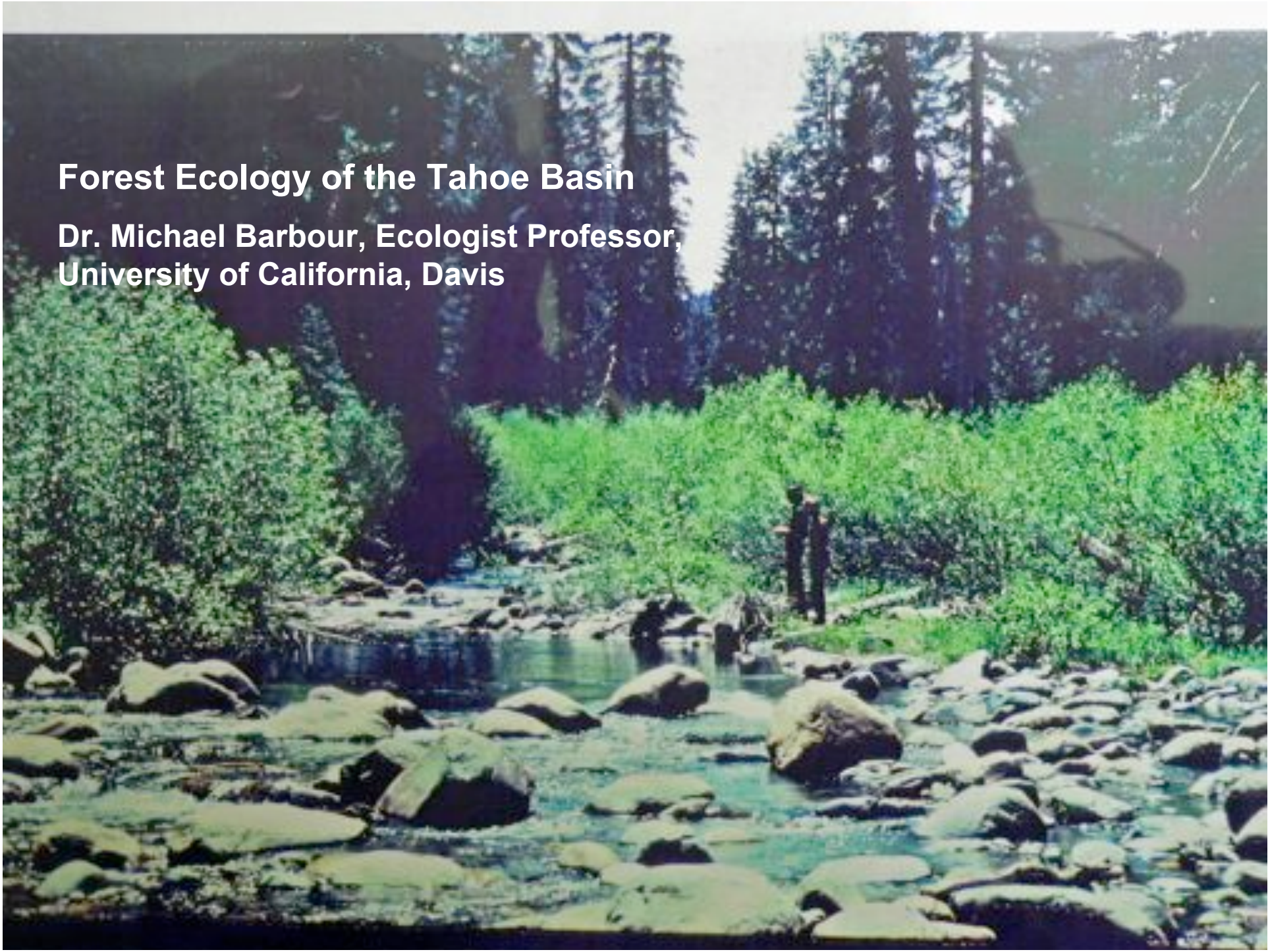
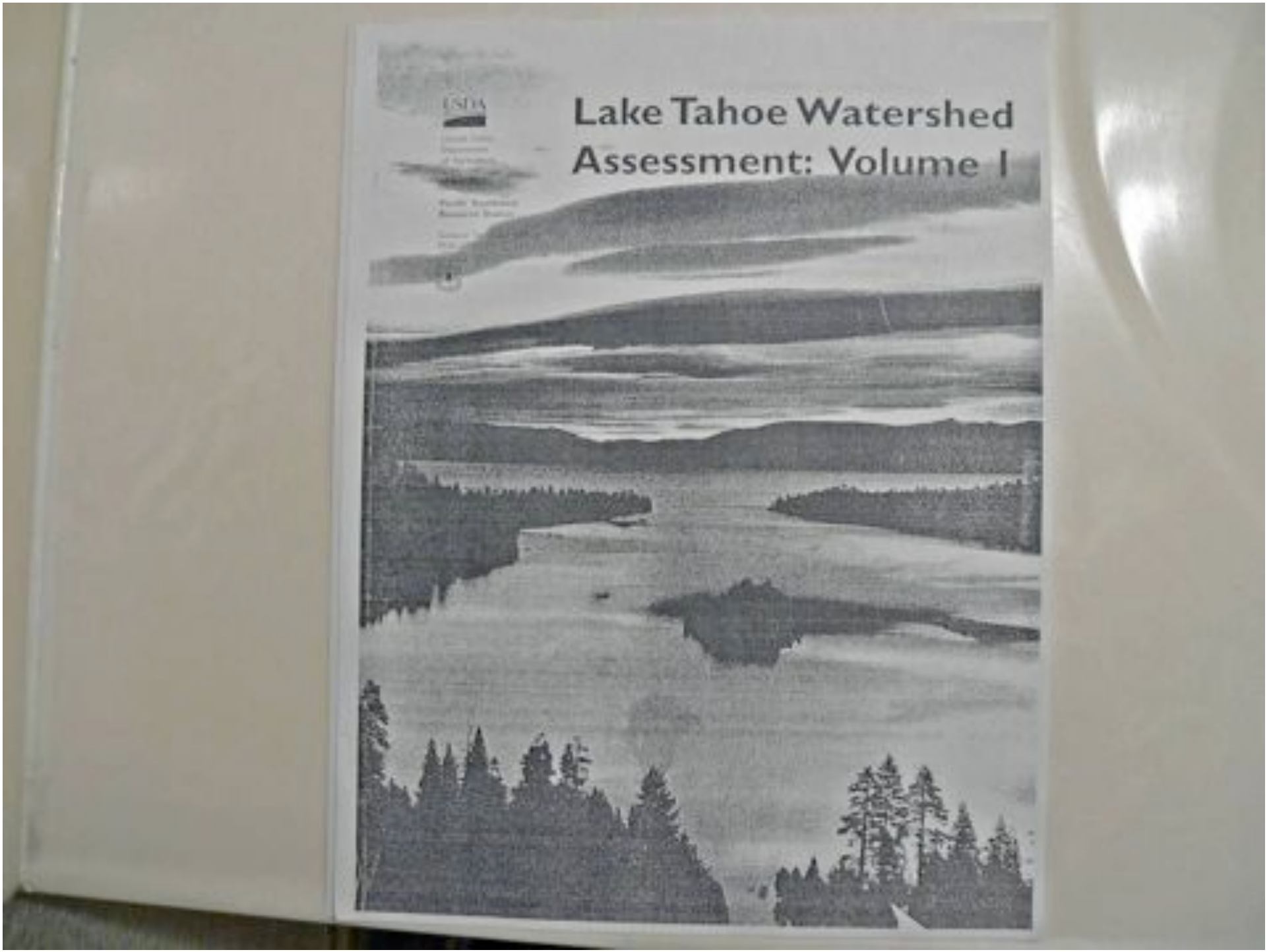


