Effects to Vegetation and the Ecosystem Resulting from the 2017 Dutchman Fire at Raglan Flat, Trinity County, California

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Introduction

On June 20, 2018, I led a group of scientists, environmentalists, and Six Rivers National Forest employees on a field trip to Raglan Flat; located in the northeastern region of the North Fork Eel River Watershed, (for a list of participants see Appendix 1). The objective for the trip was to observe the impacts from the 2017 Dutchman Fire to the area's vegetation. We also visited the Yellowjacket place, located just to the south of the burned area. A separate paper discussing the field trip to the Yellowjacket place: *Changes to Vegetation from 1983 to 2018 Associated with the Yellowjacket and Sally Jacket Place, North Fork Eel River Watershed, Trinity County, California,* is available on my web site.
The sites are located on the Mad River Ranger District of Six Rivers National Forest.

This paper provides a summary of our visit to Raglan Flat within the context of over three decades of research by the author on the historical processes and ecosystem dynamics that have affected the North Fork watershed's environmental trajectory through time. It is focused on the effects to the vegetation found on the site resulting from the 2017 Dutchman Fire. In 2017, I presented a paper discussing historical research at Raglan Flat: *Protohistoric and Historic Native American Sites within the North Fork Eel River Watershed, Trinity County, California.* The paper is available on my web site. All photographs in this paper unless otherwise attributed were taken by the author.

I first visited the North Fork Eel River watershed in the fall of 1980, while surveying for cultural resources in a timber stand for a proposed timber sale located near Hettenshaw Peak at the northern end of Mad River Ridge. When I looked out across the North Fork Eel River watershed from this vantage point, I saw what appeared to be a vast wilderness stretching for miles to the south and west.

At that time, no bridge crossed the river for its first 25 miles (the Zenia-Covelo Bridge near the Mendocino County line is still the only permanent bridge over the river). The only road of any consequence east of the North Fork Eel--the Jones Ridge road climbed south from Three Forks along the divide between the Mad River and North Fork watersheds in order to access the upper Mad River/Yolla Bolly Country (this road FS road 27N02 was paved in the 1970s and overlays portions of the old Round Valley to Weaverville Trail).

At that time, there were no year-around residents east of the river all the way south from the North Fork's headwaters, near Hettenshaw Valley, to the Travis Ranch--located about three miles north of the Mendocino County line. West of the river, there were a few houses and isolated cabins and ranches to the east of Zenia along the relatively broad crest that divides the Main Eel to the west from the North Fork watershed. A few more private tracts of land with ranches and isolated homesteads were located in Kettenpom Valley and nearby Hoaglin Valley on the largest areas of flat land within the entire watershed. There were also a couple of old homesteads surrounded by national forest lands out on Long Ridge. The population of the entire North Fork watershed at that time numbered a few dozen or so permanent residents.

Given the lack of roads, any significant level of logging or other development, and very few residents, it was easy for a first time visitor looking out over the North Fork Eel watershed to conclude that this area was still an untouched "wilderness." It did not take long, however, to learn that first impressions can be deceiving. It is clear now, that history tells us this region was inhabited by more people during the prehistoric era and for much of the first century of the historic era than it was during the last half of the 20th century.

Over the last two decades, with the recent boom in the cultivation of marijuana, the area's population is again on the increase. Only the future will reveal the impacts to the watershed from this increase in population and new land use activities. But what remains clear after decades of research on the past environmental and cultural history of this area is that, the North Fork Eel River watershed has been intensively managed and the environment manipulated in order to maximize subsistence resources for human lifeways for hundreds—if not thousands—of years. Hopefully, a better understanding of the past cultural and environmental history of the North Fork Eel River watershed will help us do as good a job of responsibly managing this fragile ecosystem in the future as it was by its first inhabitants.

Raglan Flat Background and Locational Information

In November of 1984, I recorded a cultural resources site (CA-TRI-991/H) at Raglan Flat. Since then, the site has been visited numerous times. On my last visit before the fire, in April of 2004, I was accompanied by Coyote Fred Downey and Ernie Merrifield. Coyote is a resident of Hulls Creek, and a direct descendant of the Wailaki who inhabited the North Fork Eel River watershed prior to the Contact Period. Ernie Merrifield, also Wailaki, also has family connections to this area. At the time of the visit, he was a member of the Round Valley Indian Reservation Tribal Council.

Raglin Flat is situated within the western portion of the area burned in 2017 by the Dutchman Fire (Image 1). Although only a short time was spent on the site during the 2018 field visit, past field observations, combined with Forest Service fire data and maps, and Google Earth photos provide for a good understanding of the changes that have taken place at Raglan Flat over the last several decades, as well as the effects to the area resulting from the recent fire.

