Annual Report 1995

Research, Inventory, and Monitoring

Mineral King Risk Reduction Project

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1995 Annual Report - Research, Inventory, and Monitoring: Mineral King Risk Reduction Project

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Executive Summary

The Mineral King Risk Reduction Project (MKRRP) was initiated out of a need to assess the operational requirements and cost effectiveness of large scale prescribed burning for wildland management in a setting altered by a century of fire suppression. The direct objectives of the project will be to initiate the reduction of unnatural fuel accumulations and to begin restoration of ecosystem structure and function within the East Fork watershed. However, because the scale of the prescribed burn project is unprecedented, a number monitoring and research projects were also initiated to assess the impacts and responses to the burn of key attributes of both the watershed and the vegetation. These projects and their results are of critical importance since burning on this scale is a new and untried management strategy with little information existing on either short- or long-term resource impacts and responses. Information from these results will feed back into management planning and permit modification and fine tuning of the burn program in addition to providing information to both the public and policy makers.

Following a major planning effort during the spring of 1995, sampling for the MKRRP was begun in June with the objective of collecting baseline or background data in 1995 prior to the initiation of burning. Several types of vegetation sampling was conducted. Standard fire effects monitoring plots were installed in forest and chaparral sites and new Natural Resource Inventory (NRI) plots were established that supplement existing plots in the watershed. An additional study was begun to look at the relationship between fire-scar development in giant sequoias and local fuel loadings. Extensive fuel inventory sampling was also carried out on the south facing aspect of the drainage which will be used as input to the FARSITE fire spread model. Wildlife studies were conducted with these emphasizing fire effects on small mammal populations, but also addressed questions regarding the effects of burning on mountain beaver colonies and fishers populations, sensitive species located in the watershed. Water related sampling was carried out and monitoring equipment installed that looked at stream chemistry, hydrology, and aquatic macroinvertebrates to obtain data on how these will be affected by the burning program. Lastly, fire history sampling was conducted within the watershed to begin looking at spatial extent and variation of past fire events on a landscape scale.

Projects funded out of the Mineral King Risk Reduction Project include fire effects monitoring, fuel and wildlife inventories, and a study on the relationship between fuel loadings and fire impacts on giant sequoia fire scars. Other projects being conducted using resources from within Sequoia and Kings Canyon National Parks and the Sequoia and Kings Canyon Field Station (National Biological Service) include; natural resource inventory, watershed hydrology, stream chemistry, and fire history. Cooperative research concentrating on aquatic biota in the watershed is also being conducted by the University of California, Davis. Resource and research objectives for 1996 will entail the continuation of most studies that were initiated in 1995. Areas sampled in 1995 will be resampled if they were within the perimeters of the area burned in segment #3 and not already rechecked. New sites to be sampled during 1996 will concentrate on segments scheduled for burning during the summer and fall 1996. These will emphasize fire effects plots, fuel loads, small mammal trapping in new vegetation types, and fire history. Continued sampling will include watershed, and aquatic biota. Resampling of the 1970's Pitcher plots (set up to examine forest structure and fuels in red fir forest) will be given emphasis to acquire these data prior to these plots on the south side of the East Fork being reburned. Two new graduate student studies will also be initiated in the watershed during the summer of 1996. One will use remote sensing data to update vegetation classification for the area and evaluate fuels at a landscape scale while the second will be addressing questions revolving around the means and the landscape-scale consequences of selecting differing mechanisms for restoring forest structure to something near pre-Euroamerican conditions.

I) Project Year Synopsis

Accomplishments for each 1995 project and goals for 1996.

! **Fire Effects Plots** - A total of 15 plots within the Mineral King Risk Reduction Project (MKRRP) area were established during 1995. These include six forest plots (one is a control) and nine brush plots. At least three and probably all five forest plots burned during the burning of segment #3. Two of these have had postburn rechecks completed. During 1996 all burned plots will have postburn rechecks completed and new fire effects plots will be established in segments scheduled for ignition.