Forest Ecology of the Tahoe Basin

Dr. Michael Barbour, Ecologist Professor,
University of California, Davis


Lake Tahoe Watershed
Assessment: Volume I

THE LAKE TAHOE WATERSHED:
TYPICAL OF ALL CALIFORNIAN MOUNTAINS

<u>THE NATURAL SETTING:</u>

- **GRANITIC SUBSTRATE, 6,000-10,000 FT. ELEV. RANGE**
- **MEDITERRANEAN CLIMATE, SUMMER STRESSES**
- **MIXED CONIFER , TRUE FIR, & SUBALPINE FORESTS IN OLD-GROWTH AND MID-SUCCESSION STATUS**
- **WETLANDS WITH MEADOWS & RIPARIAN FOREST**
- **DRY SLOPES WITH MONTANE CHAPARRAL**

<u>MANAGEMENT ISSUES:</u>

FIRE SUPPRESSION HISTORY---> FIRE & DISEASE
HARVEST VS CONSERVATION CONSTRAINTS
RECREATION ACCESS AND IMPACTS
SUBURBAN ENCROACHMENT
WATER POLLUTION
AIR POLLUTION

Fire suppression and the lack of forest thinning have led to dense, overgrown forests throughout the Sierra Nevada and Lake Tahoe Basin.