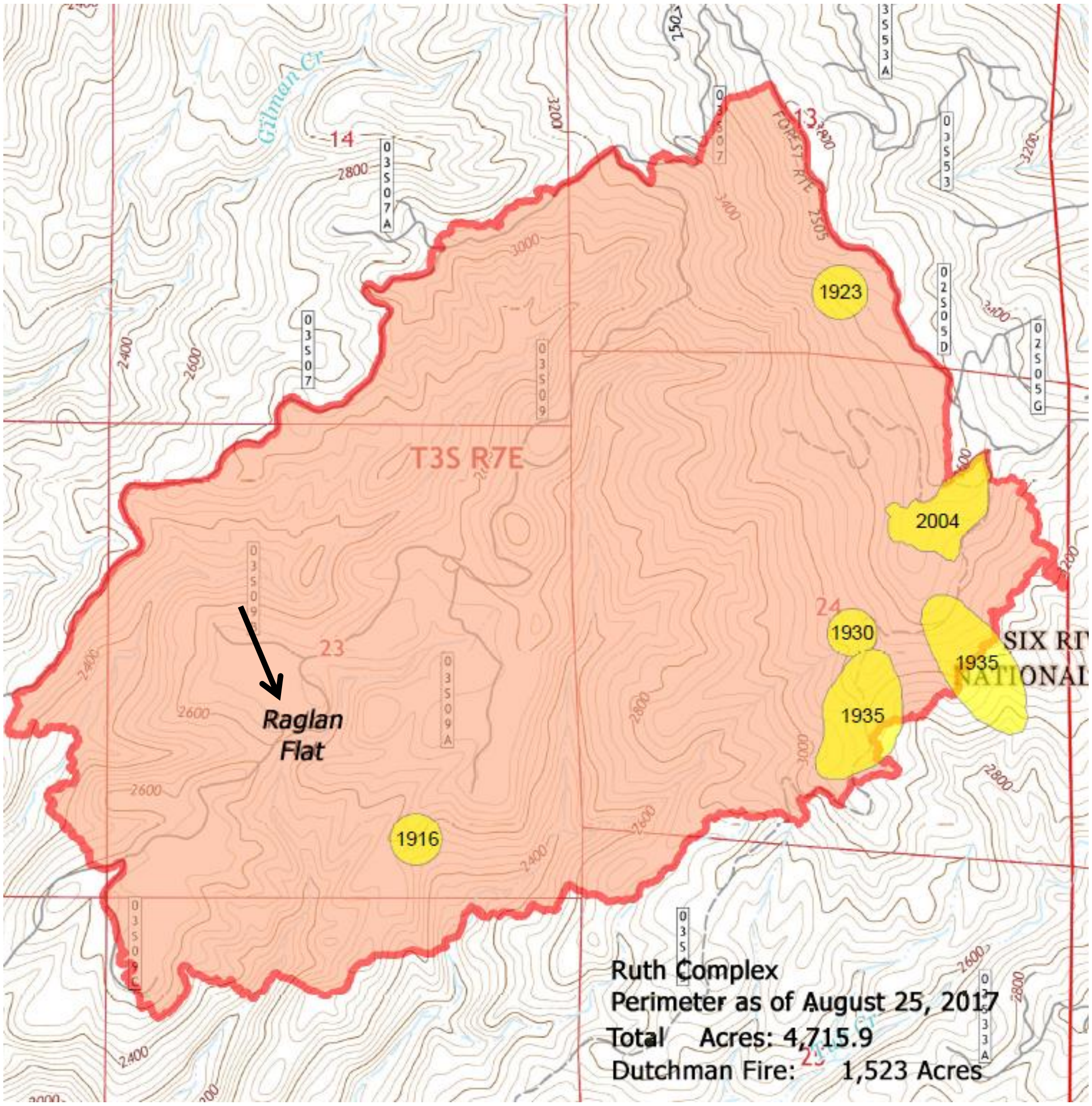

Image 1
Perimeter of the Dutchman Fire
The map also shows the dates of previous fires (in yellow) in this area

Raglan Flat (totaling roughly 12 acres) is situated on an ancient and relatively flat river terrace. During the late 1800s Thomas and Susan Raglin settled on a 160-acre tract (Image 2) centered on what is now known as "Raglan Flat." Although this location is labeled "Raglan Flat" on USGS and Forest Service maps, this spelling is incorrect; refer to the

Trinity County Historical Society Compendium (Keter 2017b: Section B01) for census records and biographical information on the Raglins. In this overview, "Raglan" is used in the text for all references to the geographical location since it is labeled that way on nearly all USGS and historical maps.

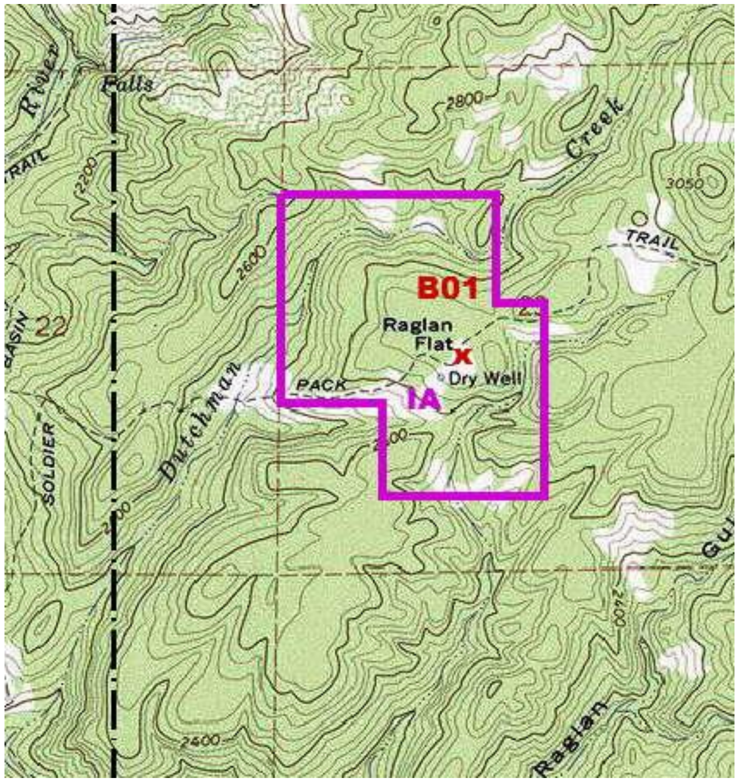

Image 2
Raglan Flat is approximately 12 acres in size and is one of the largest "flats" located on the east side of the North Fork Eel watershed..

At some point in the late 1970s or early 1980s, this tract was acquired by the U. S. Forest Service (the tract was still private in 1977—see Keter 2017b: Appendix 2: Map 21b). It may have been acquired in a land exchange with Twin Harbors Lumber Company. During the 1960s, the company had purchased a number of private tracts (old abandoned homesteads and Indian allotments) in this area—this, however, needs to be confirmed.

Since first visiting Raglan Flat in the fall of 1984, I have returned to study, inventory, and photograph the area a number of times. As a result, there is a fairly complete record of the types and rate of change to the vegetation associations that have taken place over the last 34 years. For an overview of the North Fork Eel River watershed documenting the changes in the extent and distribution of vegetation associations over the last 150 years —primarily the significant increase in Douglas firs invading the oak woodlands after cessation of anthropogenic fires by the Wailaki prior to the historic era—refer to *Environmental History and Cultural Ecology of the North Eel River Basin, California* (Keter 1995).

In the 1980s the vegetation found growing within the North Fork Eel River watershed was first classified into several broad categories by the author based on field research (Keter 1995). Then, changes in the extent and distribution of vegetation associations within the watershed since the beginning of the historic era were quantified through the use of a system of "polygons" developed by the Forest Service. The irregularly shaped polygons varied in size from about 2 to 250 acres. Most, however, averaged about 20 to 40 acres. For example, the Long Ridge 7.5 minute U.S. Geological Survey map is divided into 1,098 polygons, and the entire research area contained approximately 5,000 polygons.