! **Giant Sequoia Fire Scars and Fuel Loading** - A total of 60 giant sequoia trees (30 scarred and 30 unscarred) have been measured in the Atwell Grove to help determine effects of prescribed burning on fire scar formation and how changes in fire scars relate to the removal of surrounding fuel accumulations by buring. Sample trees burned during November 1995. Trees and fuels will be resampled during 1996.

! **Natural Resource Inventory** - During the 1995 field season, the NBS's Natural Resource Inventory (NRI) staff participated in the Mineral King Risk Reduction Burn through the establishment of eight permanently marked inventory plots within segment #3, the Atwell Grove area. Plots will be revisited during 1996 to assess burn impacts and first year postburn vegetation response.

! **Wildlife Monitoring** - Two permanent small mammal live-trapping plots were established and sampled during 1995. The plots are located in sequoia/mixed-conifer forest (Atwell) and chaparral/oak shrubland (Traugers). The mid-elevation sequoia plot located in segment #3 burned during November 1995. Serendipity trapping was also carried out at a number of locations. The Atwell plot will be resampled and a third (and possibly a fourth) plot will be established and sampled during 1996.

! **Watershed Sampling: Stream Chemistry and Hydrology** - Potential sampling locations were evaluated and long-term baseline sampling sites selected (sites were chosen that would not burn during 1995 to provide a longer preburn baseline period). Long-term monitoring sites are Trauger's Creek, Deadwood Creek, and the East Fork of the Kaweah (stream chemistry at all three and hydrology at former two only). Stream chemistry has been sampled at regular intervals (weekly) since May 1995 and will continue through 1996.

! **Watershed Sampling: Benthic Macro-Invertebrate Survey** - Six treatment (burn) streams were located and sampled in the East Fork watershed and four non-treatment reference streams in the Middle Fork watershed in September 1995. The Redwood and Atwell Creek sites burned during 1995. Postburn surveys will track biotic impacts and responses.

! **Fire History** - Fire history samples were recovered from throughout much of segment #3 prior to the area burning. These samples will become part of an effort to reconstruct the spatial scale and pattern of pre-European fire events from throughout the East Fork watershed and to provide baseline data on past fire occurrence in variety of habitats, vegetation types, and aspects in the drainage.

! **Fuel Inventory and Monitoring** - Fuel-load sampling during 1995 was concentrated on the south aspect with all but one burn segment on this aspect sampled. A total of 488 plots were sampled within the East Fork watershed. In addition to estimating fuel loads at each plot, additional forest attribute measurements were obtained on tree height, basal area, height to lowest branches, and on litter and duff depths. These will provide input into the FARSITE fire spread model. Field crews will continue fuel sampling (primarily in segment #10) on the south side of the East Fork during 1996.

! **Prescribed Fire Cost-Effectiveness Project -** GIS data was the primary information from the MKRRP provided to this study during 1995. These data included ARC/INFO coverages for various attributes of the East Fork watershed, remote sensing and various type of map data, and information databases associated with the East Fork watershed. Fuels data are also being provided to help drive the NPS FARSITE model simulations that will eventually be a product of the prescribed fire cost-effectiveness project.

! **Data Coordinator -** Contacts were made and meetings coordinated with several graduate students about possible research projects involving the MKRRP. Currently, two students have actively expressed an interested in carrying out studies within the East Fork watershed. Coordination between Fire Management Office (FMO) and field crews was maintained during the burning season. Help was provided to field crews when needed and an effort was made to locate and document past resource or research information, data, or plots sites within the east fork. A bibliography of material related to fire and resource issues in the southern Sierra is being developed. Information and graphics were provided to the Public Information Office (PIO) about resource studies applicable to the MKRRP.

II) Overview of Project

Objectives

The direct objectives of the Mineral King Risk Reduction Project (MKRRP) for Sequoia and Kings Canyon National Parks (SEKI) focus on reducing unnatural fuel accumulations that have resulted from a century of both direct and indirect fire suppression activities in southern Sierrian ecosystems (NPS 1995, Stephenson 1995). In many instances these fuel accumulations create hazardous conditions for visitors, developments, and natural resources. The overall objectives of the project are to assess the operational requirements and cost effectiveness of large scale prescribed burning for wildland management (NPS 1995). The latter evaluation will be accomplished through the use of information derived from the field operations and their outcome within SEKI.