Although highly variable across the stand, downed and dead fuel loading now commonly exceeds 616,000 pounds per acre in some locations.

The table below depicts the long-term trends in Primary Productivity (Reuter, 2000). The recovery of low Primary Productivity values following the Comstock era disturbance (extremely high soil erosion due to deforestation in the Tahoe Basin) indicates that Lake Tahoe may recover from the current high Primary Productivity if proper controls are instituted in a timely fashion.

Era	Time Period	Value*
Before Comstock Logging	up to 1861	27
Comstock Logging	1861-1898	176
Post Comstock Logging	1900-1969	29
Modern Urbanization	1970-1991	95
Current	1991-	160+ (5-6% increase/year)

* Primary Productivity in Lake Tahoe ($g\ C\ m^{-2}\ y^{-1}$)

WHAT IS THE RECONSTRUCTION OF PRE-CONTACT MIXED-CONIFER OLD-GROWTH FOREST?

- **SURFACE FIRE REGIME:**
SLOW MOVING, MODERATE FLAME LENGTH, COOL-HOT BURNING; HOT ENOUGH TO KILL 30-60% OF UNDERSTORY TREES 10-20 CM DBH; OVERSTORY TREES <10% MORTALITY BUT LOCALLY SCARRED; FIRE RETURN INTERVAL = 50 YR; AVERAGE SIZE OF SINGLE FIRE (MODE) = <15 HA

- TREE DENSITY/HA = 110

- SAPLING:TREE DENSITY RATIO = 3:1

AGE (SIZE) DISTRIBUTION = FLAT

- PINE:FIR RATIO = 1

- SHRUB + HERB COVER = 10%

- STANDING DEAD TREES = 5-15%

- DISEASE INCIDENCE (SPM) = 12%

- COARSE WOODY DEBRIS BIOMASS = ?

