3.17) Fire History

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OBJECTIVES

Over the last three decades the parks' fire management program has evolved to where it now includes restoration of fire at a landscape scale. However, burning at such scales has raised a variety of new management and resource questions. These include an understanding pre-Euroamerican fire regimes at such large ecosystem scales. While fairly extensive fire history research, based on fire scars recorded in trees (**Fig. 3.17-1**), has been carried out in Sequoia and Kings Canyon National Parks (Kilgore and Taylor 1979; Pitcher 1987; Swetnam et al. 1992; Swetnam 1993; Caprio and Swetnam 1995) considerable gaps still remain in our knowledge and understanding at some levels (Caprio and Lineback in prep). For instance, we have limited information about past fire regimes at a scale that encompasses tens of thousands of acres and includes varying slope, aspect, vegetation type, and elevation. Local knowledge about past fire regimes from several common vegetation types is lacking. Acquiring this information would be of great value to managers when planning and reintroducing fire in park ecosystems and to ecologists interested in understanding dynamics of pre-Euroamerican plant and wildlife communities.

Figure 3.17-1. Example of dated fire scars from a giant sequoia snag-- intervals between fires generally varied from 15 to 30 years.

The goal of this data collection effort is to: 1) obtain information on the spatial extent of pre-Euroamerican fires on a watershed scale (fire size, spread patterns, and frequency variation), and 2) to acquire data on pre-Euroamerican fire regimes from the wide array of vegetation types within a watershed. This work will begin to reconstruct the spatial scale and pattern of pre-European settlement fire events from throughout the East Fork watershed and to provide information on past fire occurrence, frequencies, and size in a variety of habitats, vegetation types, and aspects in the drainage. These data will also provide additional and improved data on fire frequency regimes from a range of vegetation classes that are being used as input into fire/GIS analyses that are reconstructing past fire frequency regimes throughout the parks (Caprio and Lineback in prep). Reconstructing the large scale spatial pattern fire in the East Fork will help managers determine whether they are meeting management objectives in restoring fire as an ecosystem process and to develop improved burn plans.

Recently, computer models that look at surface fire regimes and forest patterns across elevation gradients in the southern Sierra Nevada have been developed (Miller 1998). They examine connectivity and spatial extent of fire over elevational gradients. The models

also suggest differences in burn patterns/frequencies by aspect with these differences most notable between south and north slopes (Carol Miller personal communication). However, at this time little data exists on pre-European settlement fire history for north aspect forests in the southern Sierra Nevada. Thus information collected in the East Fork will be important in verifying these models and as input for more rigorous parameterization to improve their predictive ability.

FIELD WORK AND DATA COLLECTION

Sampling during 1997 concentrated on burn segments scheduled to for ignition during 1997 and 1998 (Tar Gap [segment #10], Redwood [#4], and Lookout [#1]). Additional sites were also located in the Oriole Lake (#1), Atwell (#3), and Eden Grove (#11) segments in addition to the Milk Ranch area– an area outside the MKRRP boundaries but within the East Fork drainage (**Fig. 3.17-2**). Emphasis was placed on collecting sites in higher elevation conifer forest and on aspects, or vegetation types for which we have little information. Specimens are being dendrochronologically crossdated to determine precise calender years (**Fig. 3.17-3**) in which past fires occurred (Stokes 1980). Intra-annual position (or approximate season) of fire dates is also being determined when possible. Sample preparation and crossdating have been begun on samples from many sites with this work most advanced from sites collected during 1995 and 1996 on south aspects.

RESULTS and DISCUSSION - PRELIMINARY ANALYSIS

Over 160 specimens (logs, stumps, snags, or trees) were collected from 31 sites which supplements some 35 sites previously collected (Caprio 1997b). These collections have supplemented and added to previous work that was carried out in the watershed (Pitcher 1987; Swetnam et al.1992). Some vegetation types represented in these collections have not previously been sampled in the parks for fire history and will be a useful source for new information. These include Jeffery pine, lodgepole pine, and oak woodland while others such as red fir have only been sparsely sampled.