The conditions resulting from unnatural fuel accumulations have resulted in wildland managers being called upon to modify fuels in order to reduce wildland fire hazard and restore ecosystems to some semblance of pre-Euroamerican conditions. Current national management issues are forcing land managers to use two main tools for fuels management: mechanical removal (cutting) and/or prescribed burning. However, both of these tools remain controversial and managers are being asked to justify their choices. These issues motivated a major effort by the National Interagency Fire Center (NIFC) to begin an assessment of the operational requirements and cost effectiveness of using large-scale prescribed burning as a tool in fuels management. As part of this effort NIFC funded Sequoia and Kings Canyon National Parks to carry out a watershed-scale burn program with an objective of prescribed burning about 30,000 acres over a five year period (1995-2000) in the East Fork of the Kaweah River (**Fig. 1**). A collateral objective of the burn project is to evaluate the cost effectiveness of a hazard fuel reduction program of this magnitude by Colorado State University.

Since the scale of the burn project is unprecedented a number of resource related studies are being undertaken and are an integral part of the project. These research, inventory, and monitoring projects in the Mineral King burn are designed to meet the following objectives (Stephenson 1995) :

> ***To supply the information needed to practice adaptive management*** *(1) by determining whether the burn program's objectives are being met, (2) by identifying unexpected consequences of the program on the ecosystem, and (3) if objectives are not being met, by suggesting appropriate program changes.*
>
> ***To provide information for public education, response to public and governmental inquiries, and to document legal compliance.***

These research and monitoring objectives are particularly important because SEKI's watershed scale burn program will be one of the first national attempts at using fire on a watershed scale for fuels management.