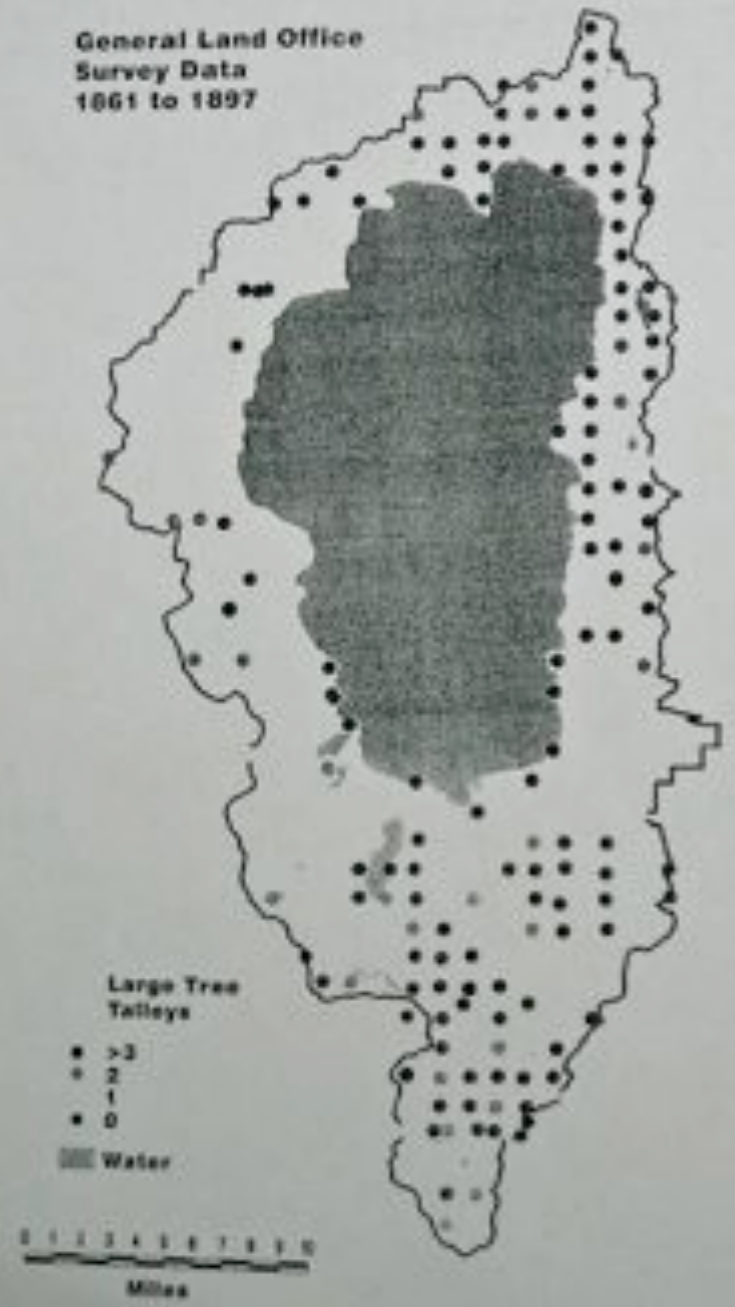

General Land Office
Survey Data
1861 to 1897
Large Tree
Talleys
>3
2
1
0
Water
Miles

Figure x. Species composition in late 1800's in montane zone (<7,000' elevation) based upon tally of trees at section corners.