In the early 1990s ecologists working for Six Rivers National Forest developed the Ecosystems Classification System (ECS). The ECS is a more refined GIS-oriented vegetation association classification system than that originally used by the author. For a discussion of the ECS and how it was incorporated into the final North Fork study refer to *Growing the Forest Backwards: Virtual Prehistory on the North Fork of the Eel River* (Keter and Busam 1997).

<u>Vegetation Associations at Raglan Flat (summarized from Keter 1995)</u>

- * Bushlands
  Areas of brush, xeric aspects with limited vegetation, areas of poor soils.

- * Grasslands
  Areas where grasslands predominate (savanna, oak savanna).

- * Oak Woodlands
  Areas of oak woodlands where sub-dominant associates include invading Douglas-fir and mature scattered ponderosa pines and incense cedars.

- * Douglas fir stands under 120 years old (1985)
  Fir predominate or are invading and over-growing the oak woodlands.

- * Established Douglas-fir stands >120 years of age (1985)
  No mature or any old-growth stands of Douglas firs were noted by the author during archaeological surveys in 1983 and 1984—these surveys (50 to 100 meter transects) included much of the area located within the perimeter of the 2017 fire.

The North Fork region, as classified by Kuckler (1977: map), contains three major vegetation types: Oregon Oak Forest (*Quercus*), Mixed Evergreen with Rhododendron (*Arbutus*, *Pseudotsuga*, *Lithocarpus*, *Quercus*, *Rhododendron*) and Coast Range Montane (*Abies*, *Pinus*, *Psuedotsuga*). In this region, the Oregon Oak Forest type (referred to by its local name white oak in this study) includes white oak (*Quercus garryana*) and black oak (*Quercus kelloggi*). The black oaks usually grow in association with, but sub-dominate, to white oak and madrone. Within the North Fork watershed, the Mixed Evergreen Forest vegetation community is predominately Douglas-fir (*Pseudotsuga menziesii*). Although madrone (*Arbutus menziesii*) are found to the east of the North Fork, they are more common to the west of the North Fork of the Eel River (they also seem to grow larger as you get closer to the coast—personal observation). Tanoaks (*Lithocarpus densiflorus*) are found only in a few areas of the watershed to the west of the North Fork Eel River (Keter 1995).

By the early 1980s, as a result of the lack of periodic wildfires, Douglas firs had already invaded, over-topped, and shaded-out oak trees throughout much of the North Fork watershed and thousands of oaks were dying or already dead (Image 3). As a result, today, most of the original oaks woodlands have disappeared; data indicates that there has been about an 85% reduction in the areal extent of the oak woodlands within the watershed since 1865 (Keter 1995, Keter and Busam 1997). The deadfall and buildup of woody debris on the ground (Image 4) resulting from this change in vegetation was the primary reason the Dutchman Fire burned so hot in many of these areas.

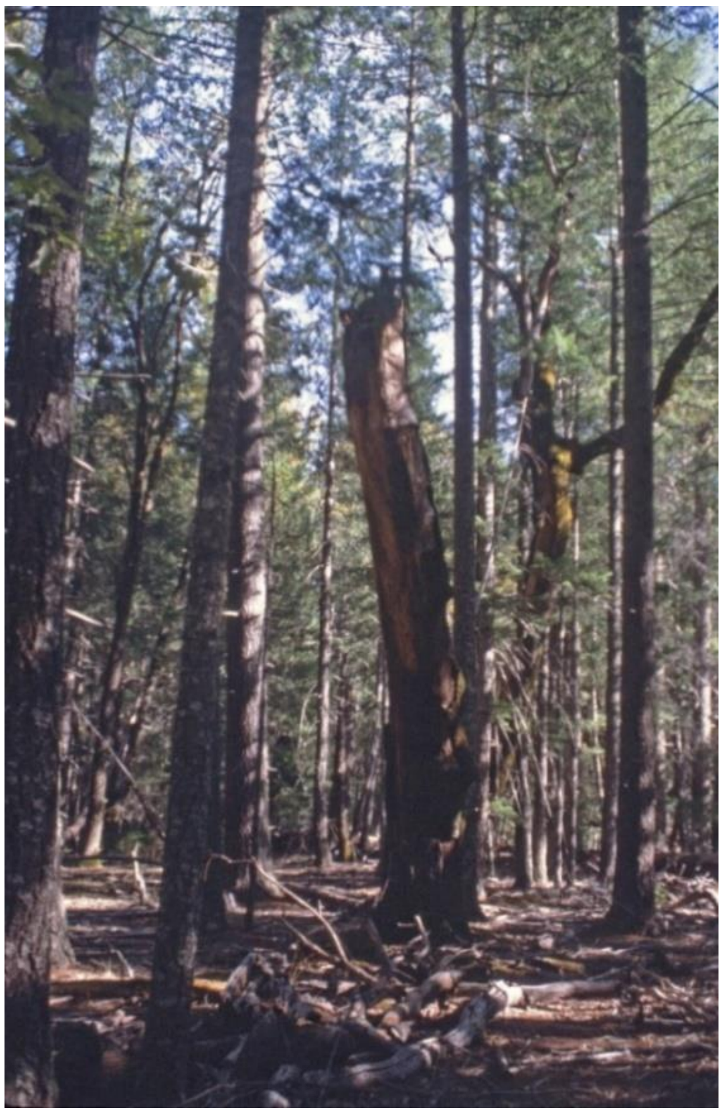

Image 3
Western edge of Raglan Flat in 1989; note the large dead oak (center) and how closely the even-aged Douglas firs are growing.

Image 4
1989: View of the dead fall on a flat just to the east of Raglan Flat.
The large Douglas fir on the left (foreground) is about 110 years old.

Effects from the Dutchman Fire to the Vegetation at Raglan Flat

Image 5 provides an overview of the entire area burned by the Dutchman Fire (the orange tinged areas along the edge of the burn indicate where retardant was dropped). The areas most affected by the fire (i.e. that burned the hottest) were those areas dominated by even-aged stands of Douglas firs that have been invading the oak woodlands over the last 150 years since the cessation of aboriginal burning (Keter 1987, 1995).

Image 6 shows Raglan Flat in May 2014 and Image 7 shows the same area after the 2017 fire. Fire behavior is complex and given the numerous variables including; moisture content of the fuels, temperature, humidity, time of day, etc. each fire is in some ways unique. There are, however, some generalities that can be made concerning fire behavior. The Dutchman Fire, like most fires, burned at different intensities throughout the area; influenced primarily by vegetation associations and the other variables referred to above. This was particularly evident on Raglan Flat and the adjacent area where the fire burned erratically--in some places leaving little evidence today that a fire had even passed through the area less than a year ago, while in other areas, there was 100 percent mortality of the vegetation.