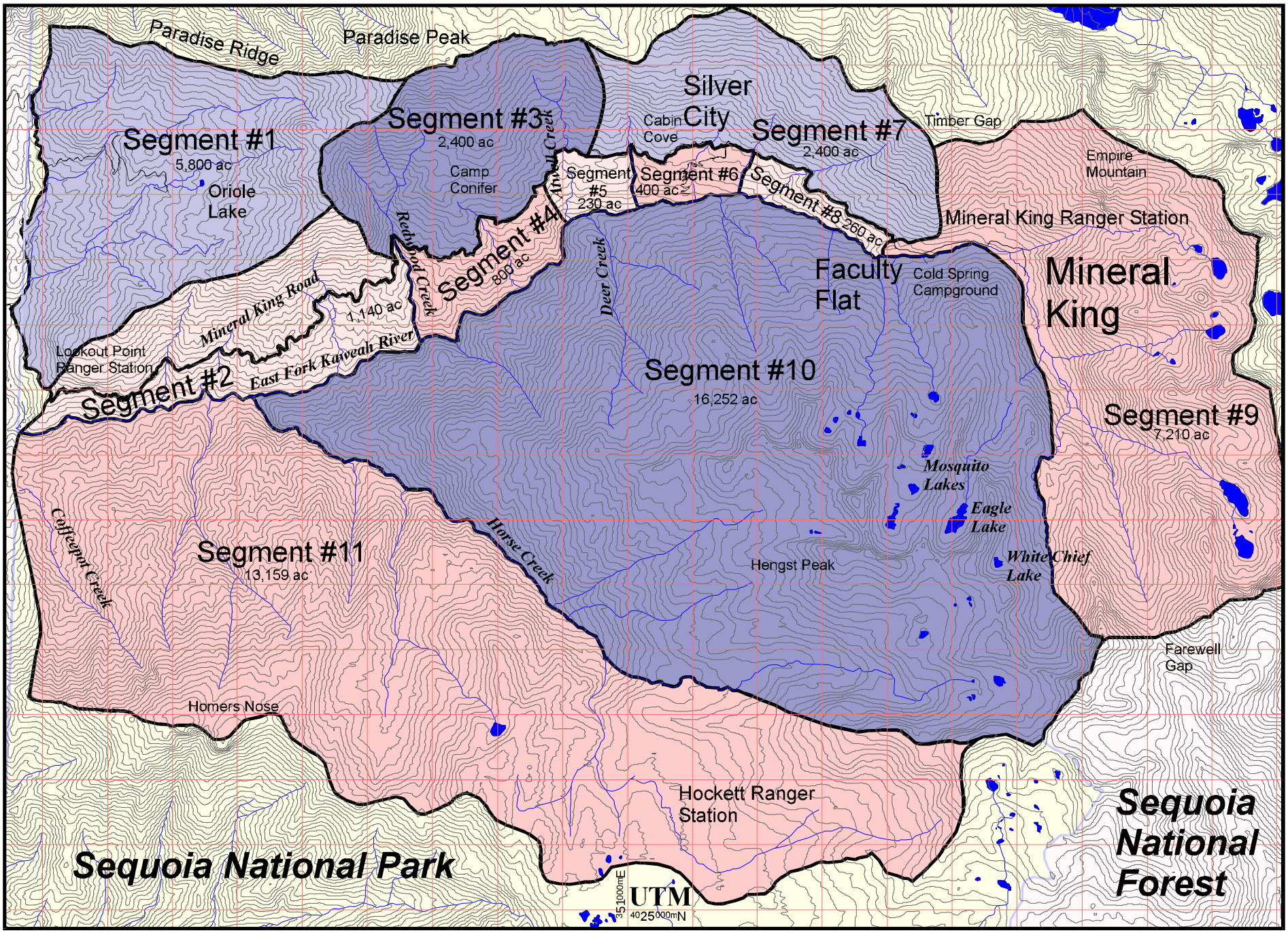

Figure 1.

Mineral King Risk Reduction Project

Project Area and Burn Segments: East Fork Kaweah Watershed

Description - East Fork Project Area

The East Fork watershed which encompasses the MKRRP is one of five major drainages comprising the Kaweah River watershed which flow west (historically but is now heavily diverted for agriculture) into the Tulare Lake Basin in the southern Central Valley. Terrain in the watershed is rugged, elevations range from 874 m (2884 ft) to 3767 m (12,432 ft) within the project area. The watershed, 21202 ha (52369 ac) in size, is bounded by Paradise Ridge to the north, the Great Western Divide to the east, and Salt Creek Ridge to the south. Major topographic features of the watershed include the high elevation Mineral King Valley, Hocket Plateau, Horse Creek, the high peaks producing the Great Western Divide, and the Oriole Lake subdrainage (with an unusually low elevation lake for the Sierras at 1700 m elevation).

Vegetation of the area is diverse, varying from foothills chaparral and hardwood forest at lower elevations to alpine vegetation at elevations above 10-11,000 feet (**Fig. 2**). About 80% of the watershed is vegetated with most of the remainder rock outcrops located on steep slopes and at high elevations. Lower elevation grasslands and oak woodland, while common at low elevations in the Kaweah drainage, are uncommon within the park's portion of the East Fork watershed. Sequoia groves within the project area include Atwell, East Fork, Eden, Oriole Lake, Squirrel Creek, New Oriole Lake, Redwood Creek, Coffeepot Canyon, Cahoon Creek, and Horse Creek. Vegetation is dominated by red and white fir forest with pine and foothill types of somewhat lesser importance (**Table 1**). An artificial discontinuity in the vegetation map of the

Vegetation Classification	Hectares	(Acres)
Foothills Chaparral	1119.2	(2764)
Foothills Hardwoods & Grassland	1432.5	(3538)
Ponderosa Pine Mixed Conifer	1967.7	(728.8)
White Fir Forest	4034.0	(9964.0)
Red Fir Forest	4205.7	(10388.1)
Xeric Pine Forest	1244.4	(3073.7)
Montane Chaparral	483.8	(1195.0)
Mid-Elevation Hardwood Forest	170.0	(419.9)
Lodgepole Pine Forest	966.5	(2387.3)
Subalpine Forest	98.6	(266.2)
Meadow	132.7	(327.8)
Other (primarily water)	100.1	(247.3)
Barren Rock	4197.5	(10367.8)
Missing or No Data	1049.8	(2593.0)

Table 1. Vegetation type classification for the East Fork watershed and the area occupied by each class.