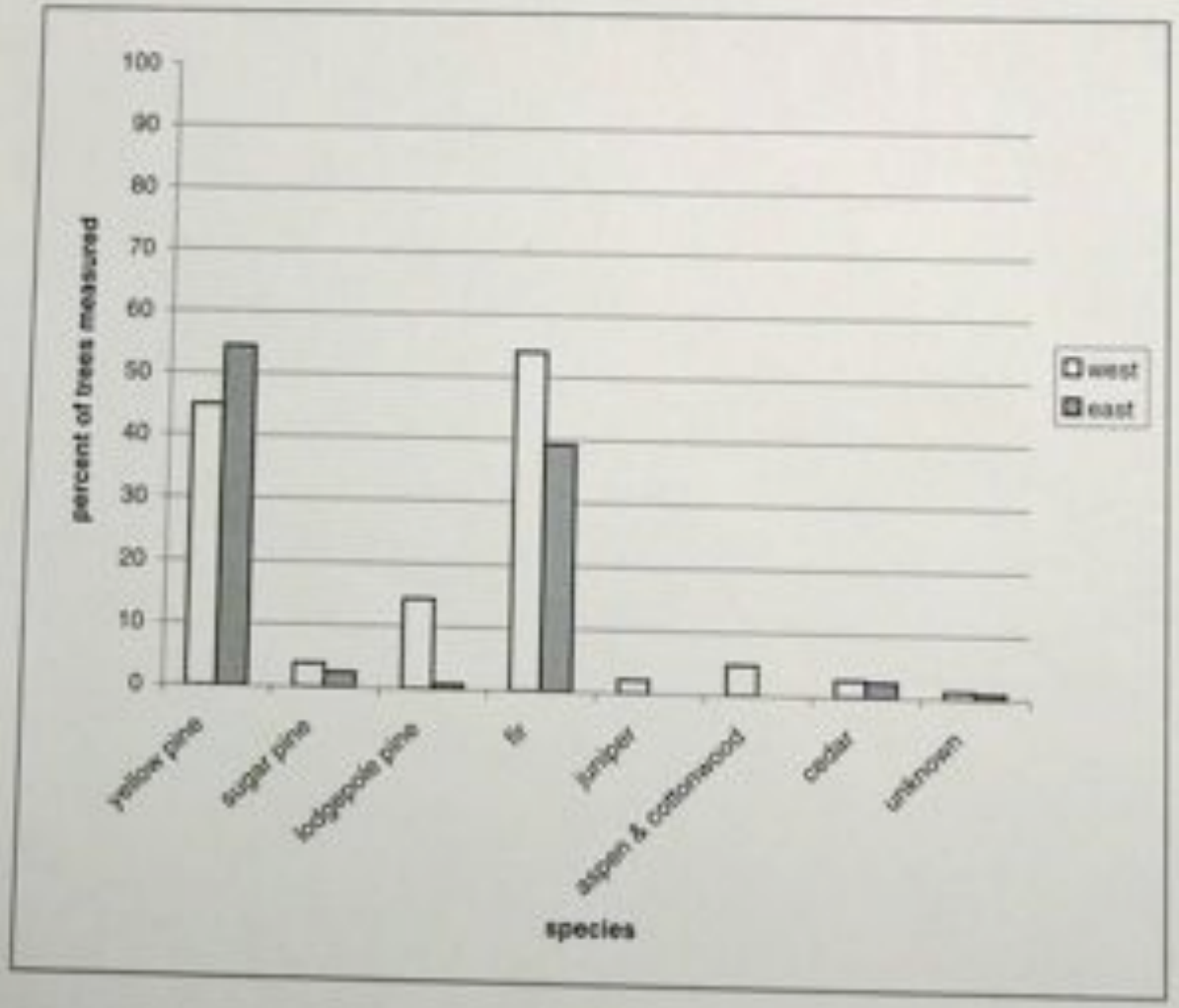
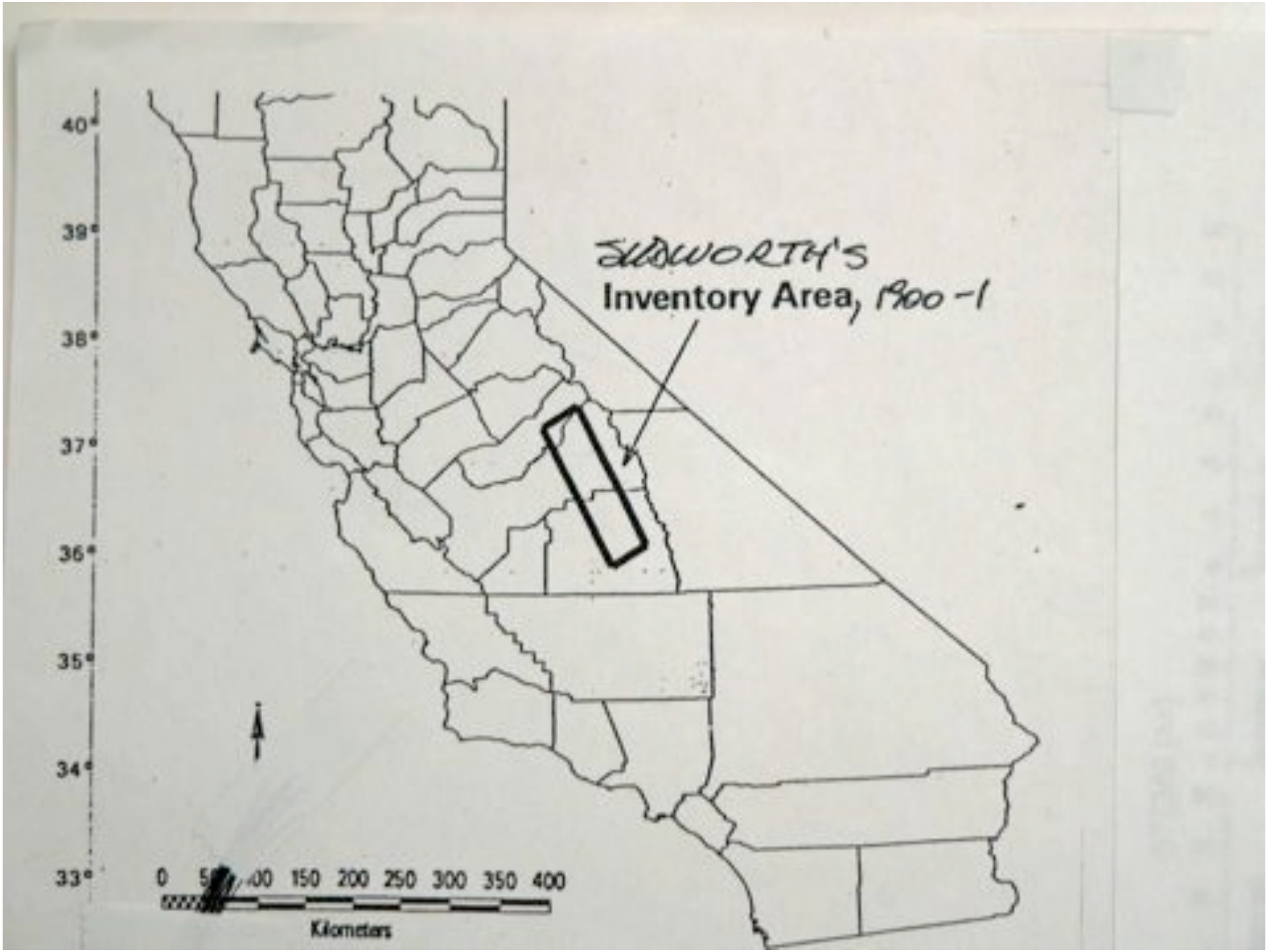
