Indian Burning:
Managing the Environment before 1865 along the North Fork

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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 1988. 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 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.

TK
November, 2015
Three River, CA.

Introduction

For the last several years I have been conducting archaeological surveys within the North Fork of the Eel River basin in southwestern Trinity County. It became evident from interviews with local residents, historical research, and field observations that the environment has changed dramatically since the beginning of the historic period. Hunter-gatherer peoples have an especially close relation to their environment. Their ability to efficiently exploit and maximize local resources is essential for survival. Therefore, it became evident that to effectively interpret the prehistoric record, an understanding of the environment as it existed before the contact period would be useful.

This paper, building on my past research in the area (Keter 1985, 1986), discusses how the environment of the North Fork appeared in about 1865. I have revised this date [from 1854] because research indicates that during what I have termed the Conflict and Refuge Period 1854-1865 [Keter 1990] many of the traditional subsistence activities were carried on. There were, however, no significant impacts to the environment from Euro-Americans moving into the area until about the mid-1860s. The army operated extensively in this area during the first half of the 1860's and by 1865 nearly all the local inhabitants had either been killed in clashes with the army, murdered or kidnapped by local bands of settlers, or relocated (usually forcibly) to the Round Valley Indian Reservation (Carranco and Beard 1981-28-101). Shifts in land-use practices taking place during the historic period and their effects to the environment are discussed and data presented documenting the changes to vegetation that have occurred within the North Fork Eel River basin. Finally, some comments are made concerning the theoretical implications of the data for further research in the area and beyond.

The North Fork Eel River basin was inhabited by two closely related Athapascan speaking groups; in the southern portion were the Pitch Wailaki and from Salt Creek north the Wailaki Lassik (Baumhoff 1958: 177).

[I now believe a more appropriate term is Wailaki Lassik as a result of my subsequent research and interviews with local Native Americans; see Keter 2009 in the References Cited section of this paper.]

Unlike the northern part of Trinity County where gold was the lure to Euro-Americans, in the south, it was the rich grazing lands. The most immediate effect of contact between the Lassik and Pitch Wailaki with Euro-Americans entering the area was the heavy loss of life to both groups resulting from violent confrontations [Keter 1990]. In addition, disease and the placement of most survivors on reservations all but destroyed these two cultures. At

the same time there were major impacts to the environment. While in some respects environmental change was relatively slow, for instance the steady encroachment of oak-woodlands by conifers, in other ways it was rapid. For example, the introduction of livestock disrupted many traditional food resources and polluted springs (Murphy 1941: 360). Also large numbers of deer were killed by hide hunters. The effect of this disruption to the environment was disastrous, for it broke the bond between the people and the land. To hunters and gatherers this disruption of the environment alone would have threatened their very existence.

Today, the North Fork of the Eel River basin, north of Hull's Creek, is relatively unpopulated except to the west along Haman Ridge which divides the North Fork from the main Eel. A few families also live in Hoaglin and Kettenpom Valleys and on Long Ridge. In the late 19th and early 20th centuries many small homesteads dotted the North Fork country. There were small schools on some of the ranches and the Caution Post Office was located on the east side of the North Fork for about 15 years. There was even a roadhouse [Red Mountain House; see Keter 1994] that was located on a trail leading from Round Valley to Weaverville. Today nearly all these homesteads are gone. Most were bought by local ranchers and are used for grazing.

In an earlier paper (Keter 1986), I divided the historic era into four distinct periods. Each of these periods left its own imprint on the land. Through historical documents, publications, census records, interviews, homestead records, and unpublished manuscripts, I have gathered a surprising amount of information about the area; including historic-land use practices. Factors from the historic era affecting environmental change were:

- Intensive grazing and over grazing by livestock and feral pigs
- Historic settlement patterns and the role of fire during the ranching and homesteading periods
- Introduction of non-native plant species [Keter 1989]
- Exploitation of timber resources and an emphasis on commercial timber growth
- Suppression of wildland fires since 1905, when the Forest Service took over management of much of the region. {Keter 1987]

In addition, another factor possibly affecting changes in the vegetation types and distribution was considered; a possible change in climatic conditions coinciding with the advent of the historic era. For the prehistoric period the variables examined which affected the environment [the distribution of vegetation associations] in 1865, were burning by the local inhabitants and the possibility that natural fires caused by lightning may have accounted for the areal extent of the vegetation associations within the basin prior to 1865.