Patterns of past fire occurrence are beginning to emerge as more sites are collected and crossdated from a broad array of areas in the watershed. Dating of samples is most advanced for the area extending from the Redwood Creek to Atwell Creek areas on the north side of the drainage. Preliminary mapping of a few fire years supports the proposal that patterns of past fires over the landscape can be reconstructed to a certain degree (**Fig. 3.17-4** and **Fig. 3.17-5**). For example, the current map of the 1777 fire date shows a burn (or possibly more than one burn) with a fairly well defined burn area, based on those areas from which fire dates have been collected and dated. This preliminary mapping suggests the burn was primarily centered on the north side of the drainage in an area from Redwood Creek to above Atwell. However, the 1777 date was also recorded from the one site dated in the Oriole Lake drainage, suggesting the fire may have been more widespread than the current map indicates. Other fire dates showed different patterns. The current information for an1829 burn(s) shows that it occurred in both the main East Fork drainage and the Horse Creek drainage. Of interest were maps of the extent 1873 and 1875 burns (**Fig. 3.17-5**). The area of the 1873 burn that has currently been mapped shows that it burned in the central portion of the Atwell Grove while the map for the 1875 burn showed it burned predominantly to the east and west of this area. The maps show burns that appear to be somewhat mutually exclusive. Two potential hypothesis may explain this pattern. One is that fuels may have been sparse enough at two years postfire that a send burn was not able to carry through the area. The second, that the burn carried through the area but due to sparse fuel the burn was not hot enough to scar many trees. There is also an interesting historical footnote for the 1875 burn. While traveling through the Atwell area in 1875 John Muir made natural history observations about a fire that appears to be this 1875 burn (Muir 1878). He observed the fire burning intensely up-canyon through chaparral vegetation but with decreasing intensity once it entered the sequoia grove where fuel levels were low and consisted primarily of conifer needles.

The number of sites on the north aspect was increased substantially during 1997 during an eight