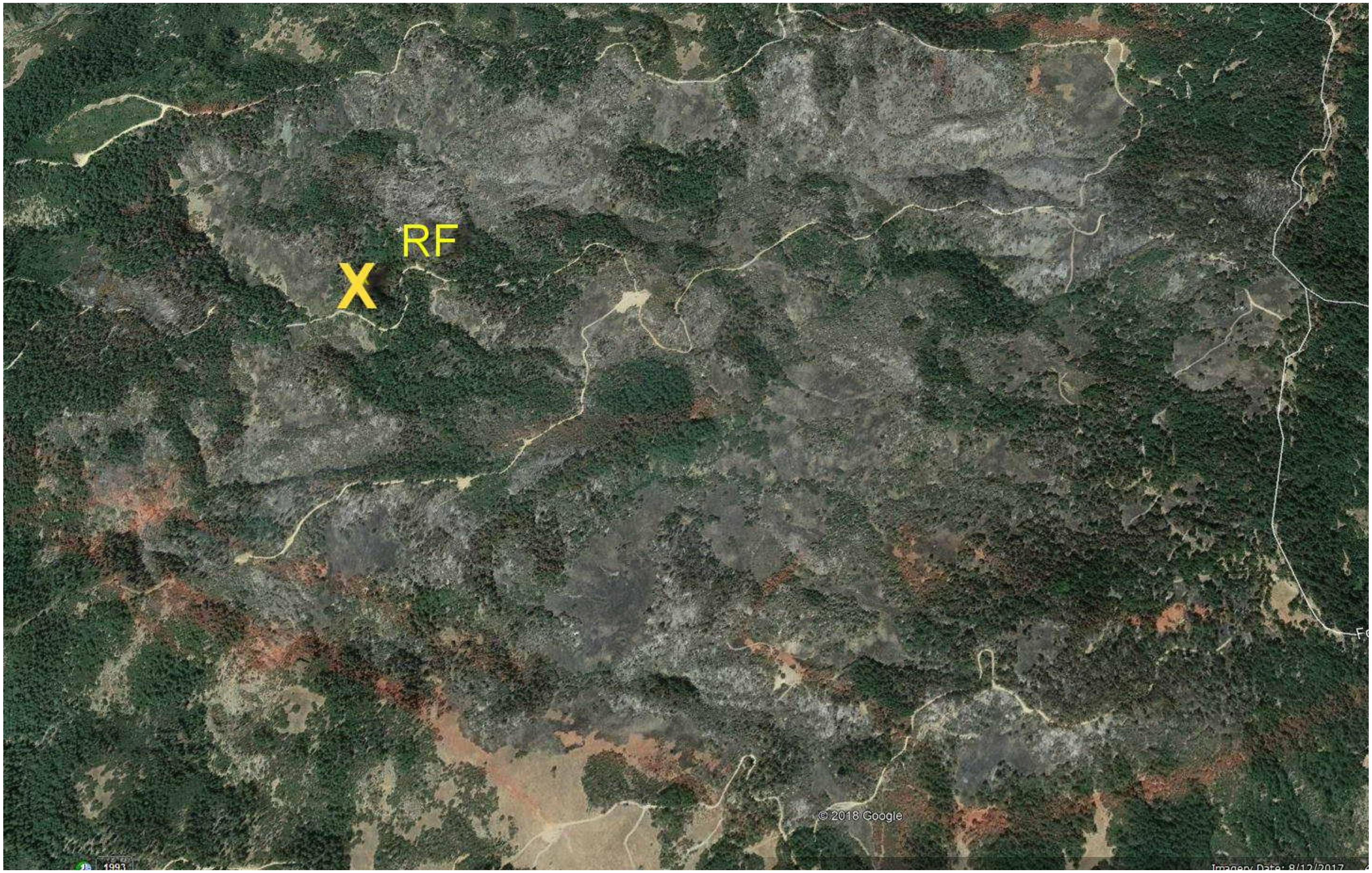

Image 5
Overview of the Dutchman Fire area relative to Raglan Flat (Google Earth, August 2017)

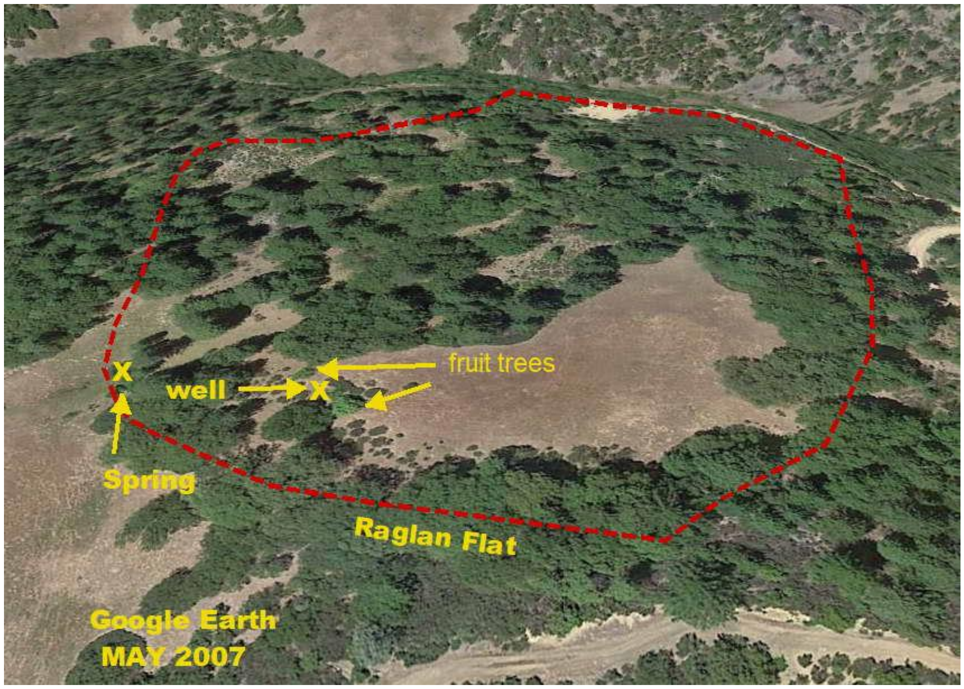

Image 6
Overview of Raglan Flat in May of 2014 (Google Earth)