The Role of Fire

It appears that natural fires caused by lightning are not uncommon in this region. The majority of lightning strikes and thunderstorm activity, however, occurs further to the east in the Yolla Bolly Mountains and around the southern end of South Fork Mountain. There is an average of five thunderstorms per year with an average of about five lightning strikes per storm. Thunderstorms most commonly occur in the months of August and September. In some years, there is an intense period of activity where many strikes will occur in one storm (personal communication Orville L. Robinson U.S. Weather Service, Eureka; personal communication Dick Gassner, Fire Officer Management Six Rivers National Forest). It seems probable, therefore, that during the prehistoric period some fires resulted from natural causes.

Further north in Humboldt County, Lucy Thompson (c1916: 31), a Yurok, wrote in about 1916 that: "our legends tell when they arrived in the Klamath river [sic] country that there were thousands of acres of prairie lands and with all the burning that they could do the country has been growing up in timber more and more." It is my opinion that a similar process can be hypothesized for the North Fork region. That is, if only natural fires had occurred, the periodicity between burns would have been sufficient to establish a greater number of conifer stands than my data indicate were present in 1865. Ethnographic data presented in this paper for the Lassik and the Wailaki and ethnographic analogy to other hunter-gatherer groups in similar fire regime environments indicate that anthropogenic fires were used extensively and for a number of reasons. This use of fire on a regular basis would have resulted in a greater number and a shorter periodicity [frequency] for anthropogenic fires within the North Fork region than those resulting from natural causes. Thus, anthropogenic fires would have been a more significant factor than natural fires in influencing vegetation and the environment. Absence of any human burning prior to 1865, however, would have still resulted in an environment more open than today.

The authors of one of the major studies of historical California vegetation associations noted that little is understood of aboriginal burning practices within the state (Barbour and Majors 1977: 408-409). In the early 1900's Willis Linn Jepson, a professor at the University of California, who authored *The Silva of California* outlined evidence for Indian burning (1910: 10). Jepson (1910: 11) noted that:

> "With an annual average rainfall of forty to fifty inches, with a rich soil and with an increasing control of annual fires, the forests and woods of this whole region are showing a decidedly aggressive character and are encroaching steadily on the barren lands. There is today more wooded area

> in Humboldt County than when the white man came over a half-century since."

There is little doubt that prior to the contact period many of the Indian groups of California utilized fire in conjunction with subsistence activities. Henry Lewis (1973: 1-101) has presented an overview of Indian burning in California. In addition, others (for a good overview see Pyne 1982: 71-83) have documented that burning was practiced by many Indian groups throughout North America.

In a later study, Lewis (1983: 75-80) discusses contemporary burning practices of the aborigines of Australia. He notes that among aboriginal groups still depending on the environment for traditional food resources, burning is utilized to improve habitat and to maintain diversity (Lewis 1983: 79). It is not, he points out, simply a "fire management program," but rather a hunting and gathering fire management program (1983: 79) to maximize desirable subsistence resources. It appears, using ethnographic analogy, that burning was used within the North Fork basin for similar reasons. Earlier research (Keter 1986: 3-8) indicated that for much of the North Fork basin the oak-woodlands are the seral (intermediate succession) stage for the mixed evergreen forest; in this area dominated by Douglas-fir. By preventing the establishment of the climax vegetation community, the oak-woodlands were "managed" to maximize desirable subsistence resources. [See Keter 1989, 1995, 1997]

As Lewis points out (1983: 75):

> ...to successfully forage for plants and animals, people must understand the seasonal availability and regional distribution of the plant species used by them as well as those consumed by the animals they hunt. They must also understand the life histories and adoptive strategies of the resource animals hunted and the predators with which they compete. Thus, for a people to depend upon a few, mechanically simple tools to obtain a livelihood, they must have a broadly based and detailed knowledge of the environment they exploit.