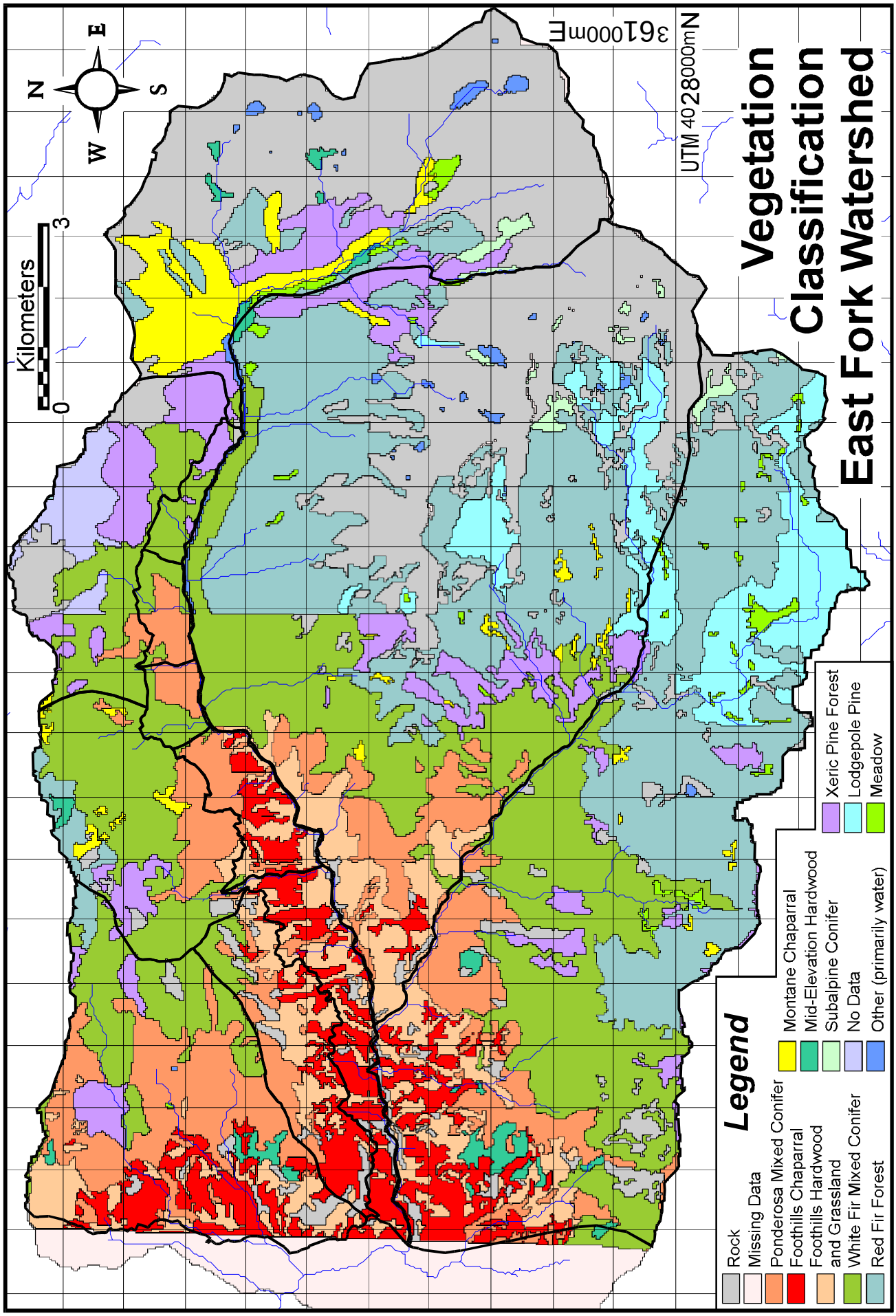
Vegetation Classification
East Fork Watershed
UTM 40 28000mN
361000mE
N
E
S
W
Kilometers
0
3
Legend
Rock
Missing Data
Ponderosa Mixed Conifer
Foothills Chaparral
Foothills Hardwood and Grassland
White Fir Mixed Conifer
Red Fir Forest
Montane Chaparral
Mid-Elevation Hardwood
Subalpine Conifer
No Data
Other (primarily water)
Xeric Pine Forest
Lodgepole Pine
Meadow

Figure 2.