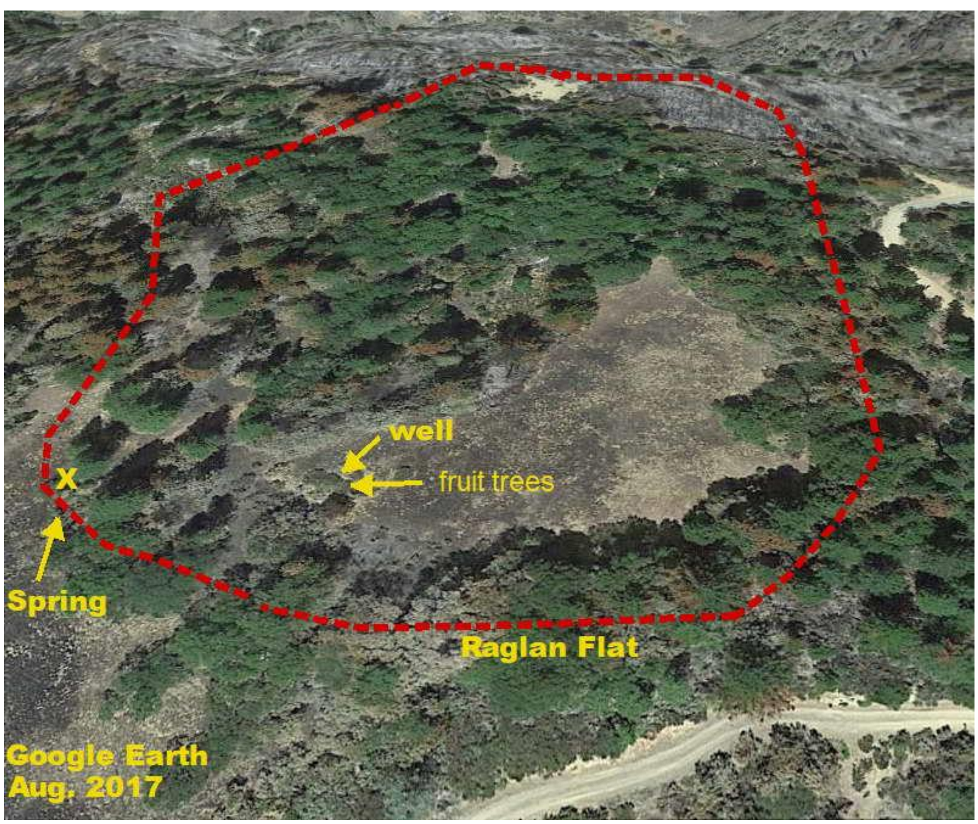

Image 7
Raglan Flat shortly after the Dutchman Fire in August of 2017 (Google Earth)

The following discussion focuses on the specific area of Raglan Flat showing the effects to the vegetation growing resulting from the 2017 Dutchman Fire. The areas discussed below are labeled #1 to #5 on Image 8.

Image 8
Areas on Raglan Flat discussed in the next section. (Google Earth 2017)

<u>Area #1 Pit Feature</u>

A paper (Keter 2016) discussing the cultural significance of the pit feature was presented to the Society for California Archaeology in 2016. Douglas firs had been encroaching for many decades on the small opening that originally surrounded the pit feature and as a result the fire burned very hot in this area. The firs had established themselves in the partial shade of some scattered oaks. Many of these Douglas firs were only three to ten feet tall on my first visit to the site in the fall of 1984. Given their density (and shading from the oaks), many of these trees had experienced little growth over the last three decades (see Images 9, 10, 11).

Image 9
View west to pit feature and young Douglas firs invading the opening in the fall of 1984.

Image 10
View south to Douglas fir saplings growing on the berm of the pit feature. The oak tree (center right) was cored. It was approximately 85 (+/- 5) years old in 1984.

Image 11
View to SE from the pit feature in 1989. Note the density of young Douglas firs and the lack of undergrowth. See Image 15 for the same area after the fire in 2017.

In 1989, as part of the archaeological investigation of the site, all of the young Douglas firs adjacent to or within the pit feature were removed by the author except for a Douglas fir about 6” in diameter (Image 12). On a visit to the site in April 2004, it was noted that despite the intervening 14 years, no other trees had grown back (Image 13).

What appears to be the “mother tree” Douglas fir for many of the young trees growing adjacent to the pit feature was photographed in 1984 (Image 12) when the site was first recorded. This tree did not survive the 2017 fire (Image 14).

It is obvious from Image 14 that the fire burned hot in this area—with near 100% tree mortality. For example, in the area immediately to the southeast of the pit feature where dense stands of young Douglas firs had been growing there was 100% tree mortality resulting from the fire (Image 15)--two of the burned oaks in this area were already sprouting from their bases.

Image 12
Pit feature 1989; note the large Douglas fir (top center left) with its radial lower branches--now dead and dying from the increased shade of the younger trees. It was probably the “mother tree” for many of the young firs growing in this area.

Image 13
April 2004; Douglas firs surrounding the pit feature had grown substantially since 1989. Note only one small Douglas fir had grown back in the area where they had been removed.

Image 14
June 2018; the “mother tree” (snag upper center left) for many of the young Douglas firs growing in this area burned so hot during the fire it did not survive.

Image 15
June 2018: view southeast from the pit feature. This is the same stand of young Douglas firs in Image 11 taken in 1989. Note the two shoots (lower center) sprouting from the base the white oaks. In this area there was 100% tree mortality resulting from the fire.

Area #2 Timber Unit, Landing, and Spur Road

A survey of the general area and air photos indicate that the most intense (hottest) fire in this area burned on the north facing slope of Raglan Flat within a small clearcut unit logged during the Yellowjacket Timber Sale (see Cultural Resources Inventory Report 05-10-293 on file SRNF). The unit was on the steep north facing slope that drops down to Dutchman Creek. Associated with the unit was a newly constructed logging road (spur road 3S09B) that led to a landing (Image 16).

It is obvious from Image 17 that the fire burned very hot in this area (it is not known if the fire burned upslope or downslope). Whichever direction it burned, it is clear that there was 100% mortality to the vegetation growing on this slope.