While limited ethnographic data exists for the Pitch Wailaki and the Lassik, there are a number of references to burning. In addition, it is likely that the burning practices of the neighboring Yuki and Wailaki were similar and ethnographic data on these two groups was also reviewed. Essene (1945: 55) writes that the Lassik regularly used fire to keep their territory clear of underbrush to make it easier to hunt and to travel. One of his informants indicated that much of Trinity County was open prairie prior to the contact period. There were a number of other reasons that burning took place. For example, to drive deer

(Goddard (1923: 122), for collecting grasshoppers (Curtis 1924: 25), and after collecting acorns the area was burned so that disease was kept down (1-395) and the ground was cleared of undergrowth [including immature Douglas firs] for easier collecting in the future. One consultant [I-395] noted that when he was young there was very little brush in the area, but by the time he got through school small pines and Douglas firs were scattered all through the larger oak trees. He blamed this on the lack of fires. He also said that when he was young he was told the reason so much of the area was open was because the Indians had burned. That to keep fires from getting too hot and causing damage they would start the fires on the ridges and burn them downhill.

Burning was also utilized to improve the quality of basketry materials by encouraging the growth of young pliable shoots (personal communication Kathy Heffner McClellan, anthropologist, Six Rivers National Forest). I plan to further research this topic and present a more in depth discussion of burning practices in the future.

During the historic period, the North Fork basin was used for intensive grazing by ranchers [Keter 1994]. First cattle and later sheep were found in great numbers in the North Fork country (Herbert n.d.: 77). Evidence of overgrazing is still evident in the area. The lack of perennial grasses and the prevalence of annuals are indicators of overgrazing (personal communication Janis Stevenson Range Conservationist Six Rivers National Forest; Burcham 1981:173). [See Keter 1989]

It is well known that during this era burning was employed by ranchers on their rangelands to keep down brush and keep the land open for grazing. Many open [grasslands/savanna] areas contained little or no vegetation because of overgrazing and fires did not spread across wide areas of the landscape because of this break in the continuity of light fuels (Covington and Sackett 1986:452, Arno and Gruell 1986: 275, W.C. Interview). In addition, the time of year when burning usually took place was during the late fall when livestock were brought in from their summer range. A consultant (W.C. Interview) indicated burning took place after the first snows in the high country. Therefore, although livestock overgrazed the North Fork Eel River basin and this resulted in a general degradation of rangelands and caused erosion problems [Keter 1989], the fires ranchers set during were insufficient [they simply did not burn a wide area due to lack of fuels] in intensity or areal extent to discourage widespread growth of Douglas-fir (*Puseudotsuga menziesii*). [Especially on north facing slopes and in areas with higher soil moisture content.]

Since 1905 when this area came under the jurisdiction of the U.S. Forest Service, burning has been illegal on public lands. The emphasis has been on timber management. Interview

data and homestead records indicate that while occasional uncontrolled fires occurred after this date, they were not common nor widespread, and that since the creation of the Trinity National Forest brush density and understory growth in the oak woodlands [being invaded by Douglas fir see Keter 1995, 1997] has increased dramatically (1-395, 1-391). The ethnographer Edward Curtis (1924-25) wrote that: "one of the sorest grievances of northern California Indians, as well as many white men, is that the Forest Service will not permit the burning of the mountainsides. Indians declare that they cannot follow deer, and white men note that they cannot graze cattle, because of the impenetrable thickets."

Climatic Factors

Several papers (for example Lewin 1985: 165-166, Ritchie 1986: 65-74; Cole 1985: 289-303) have discussed vegetation and its response to changes in climate. It appears that once established, vegetation regimes tend to maintain themselves long after suitable conditions for their establishment has disappeared. An example in this area [of what might be termed vegetation inertia] are the remnant stands of western juniper (*Juniperus occidentalis* Hook.) located in the Yolla Bally Mountains. One remnant stand is located on Soldier Ridge in Mendocino National Forest and is documented in the literature (Griffin and Critchfield 1972: Map 32). In addition, I have located another stand on a xeric ridgeline (Powell Ridge) approximately ten miles to the north of Soldier Ridge on the divide between the Middle Eel and the South Fork of the Trinity Rivers. This is approximately 10 air miles to the east of the North Fork drainage. These are the only documented occurrences of western juniper in the Coast Ranges (Griffin and Critchfield 1972: 21).