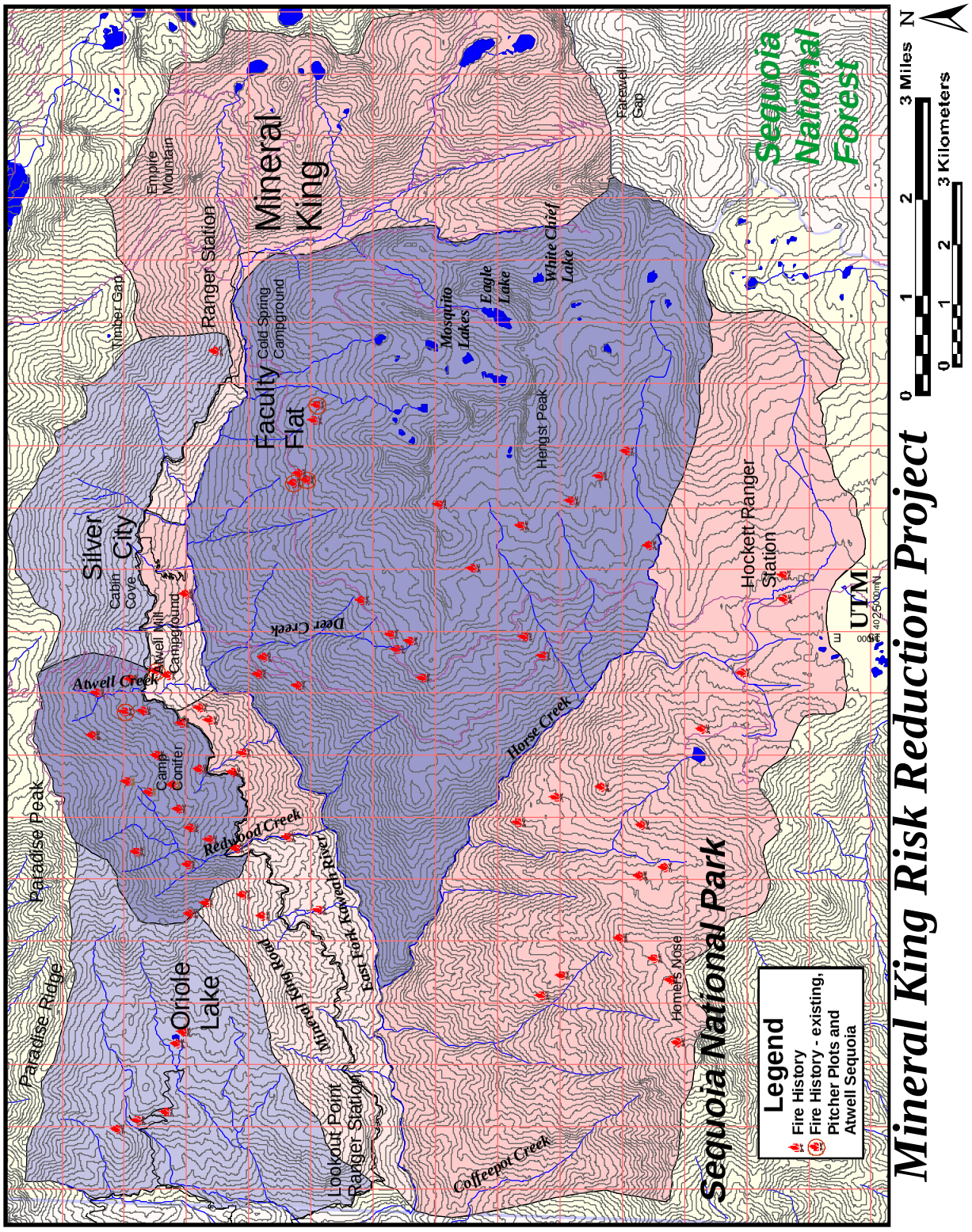


Figure 3.17-2. Fire history collection sites in the East Fork.