Table 2. Major fires ($1 acre) from about 1920 (early records are incomplete) through 1994 that occurred within the East Fork watershed (40 fires, 761.5 hectares (1881 acres) burned). Data based on SEKI fire records (NPS 1995).

Fire Name	Year	Hectares	(Acres)
Traugers #1	1934	24.3	(60)
Traugers #2	1934	97.2	(240)
Eden Grove	1934	3.2	(8)
Grunigen Creek #3	1935	0.4	(1)
Oriole #2	1935	1.2	(3)
Tar Gap Ridge	1942	1.6	(4)
Paradise Peak Lookout	1945	0.4	(1)
Paradise	1945	0.4	(1)
Atwell Mill	1946	43.3	(107)
Hockett Ridge	1950	0.8	(2)
Mineral King	1952	18.2	(45)
Paradise	1952	0.8	(2)
Conifer Tract	1955	11.3	(28)
Paradise Peak #1	1957	0.4	(1)
Horse Creek	1969	0.8	(2)
Atwell Mill #2	1970	0.4	(1)
Lookout Point	1970	89.9	(222)
Atwell Mill	1971	1.6	(4)
Jet Plane	1971	1.2	(3)
Horse Creek	1973	0.8	(2)
Lookout	1974	16.2	(40)
Whitman Creek	1976	3.6	(9)
Whitman	1978	0.4	(1)
Eden Grove	1978	6.9	(17)
Eagle Lake	1979	0.4	(1)
Coffeepot #1	1987	0.8	(2)
Coffeepot #2	1987	0.4	(1)
Silver	1987	0.8	(2)
Lost	1987	0.8	(2)
Hockett	1988	8.1	(20)
Hockett	1988	20.2	(50)
Purple Haze	1988	0.4	(1)
Paradise	1988	2.8	(7)
Deer Creek	1988	5.7	(14)
Deer Creek	1991	291.5	(720)
Paradise	1994	30.4	(75)
Horse Creek	1994	0.8	(2)
Empire	1994	47.9	(118)
Hockett	1994	23.1	(57)
Spring	1994	1.2	(3)

watershed exists, most noticable in the central portion of the vegetation map (**Fig. 2**), a result of maps produced by the NPS and USDA being patched together that had used slightly different criteria for defining vegetation types. This is a result of Mineral King Valley being a recent addition to SEKI, having been transferred from USDA Forest Service in 1978.

No large watershed-scale fires have occurred within the drainage over at least the last 60 years (**Table 2**). The largest burn during this period was the 292 ha (720 ac) Deer Creek Burn (prescribed natural fire) within the East Fork Grove in 1991 (NPS SEKI fire records database). Fire histories from two locations within the watershed show repeated fire occurrence prior to Euroamerican settlement with relatively high frequencies at some sites (Pitcher 1987, Swetnam et al. 1992). Vegetation within the area has undergone considerable change since settlement and utilization of the region beginning in the 1850's, mainly a result of decreased fire frequency (Vankat 1970; Davis 1985; Stephenson 1994).

Table 3. Segment number and area.

Segment	Hectares	(Acres)
1	2352	(5811)
2	439	(1084)
3	962	(2377)
4	289	(716)
5	121	(300)
6	135	(335)
7	989	(2445)
8	121	(299)
9	2917	(7210)
10	6577	(16252)
11	5325	(13159)

Access to the area by road is limited to the narrow winding Mineral King Road, 25 miles long. The Mineral King Valley is popular with backpackers and packers as a starting point for many high country trips. Higher elevations of the watershed receive considerable recreation use while lower elevations receive relatively little use. Developed or semi-developed areas within the watershed include Silver City/Cabin Cove, Mineral King, Lookout Point, Oriole Lake, and the Atwell Mill areas. NPS campgrounds exist at Atwell Mill and Mineral King.

Eleven burn segments have been outlined within the watershed by fire management staff (**Table 3** and **Fig. 1**). Eight segments were designated on the south facing slope (north side of the East Fork) and three large segments on the more remote north slope (south side of the East Fork). Segment locations were established to facilitate prescribed burning operations and protection of primary developments within the watershed.