[Since this paper was written I found a number of other locations with western junipers including within the North Fork basin along Littlefield Creek near Antone Ridge and at the headwaters of the Mad River/Middle Eel River divide along the Waterspout Trail that drops down to the North Fork of the Middle Fork Eel River. I last visited this area in 2012 and at that time most of the junipers were dying out as Douglas firs were encroaching the open meadows along the trail just after it headed south from the trailhead on the Forest Service road where it paralleled the seasonal drainage dropping to the North Fork.]

It appears that during the xerothermic period this region was more arid than today. The probability is that vegetation inertia, when combined with natural and anthropogenic fire, has impeded development within the North Fork basin of what should today be a predominantly mixed evergreen forest dominated by Douglas-fir. It appears unlikely that the rapid and dramatic changes to vegetation in the last 120 years can be attributed to climate. The coincidence of such significant changes to vegetation in such a short period of

time based on climatic factors alone and occurring concurrently with the radical shift in land-use patterns which took place during historic period seems unlikely.

Vegetation Study Results

The North Fork region as classified by Kuckler (1977: map) contains three major vegetation types; Oregon Oak Forest (*Quercus garryana*), Mixed Evergreen with Rhododendron (*Arbutus, Pseudotsuga, Lithocarpus, Quercus, Rhododendron*), and Coast Range Montane (*Abies, Pinus, Pseudotsuga*). In this region, the Oregon oak forest type includes the black oak (*Quercus kelloggii* Newb.) which usually grows in association with, but is sub-dominate to the white oak. Canyon live oaks (*Quercus chrysolepis* Liebm.) grow in the more well-drained rocky areas and some of the deeply eroded canyons. A large and extensive stand of live oaks is located on well-drained rocky soils along the ridgelines and slopes in the Hayden Roughs area (T.4 S., R. 8 E., Section 7). The Mixed Evergreen Forest, dominated by Douglas-fir, the Oregon oak forests, savanna grasslands, brush lands, and areas of poor soils (usually of serpentine), form a complex mosaic which at the higher elevations in the northwest portion of the North Fork basin meets the Coast Range Montane Forest.

I have divided the North Fork study area into four sub-areas (Map 1). The reason for this division is because of differences in altitude, vegetation mix, and historic activity among the sub-areas. Furthermore, it was useful for statistical purposes. I have data for all sub-areas; however, the majority of the work that has been accomplished and much of the data presented in this paper are for sub-area I.

Sub-area I is located on the east side of the North Fork and contains approximately 27,100 acres. Of these lands approximately 19,000 acres are Forest Service lands, 1,100 acres are BLM lands, and 7,000 acres are private. It is important to note that most of the private lands in sub-area I were acquired under the 1905 Forest Homestead Act or the National Forest Indian Allotment Act. One of the stipulations of bot these acts was that the land be agricultural in nature and contain no stands of commercial timber. I have the majority of homestead records for these parcels, complete with a verbal description of the vegetation and a color coded map of the vegetation distribution [mostly filled-out by Mad River District Rangers]. It is clear from these reports that almost no mature conifer stands existed on these parcels. There may have been some stands of smaller Douglas-fir invading the oak-woodlands since there is evidence for this in recently logged pole size stands on some of the private property. An example of fir encroaching on a homestead can be seen at the Russ Homestead (FS # site 05-10-54-300). This homestead was not abandoned until

about the 1930's. Here, the conifers are very young; most are under 50 years old and are crowding in around the cabin area. Clearly these trees have become established since the homestead was abandoned. It should also be noted that many of the original land surveys by the Government Land Office (GLO) and Forest Service used oak trees as bearing or corner markers. Recent land surveys have found many of these trees dead or dying within stands of Douglas-fir (personal communication Larry Walter Land Surveyor Six Rivers National Forest).

Table 1
Douglas-fir Stand-Age Data
1985

Timber Sale	Year	area	# of units	acres	Average age	age
Atkinson	1983	III	37	688	90.8	92.8
Yellow Jacket	1982	II	51	981	114.6	117.6
Lightfoot*	1985	I	53	546	-	103.0

Note: all age stand data was gathered by silviculturalists, Mad River Ranger District, Six Rivers National Forest.