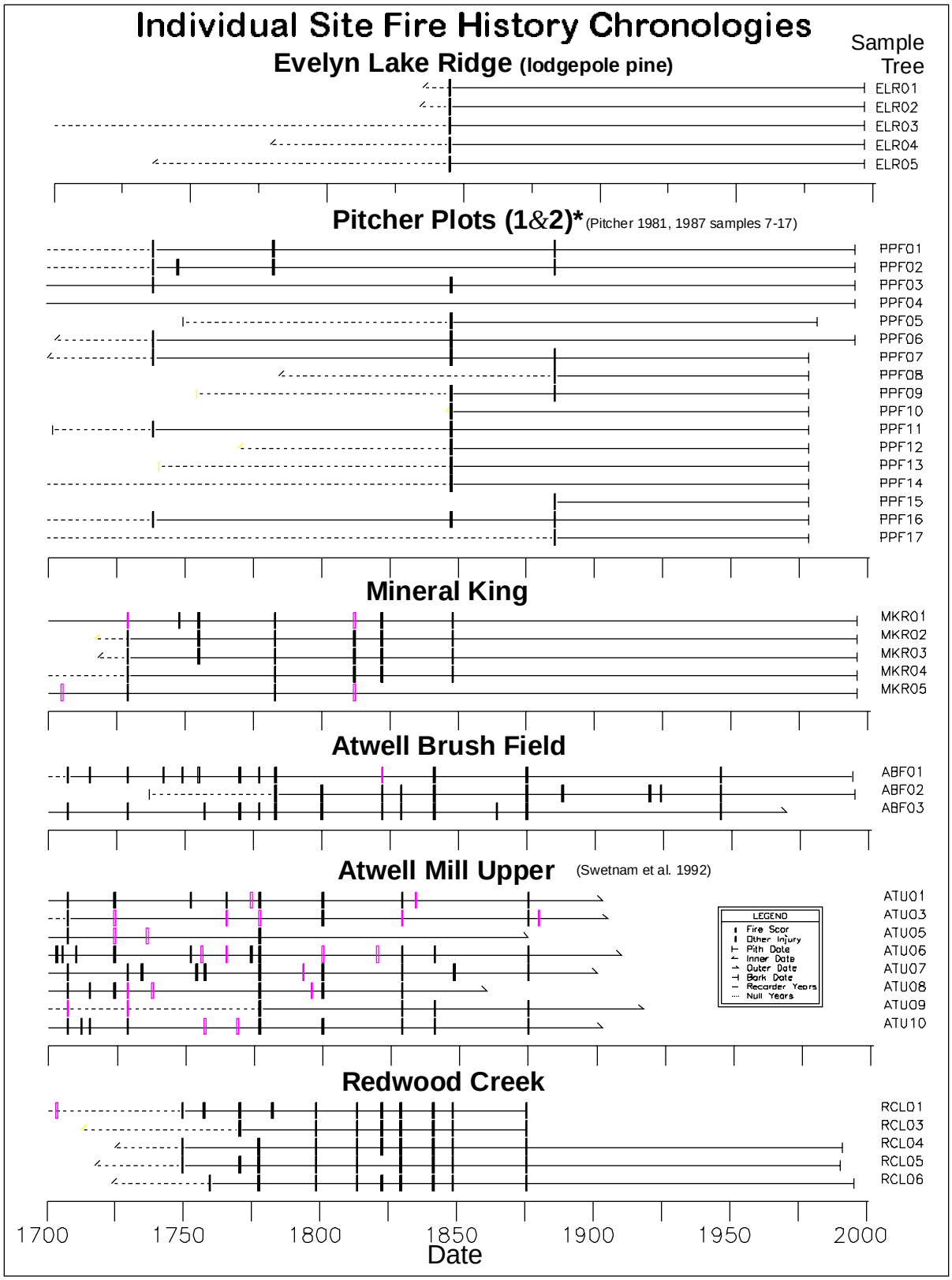
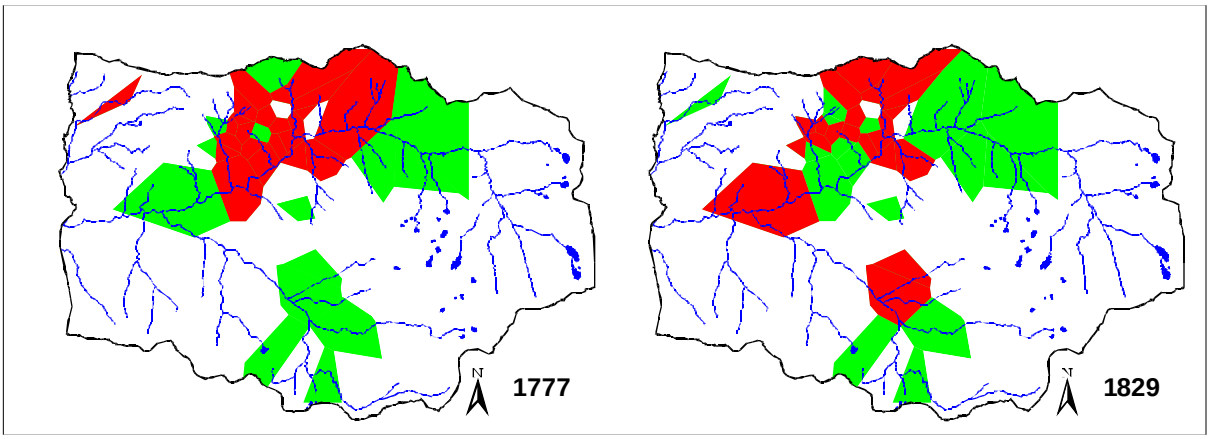


Figure 3.17-3. Examples of reconstructed fire history data from five sites in the East Fork drainage for the period from 1700 to the present. Sites illustrate varying pre-Euroamerican fire regimes from differing vegetation types and aspects in the watershed. Horizontal lines represent a particular sample (one tree) with vertical bars indicating crossdated fire dates.