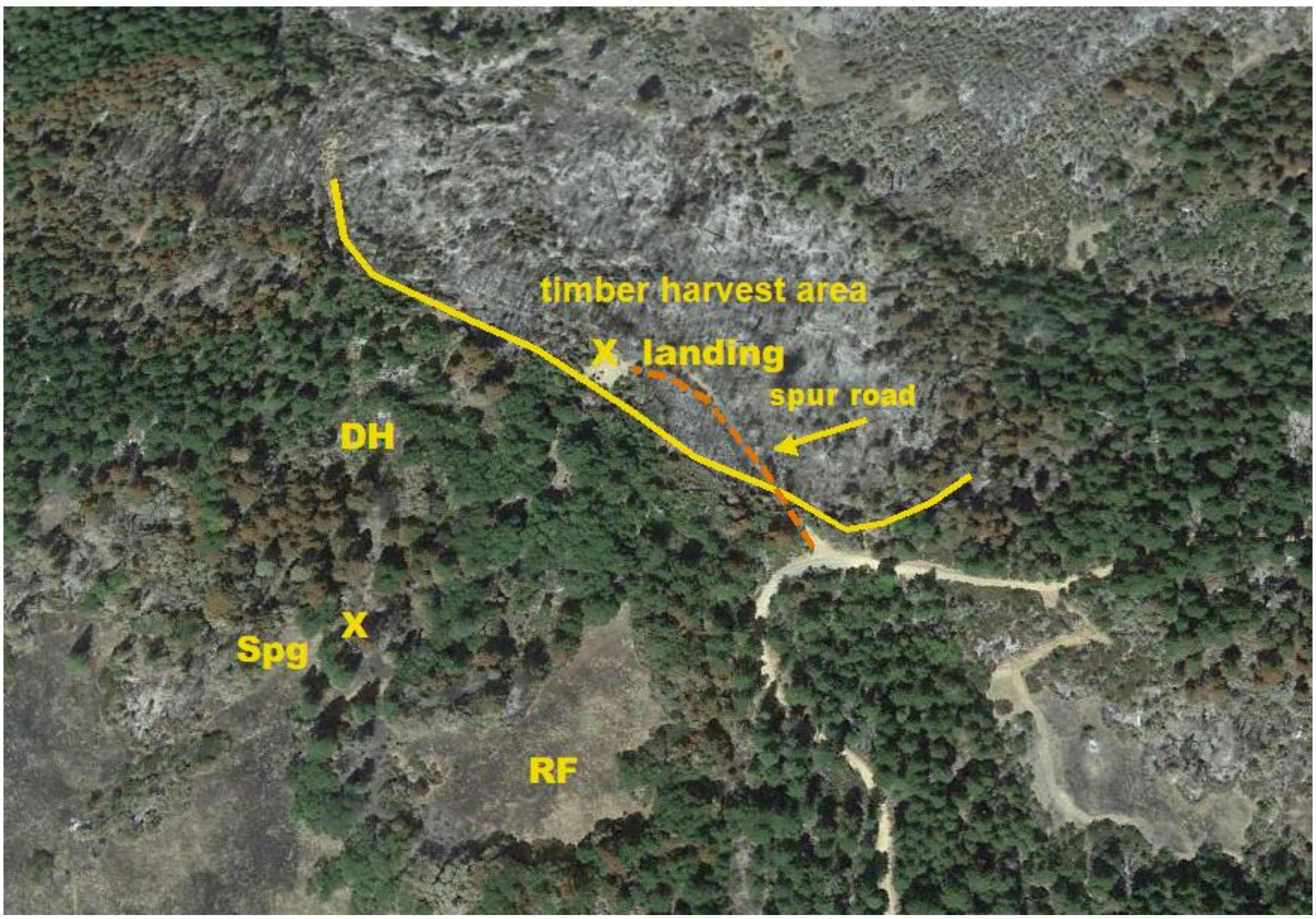

Image 16
Overview of timber harvest area #1 in relation to Raglan Flat.
(Google Earth 2017)

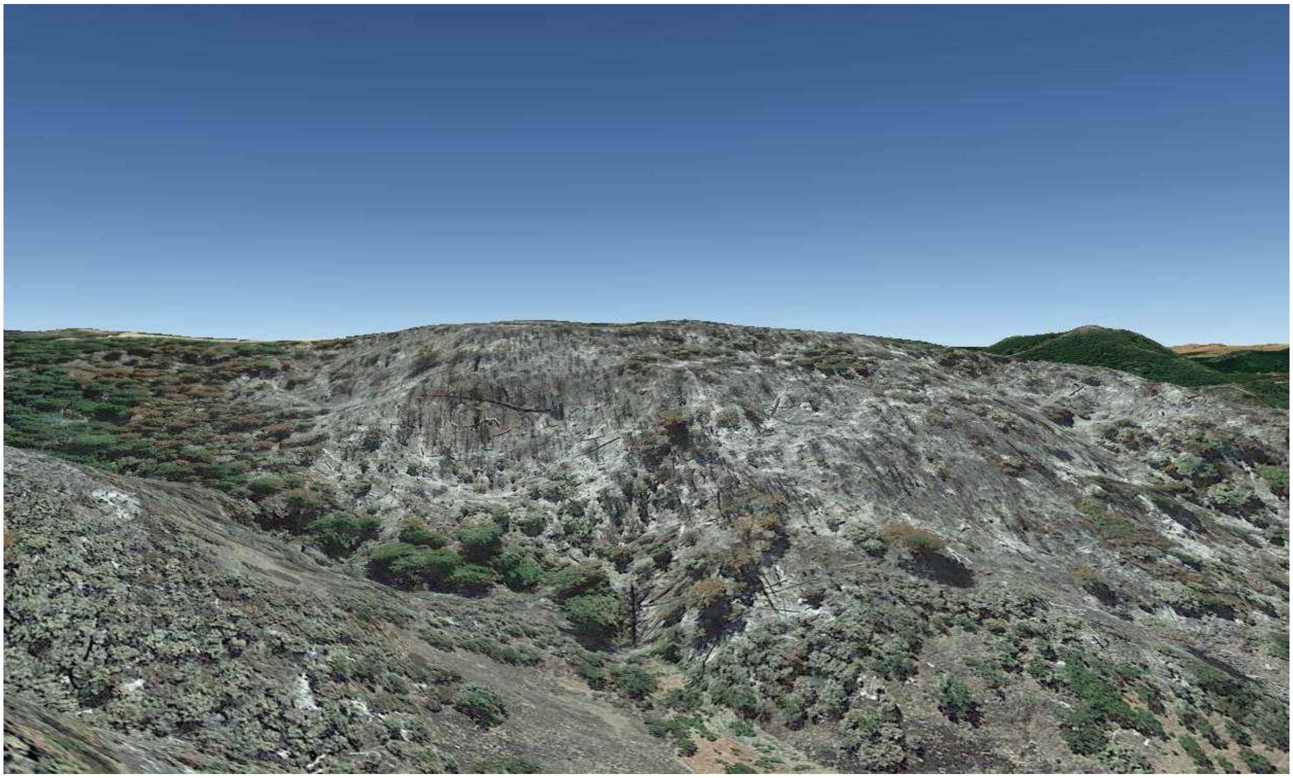

Image 17
The burned area in the center of the photo is the north-facing slope of Raglan Flat.
(Google Earth August 2017)