-number of trees aged per timber sale unit varied from about 3 to 8

*additional units have been added to 1986 preliminary data

National Forest lands, within the North Fork basin, can be classified into three categories: wilderness areas, scenic river areas along the North Fork, and multiple-use lands on which timber harvesting may take place. During the 1985 and 1986 field seasons, I surveyed approximately 3,000 acres of private, multiple-use, and wilderness lands. In addition, I classified vegetation on an additional 7,500 acres for this study. It is important to note that these timber stands represent practically all pole-size or larger conifer stands existing on multiple-use lands within this sub-area. Preliminary results of the ages for these stands were presented in an earlier paper (Keter 1986). Table I present the final analysis of this data and presents age data on timber sales in two other sub-areas. Wilderness and scenic river areas appear to be similar in nature to multiple-use lands and there is no reason to believe there is a bias towards any particular vegetation association. Some of the wilderness lands were evaluated and are included within the polygon data base.

Vegetation for the area was plotted using a system of "polygons" generated by the Forest Service Land Planning Department. The polygons vary in size from about 2 to 250 acres, most averaging 20-40 acres. Each polygon contains specific data on a unit of land, including soils and vegetation type, creating a logical descriptive unit of the area. I carried polygon maps and classified each polygon on the ground. As I surveyed or passed through an area, I noted the presence of dead or dying oak in the stands of Douglas-fir and whether the fir were in even-aged pole-sized stands. I then compared my classification with a computer printout of polygon data and indicated what the polygon would have looked like in about 1865 using field data on decadent oak stands and timber stand data on the age of Douglas-fir when available.

I developed about 20 basic vegetation classifications (Appendix A) which could be grouped into five categories. While conifer stands and oak-woodlands were relatively easy to classify and age, other vegetation associations were more problematic. For example, throughout the North Fork basin there are areas of serpentine soils and areas of exposed rock with their own unique vegetation regimes which appear to have changed little over time. It also appears that Douglas-fir are not invading the open savanna lands in sub-area I (this is not true in sub-area III). The open savannas have had dramatic changes in species composition due to the introduction of Mediterranean grasses (Jackson 1985:349) [see Keter 1989]. However, the extent of grasslands in sub-area I appears to have remained relatively stable over the last 120 years. The reason for this stable distribution is that the grasslands reduce the moisture content of the soils rapidly. In the North Fork basin soil moisture availability, rather than amounts of moisture, nutrients, light, and temperature are primary variables in determining forest composition (specifically southeastern Humboldt County, Barbour and Major 1977:367).

An example of this can be seen on some of the local private lands where pole-sized timber which invaded oak-woodlands already have been harvested. In these areas, Douglas-fir has a low regeneration success rate despite adequate soils, instead grasses are predominating. This appears to be occurring because without the shading effect of the oak-woodlands, the soil moisture content is reduced to a point where young Douglas-fir cannot be established.

Polygon Timber Stand Data

[Refer to Keter 1995 and 1997 for subsequent research and data on this subject.]

The following data based on the polygon studies represents work done in sub-area I. The other sub-areas have not been studied as much [there were less on-the-ground vegetation

surveys]. Preliminary data including field survey and timber stand age data (Table 1) clearly indicate that results will be similar in these sub-areas. Graph I and Table 2 illustrate the dramatic increase in the areal extent of Douglas-fir and the reduction in extent of the oak-woodlands since 1865. The color coded polygon maps generated for this study also further substantiate this fact. The 1985 map shows a preponderance of green polygons denoting Douglas-fir stands, while the 1865 map shows most of these areas as oak-woodlands with a very minor component of Douglas-fir.

The areal extent of Douglas-fir has increased by about 500% while the oak-woodland has decreased by about 80%. It appears that the areas of grasslands and areas of brush and poor soils have remained relatively stable in distribution. It was difficult however to document any changes to these areas. It is likely that many areas of brush or scrub (locally referred to as "roughs") have increased somewhat in density of vegetation since 1865. These areas are usually defined by poor soils often of serpentine or laterite. They appear to have unique vegetation associations which existed prior to 1865.

