	X	Comments
Aira caryophyllea	silver hair grass	A	Established 1870's
Avena fatua +@	wild oats	A	Established by 1850's
A barbata * @	slender oat	A	
Briza minor *	little quaking grass	A	
Bromus commutatus	hairy chess	A	Weed
B. mollis *	soft chess	A	Weed
B. molloformis *		A	
B. racemosus		A	Weed
B. rigidus +	ripgut grass	A	in Davy B maximus
B. rubens	fox-tail chess	A	established 1870's
B. tectorum *	downy chess	A	
Cynosurus echinatus *	dogtail grass	A	
Elymus caput-medusa *	medusa head	A	weed common in basin
Festuca myuros	rat tail fescue	A	locally squirreltail
F reflexa *		A	
*Gastridium ventricosum**	nite grass	A	est 1870's weed
Hordeum leporimun		A	established 1870's
H. hystix +	mediterranean barley	A	established 1880's
H. leporinum @	fox-tail (locally)	A	Chestnut mistook *H. murinum* for this
H. marinum+	barley grass	A	est after 1860's
H. vulgare @	barley	A	used in Round Valley
Lolium multiforum	Italian ryegrass	P	weed
L. temulentum	poison rye grass	A	
Madia sativa		A	established 1880's
Phalaris tuberosa+	(var stenoptera)	P	est late
Poa annua	annual bluegrass	A	weed
P. trivialis+	rough bluegrass	P	

Other introduced species

Many of these species were used after 1850 by local Indian groups

Erodium cicutarium *	red stemmed filare		used after 1850 as green
E moschatum	white filaree		used after 1890 as green
Heracleum lantrim	cow parsnip		*H.sphondylium* only native
Medicago denticulata	bur clover		used after 1855 as green
Rumex crispis @	curly dock	(P)	est very early used as seed source

* Identifed North Fork Basin by author or Leitner (1988)
+ Identified Mad River Ranger District Six Rivers National Forest adjacent to basin
@ Chestnut (1974) utilized in or adjacent to basin

X A = annual P = perennial

Table III
Seasonal greens

(referred to as "clovers" in literature)

Species likely to occur in the North Fork basin Harvested in late winter and spring.

Lupinus spp	lupine
*Montia perfoliata**	miner's lettuce
Traxicum vulgare	dandelion
Vicia americana *@	pea vine

Trifolium clover

T bifidium decipiens *@	seeds also make good pinole
T cyathiferum *@ A	
T dichotomum A	
*T fucatum virescens** A	
T microcephalum A	
T tridentatum A	uncommon (Davy)
T variegatum @ A	

Table IV
Bulbs

(All native and generally referred to as Indian potatoes)

Probable species in basin. Harvested in late spring and early summer.

Allium bolanderi @	Bolander's onion	Allium spp. noted in
A unifoloium @^	Indian onion	identified in basin
Brodiaea pluchella^	very sweet bulbs	
B. laxa^	also called Indian potatoes	
Calochortus pluchellus @^	deer potato	
C. venustus @	butterfly mariposa	
Camassia quamash @^	blue camus (also called commom camus)	
C. leichtlini @	Kettenchou (in Wintun)	confirmed in basin
Dichelostemma capitalatum @	Brodiaea	
Hesperoscordum hycintinum @	wild hycinith	
Hookera coronia @		
Lilium spp. (probably blanderi) *	rare	not confirmed as food resource
Triteleia laxa @	highland potato	abundant in region

Other uses

Chlorogalum premeridianum @*	soap root	Used to poison and stun fish identified in basin

* Identifed North Fork Basin by author or Leitner (1988)
\+ Identified Mad River Ranger District Six Rivers National Forest adjacent to basin
@ Chestnut (1974) utilized in or adjacent to basin
^ Curtin (1957)
X A = annual P = perennial

Table V
Berries
(collected spring early summer)

Arctostaphylos manzanita @*	Manzanita berry	July-Aug	cider also par and ground for pinole, considered highly nutritious
Fragaria california @	wild strawberry		
Grossularia californicum @	thorny gooseberry		
G. divaricata @	straggly gooseberry		
Prunus demissa @	choke (bitter) cherry		
P. subcordata @	wild (Sierra) plum		
Rubus leucodermis @	wild black (white stemmed) raspberry (special trip to mts for berries in July Chestnut 1974:355) Also dried for winter use		
R. parviflorus @	thimble berry		
R. vitifolius *	common blackberry		
Vaccinum ovatum *	evergreen huckleberry		mesic areas nw portion of basin

* Identifed in North Fork basin
\+ Identifed Mad River Ranger District (Forest Service) adjacent to basin
@ Chestnut (1974) utilized in or adjacent to basin
^ Curtin (1957)