This unit was either a clear-cut or a shelter-wood unit (see image 18). It is not clear at this time if the unit was replanted after it was logged. Whatever the silvicultural prescription, one thing is certain from the air photos; the fire burned very hot in this area (quite possibly creating such intense heat that it could have adversely affected the soils). It also appears from air photos that a significant amount of brush had invaded the old unit over the last several decades and was crowding out and dominating any young conifers and hindering their growth.

Adjacent to the landing and along the southern border of the logging unit (on the northern edge of Raglan Flat) tree mortality was nearly 100% (Image 19). Manzanita and other brush species that had dominated this site burned very hot (especially as they get denser with age). For that reason, it is clear why this area experienced such an intense burn. This situation where brush is crowding out young conifers on replanted clearcut logging units (most from the 1970s and 1980s) is especially true for many of the old clearcuts and shelterwood units on the nearby north facing slopes in the upper Mad River watershed just to the east of the North Fork Eel watershed divide (Personal observation from working in the area in the 1980s and 1990s).

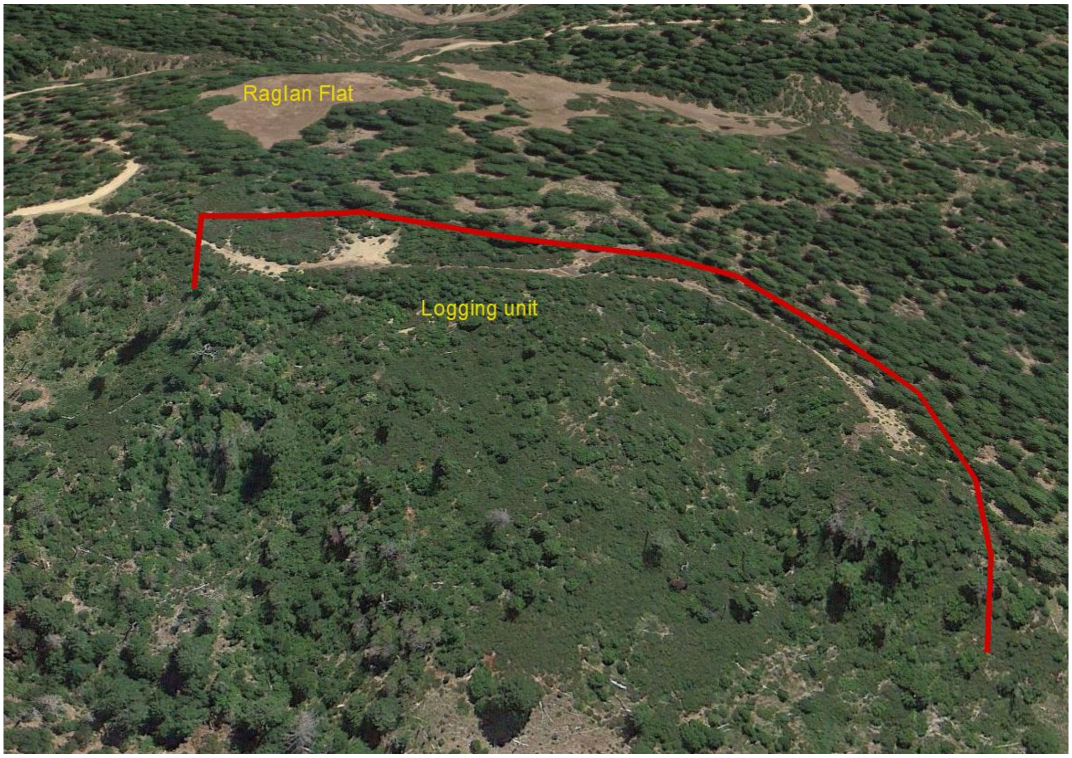

Image 18
Logging unit before the fire; the standing trees suggest that this may have been a shelter-wood unit (Google Earth 2015)

Image 19
There was nearly 100% tree mortality in places along the northern edge of Raglan Flat (2018 Bill Eastwood)

Interestingly, in one area immediately to the south of the old timber unit along the northern end of Raglan Flat, a number of young Douglas fir that had invaded the oak woodlands managed to survive the fire (Image 20). Since it appears that no retardant was dropped in this area (Image 5), it is not clear why it was not as greatly impacted by the fire—especially given its relative location to where the fire had burned very hot.

By the time of the field visit in June of 2018, the area located along the southern edge of the logging unit, vigorous sprouts were already visible (Image 21) growing at the bases of intensely burned and seemingly dead trees.

Image 20
June 2018: view north immediately to the south of the unit landing
along the northern edge of Raglan Flat.
Note that some of the young Douglas firs did not burn here.

Image 21
In the burned-over logging unit along the northern edge of the terrace some brush species and young oak trees (background upper center) and were already sprouting.
(2018 Bill Eastwood)

#3 Spring Area and Savanna Grasslands

The area adjacent to the spring was not significantly affected by the fire. It is located just above an open meadow—referred to as "prairies" or "glades" by locals-- that spreads out to the southeast and southwest as it gently drops downslope from Raglan Flat to the seasonal creek in Raglan Gulch (Image 22). It is clear that many decades ago this was a wider expanse of grassland savanna surrounded by oak woodlands that are now being invaded by manzanita, oaks, pines, incense cedar, and Douglas firs.

A ponderosa pine is situated at the head of the spring. The manzanita in the immediate vicinity have grown substantially since the site was first visited in 1984—this appears to have been especially true over the last 14 years. Images 23 and 24 show the spring area in 1984, followed by Images 25 and 26 taken in 1989 and 2002 respectively, and Image 27 taken in June of 2018 after the fire.

Image 22
View to the SW to Raglan Gulch from Raglan Flat in the fall of 1984.

Image 23
View SE to spring area (dry at this time) fall of 1984. Note the lack of brush surrounding the spring. Wiregrass can be seen growing in the drainage below the spring.