The data that I have presented indicate that the oak-woodlands have experienced the most profound changes since 1865. There are within all pole-sized stands of Douglas-fir which I examined some old-growth fir--usually at least one or two per acre. These trees have large lower branches evidence that they grew with little infra-species competition. After cessation of burning, these were the seed trees for today's pole-sized stands. The oaks provided shade for the seedlings and conserved the moisture content of the soils. When the conifers grew above the oaks and shaded them out, they began to die. It should also be noted that within many fir stands, there are a few old growth Ponderosa pines (*Pinus ponderosa* Laws). These trees cannot become established under a dense canopy and provide additional evidence of a more open vegetation regime before 1865.

The dramatic change in the last 120 years in the areal extent of conifer stands and oak-woodlands has had a significant impact on the environment of the North Fork basin. For example, the reduction in oak-woodlands--when combined with increased competition from livestock--has had an effect on the carrying capacity of the land for various animal populations such as deer. [There has been a significant reduction in the deer population within the North Fork basin see Keter 1995]. I tis clear from my research that the Indian people exploited an environment very different from that which we see today.

Summary

I believe the results of this study demonstrate that a thorough understanding of the pre-contact environment is necessary for an accurate interpretation of the prehistoric record.

This is especially important when using catchment models or evaluating the resource base for a particular group. Without a more refined environmental model, generalizations on the prehistoric resource base may be inaccurate.

The study of past human impacts to the environment can also be useful in other disciplines; for instance in the study of long term changes to the environment. A recent study of papers in the periodical Ecology (Hamburg and Stanford 1986:169-171) indicated that only 26% of the papers made direct reference to previous land-use patterns on the sites studied. As the authors point out (Hamburg and Stanford 1986:169-171): "Knowledge of the historical patterns of anthropogenic disturbance is critical to an understanding of the patterns (or lack thereof) and processes of ecological systems."

While this study covers a limited and carefully defined area, it is logical to expect that vegetation regimes within the oak-woodland regions of the North Coast Ranges, especially those areas where white oak once predominated, have a similar history. It is likely that areas further to the west and north with more mesic sites have tended to lose more grasslands to invading conifers. Tan oak (*Lithocarpus densiflorus* Hook & Arn) appear to be a good indicator species for this occurrence. Its association with Douglas-fir seems to indicate greater moisture content for soils or at least for a slightly longer period in the spring. This factor causes a generalized increase in the potential for dominance of Douglas-fir that is quickly realized with cessation of burning.

Although my study focuses on a limited area, I believe that one of its implications has a wider applicability; hunter-gatherer groups have a substantial impact on their environment. Because of their simple technologies their profound effects to the environment are often overlooked or minimized. Hunter-gatherers are far more than passive observers of the ecosystems within which they live. The concept of prehistoric America as a pristine wilderness must be tempered with an understanding that aboriginal groups affected their environments through their subsistence and cultural activities. A dynamic existed between the potentialities of a particular environment and the effects to the environment by its inhabitants.

Every region has a unique biotic history which has been influenced by many factors including climate, soils, and topography. Human effects to the environment, past and present, must be recognized and considered as major factors influencing the composition of the environment. A thorough consideration of all these factors will be useful in interpreting the prehistoric record.