Figure 3.17-4. Preliminary reconstruction of area burned by fires in 1777 and 1829 in the East Fork. Red color represents areas where samples have been dated with fires observed in the fire scar record during these two years and green color represents areas where samples have been dated and these fire dates have not been observed.



day trip into the Cahoon Meadow and Hockett Meadow areas, carried out in conjunction with sampling by Kurt Menning and his crew. Additional collections are planned for this aspect during 1998, however, because of the remoteness of some of these areas sampling density may be lower.

While the current information is encouraging a considerable number of additional sites are needed to improve the resolution and spatial accuracy of the reconstructed past burn areas. This will be somewhat dependant on available sample material in the field. This appears to vary by vegetation type and to be poorer at lower elevations and on north aspects in mid-to-low elevations (this may be why previous studies have not sampled such areas). However, it is important that fire history information be obtained from these areas to present a more unbiased picture of past fire regimes over the landscape. As the information from these samples is obtained it will greatly improve the resolution and spatial extent of our knowledge about fire from throughout the watershed. Data from some of these new collections have been used as input into a GIS/Fire model being developed for Sequoia and Kings Canyon National Parks (Caprio et al. 1997). As more data on fire dates are added from a larger portion of the watershed, more detailed analyses will be carried out.

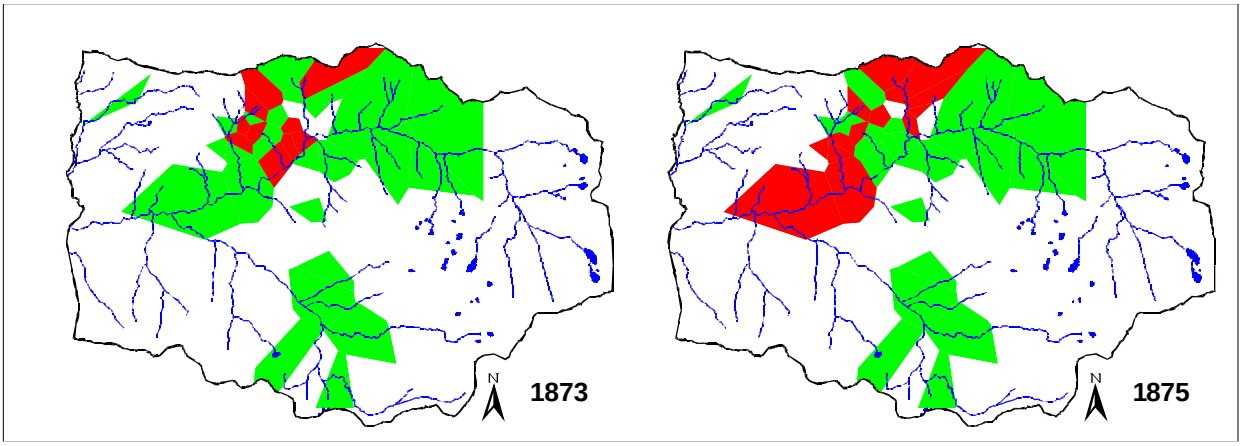


Figure 3.17-5. Preliminary reconstruction of area burned by fires in 1873 and 1875 in the East Fork. Red color represents areas where samples have been dated with fires observed in the fire scar record during these two years and green color represents areas where samples have been dated and these fire dates have not been observed.

PLANS FOR 1998

Sampling will continue during 1998, again concentrating on segments scheduled for burning during 1998 and 1999 and on locations having north aspects. Particular target areas include upper elevation red fir, lodgepole and western white pine forests, where some stand replacing burns may have occurred in the past. Sampling in the Oriole Lake drainage and Milk Ranch area will continue (approximately six additional sites) and should be completed during 1998. Permission from the BLM was obtained for collecting in the Milk Ranch area with the stipulation that they receive copies of the fire history data. This area will provide fire dates for lower portion of the East Fork drainage and is interesting because it is largely surrounded by chaparral vegetation and similarities or differences between fire dates from here and other portions East Fork may provide insights into fire source and spread patterns through what is now chaparral vegetation.