Image 24
View NE to spring area fall of 1984.

Image 25
Fall 1989: Note the size of the manzanita and ponderosa pine has changed little since 1984.

Image 26
Spring area July 23, 2002

Image 27
Spring area June 20, 2018.

All of the manzanita associated with the spring appears to have been destroyed by the fire.
On this visit, most notable was how fast the glades/grasslands in this area were recovering from the recent fire. Image 28 was taken in the spring 2004. It is a view to the southwest on the west side of the glade that surrounds the spring and shows the buildup of a dense understory crowding out the oaks. Image 29 is a panoramic view to the northwest of the same area from the spring after the fire. Despite the near 100% mortality of the overstory (note the surviving oak on the left in the photo, the grasses in the glade have already recovered from the fire.

Image 28
Spring of 2004; view SW from the western side of the opening surrounding the spring. By this time more trees and brush were encroaching on the west side of the glade.

Image 29
View to NW from the spring area; the grasslands seem to have already recovered from the 2017 fire. Note the surviving oak (far right) and high mortality of the Douglas firs.
(Pat Higgins 2018)

Immediately to the north of the spring, the glade is dominated by grasses. It extends up the gentle slope of the drainage that feeds the spring for another 40 meters or so. Above the spring, in addition to some green grasses, some bulbous plants (used as a food resource by the Wailaki) were growing and in some places the soil on the surface was still damp. Image 30 shows that the glade/meadow above the spring has already begun to recover, and is already blanketed with grasses and late spring flowers still green and growing.

It is clear that the glade experienced some of the least impacts from the fire and in the very first year has recovered significantly. The loss of most of the Douglas firs to north of the spring area from the recent fire may be the reason that the spring appears to be running somewhat stronger than it has on past visits (this may also be a result of seasonal variations in rainfall). This supposition could be tested by visiting this site in late August or early September to see if the flow of this spring has increased subsequent to the fire.

Image 30
2018 View SW from western edge of Raglan Flat to the spring area
Note how green the meadow is the first year after the fire.
(Susan Nolan)

#4 Raglan Flat

Much of Raglan Flat is an open grassland/savanna. Image 31 shows the area in 2002. At that time, manzanita growing adjacent to the fruit trees was still very small and had grown little over the years since the site was first visited in 1984. Image 32 shows the northeastern portion of the glade on a visit to the area in the spring of 2004.

By the time of our visit in 2018, much of the vegetation growing on Raglan Flat was already recovering from effects of the fire (Images 33 and 34). The oak woodlands area, located in the southwestern portion of the flat, showed little evidence of the recent fire (Image 34). Overall, it appears Raglan Flat experienced few long-lasting adverse effects from the fire.

Image 31
Raglan Flat 2002; view to NE; note the size of the manzanita growing by the fruit trees on the far right center and upper center of the photo.

Image 32
View to the NE from the western edge of Raglan Flat; spring of 2004.

Image 33
June 2018: view to the NE. The glade still appears much as it has on previous visits.
Note that most of the Douglas firs along the eastern side of the flat survived the fire
(Pat Higgins)

Image 34
June 2018: this oak woodlands area located along the SW portion
of the flat has already largely recovered from the fire.
(2018 Pat Higgins)

<u>#5 Raglan Flat-- Location of the Fruit Trees and Well</u>

The main impact from the fire to the historic site on Raglan Flat was in the area of the fruit trees that surround the dry well. Here, nearly all of the manzanita was destroyed. Also, several of the fruit trees were damaged or killed by the fire.

One of the biggest surprises revisiting the site after 14 years was the significant growth of the manzanita adjacent to the fruit trees. Up until 2004 there had been little growth in the manzanita on the flat since the 1984 visit. Image 35 was taken in the fall of 1984—note that at that time no manzanita were growing around the fruit trees. Image 36 was taken in 2002 and shows the same area viewed from the northern end of the flat.

Over the last 18 years there had been little encroachment of manzanita into this area. Images 37 and 38 were taken after the 2018 fire and show that the manzanita had grown substantially over the last 14 years.

Image 35
November 1984: note the lack of manzanita growing adjacent to the fruit trees.

Image 36
View to SE; note the size of the manzanita in 2002.

Image 37
2018: view to same area as Image RF2-30 above (just to the south of the fruit trees)
Note the oaks in the background of both photos; by now the manzanita was 6’ to 8’ tall.


Image 38
Manzanita and pines invading Raglan Flat;
located immediately to the south of the fruit trees.
(Pat Higgins 2018)

Conclusions

Based on having visited this site numerous times over the past 35 years, it appears that with a few localized exceptions where the fire burned extremely hot due to heavy fuel loads, that overall, Raglan Flat experienced few long-lasting adverse effects from the fire.

By the time of our visit in May of 2018, much of the vegetation growing on Raglan Flat was already recovering from the Dutchman Fire. The adjacent oak woodlands were also recovering nicely and the grasslands were already full of grasses and forbs that appeared to have suffered very little from the effects of the fire. Given the light fuel load in those areas that is not surprising. The stands of young Douglas firs experienced the highest mortality and in many areas it will be years before there is any reestablishment of young tress.

Another visit to Raglan Flat is planned within the next couple of years to monitor post-fire recovery. This will hopefully provide further insights into the effects of fire on the ecosystem of North Fork Eel River watershed and provide future land managers with useful data on the fire history of this still remote region.

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2018 Changes to Vegetation from 1983 to 2018 Associated with the Yellowjacket and Sally Jacket Place, North Fork Eel River Watershed, Trinity County, California.

Appendix 1

<u>Field Visit Participants</u>

Fred Bauer: Eel River Restoration Project (EERP)
Brandy Clark: Archaeologist (USFS)
Pat Higgins: Managing Director Eel River Recovery Project
Bill Eastwood: Director, EERP
Imil Ferrerra: ERRP Forest Health Coordinator
Richard Geinger: Environmentalist and KMUD environment program host
Jeff Hedin - Wilderness Committee Co-Chair
Phil Hoskins - ERRP Wilderness Coordinator
Doug Parkinson: EERP
Ben Schill: (Avocational anthropologist and linguist)
Susan Nolan: avocational botanist studying forbs and grasses
Kitty Lynch: personal friend and environmentalist
Angelique Russell: Six Rivers National Forest, Mad River RD staff
Lulu Wacks: Consultant on communities, ecology and economy of North Coast
Walker Wise: EERP