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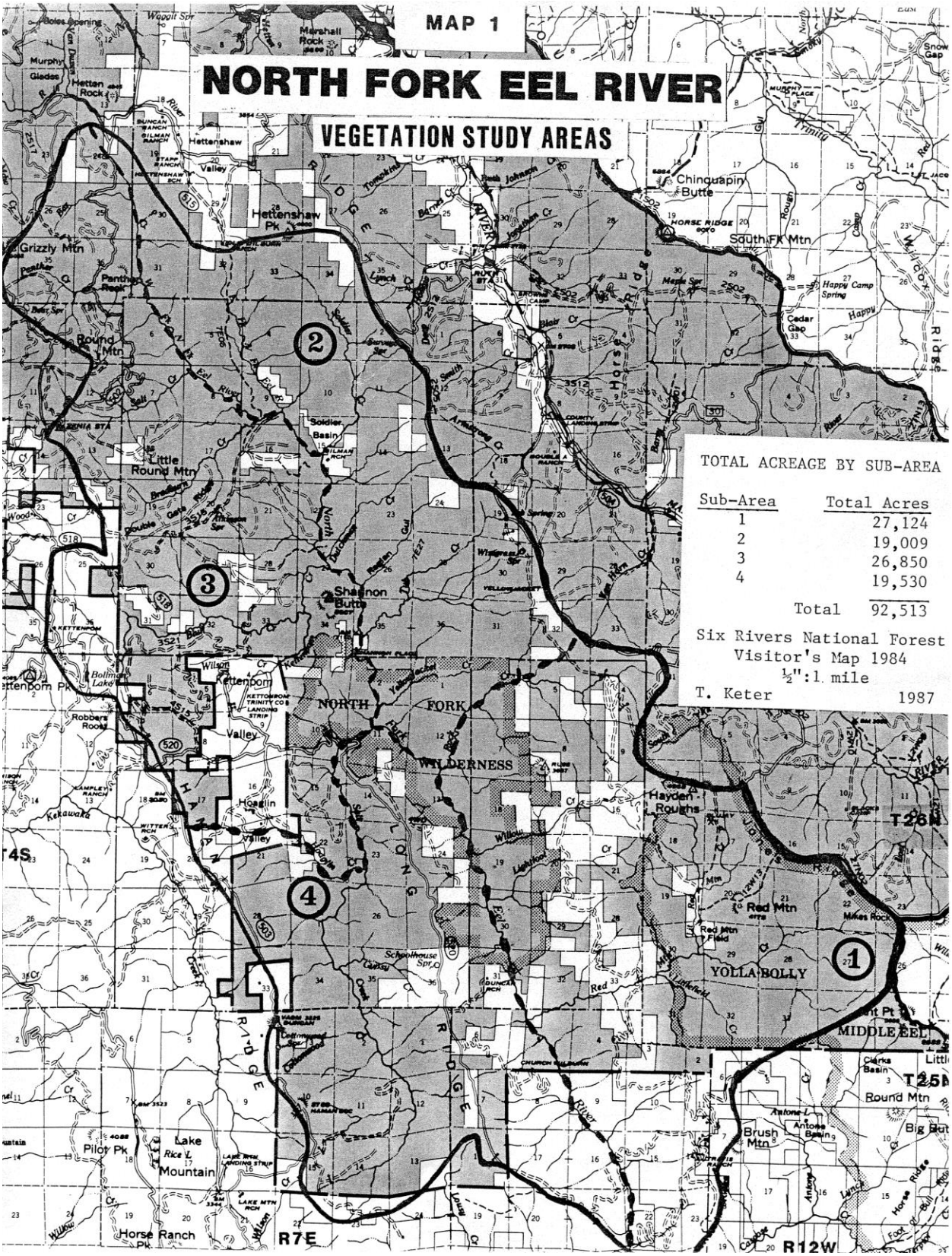

GRAPH 1

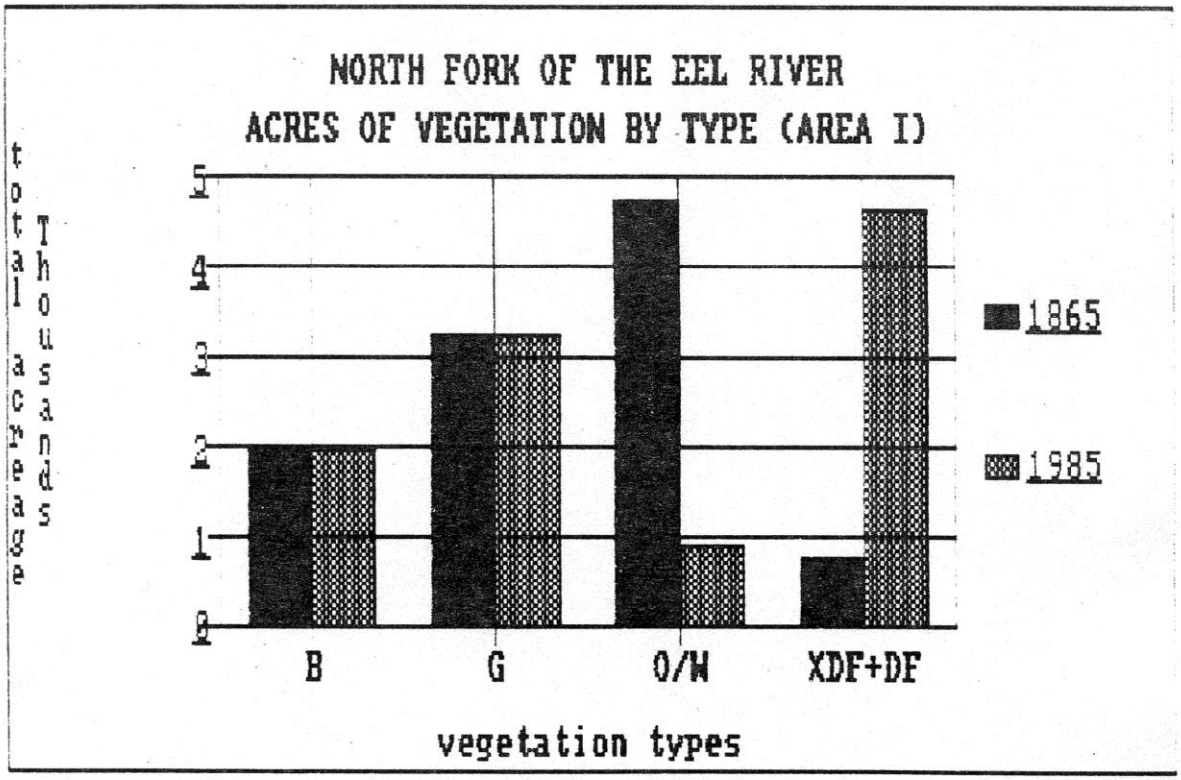

TABLE 2

TOTAL ACRES OF VEGETATION CLASSIFIED SUB-AREA I

Vegetation Type	Abbreviation	1865 (acres)	1985
brushlands/ poor soils	B	1989	1955
grasslands (savanna)	G	3232	3217
oak-woodland	O/W	4734	928
Douglas-fir (predominating before 1865)	XDF	769	769
Douglas-Fir (post 1865)	DF	-	3855

These figures are represented in Graph I.

APPENDIX A

Key to Polygon Coverage Map

Vegetation regiemes

B	barren few grasses or brush
Bbg	mostly barren some brush, grasses, lo, dp
Bol	brush mix of some oak. lo, dp
Bf	brush some df, and/or dp, pp present
Bl	brushland manzanita etc.
Blo	poor soils lo predomiates
Bps	poor laterite soils jp, manz, and/or brush present
Osx	xeric grasslands some manz. and/or dp, oak
Oso	open grassland prairie
Os	grassland few oaks (under 10 per acre)
Osw	greater number of oaks (10-20 per acre)
Osc	os with and/or pp, jp, df, oak present
W	oak-woodland (over 30 oaks per acre)
Wc	oak-woodland with conifer present (df, pp)(under 10 per acre)
Wdf	oak-woodland small df invading (still under oak canopy)
Wb	oak-woodland some manz. or xeric vegetation
Dfo	DF have invaded stand of oaks are closing canopy (+50 yrs.)
Dfd	df have over grown oak which are mostly dead or dying
Dfy	df have invaded stand of oaks (-50 yrs)
Dfb	some type of xeric species such as manz, dp present
Xfw	df and oak in mix or where df have predominated before 1850
Xdf	mature stand of df (+150)
Xob	Df with some oak & brushland mix

Key to Abbreviations

df	Douglas-fir	lo	live oak
dp	digger pine	oak	white/black oak (white oak predominates in in most areas)
manz	manzanita		
pp	ponderosa pine		
jp	Jeffery pine		
xdf	Douglas-fir predominating prior to 1865		

View of area (for polygon data sheet)

1 surveyed area
2 walked through area
3 drove or walked through some of area
4 view from afar (ex. across drainage)
5 air photo