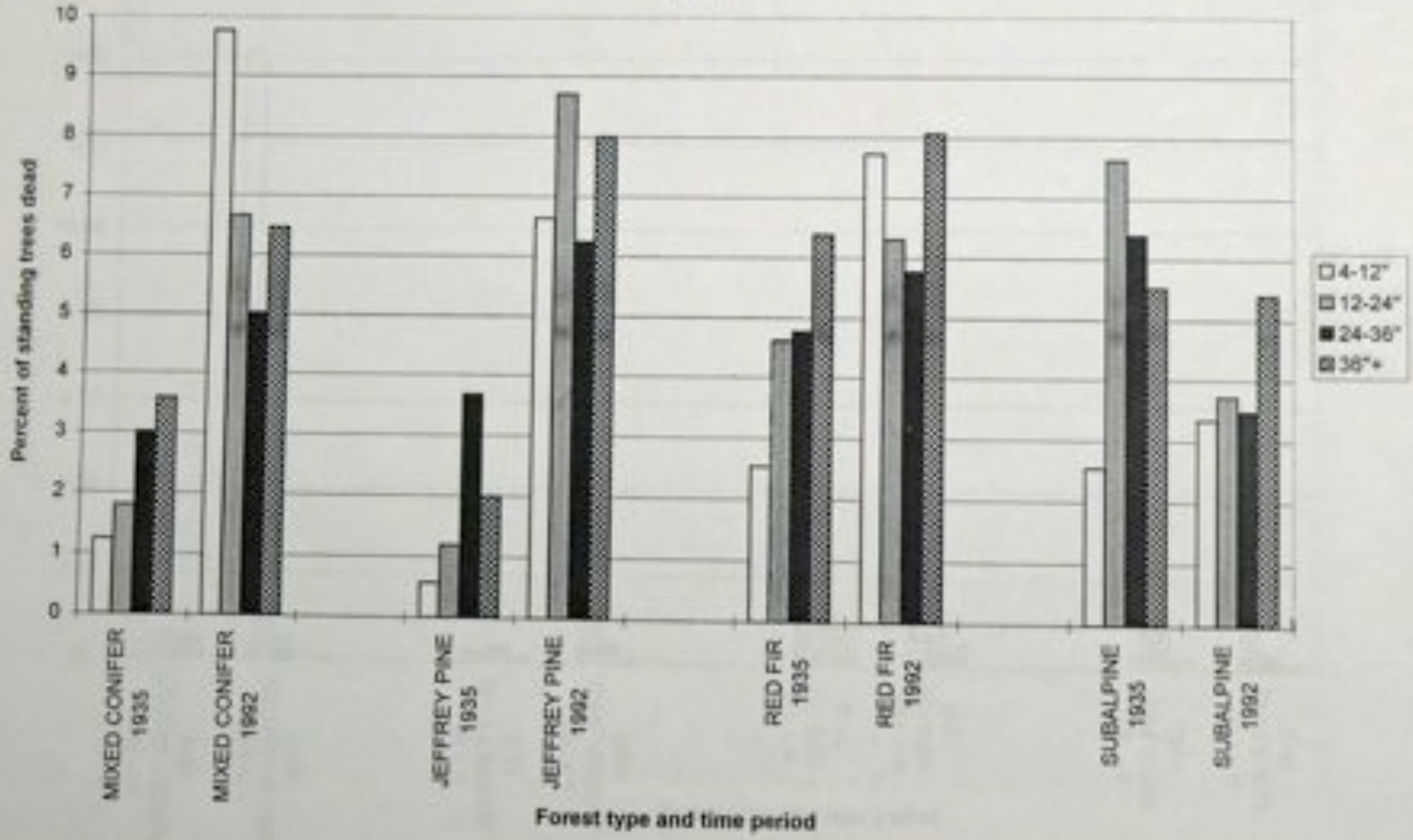
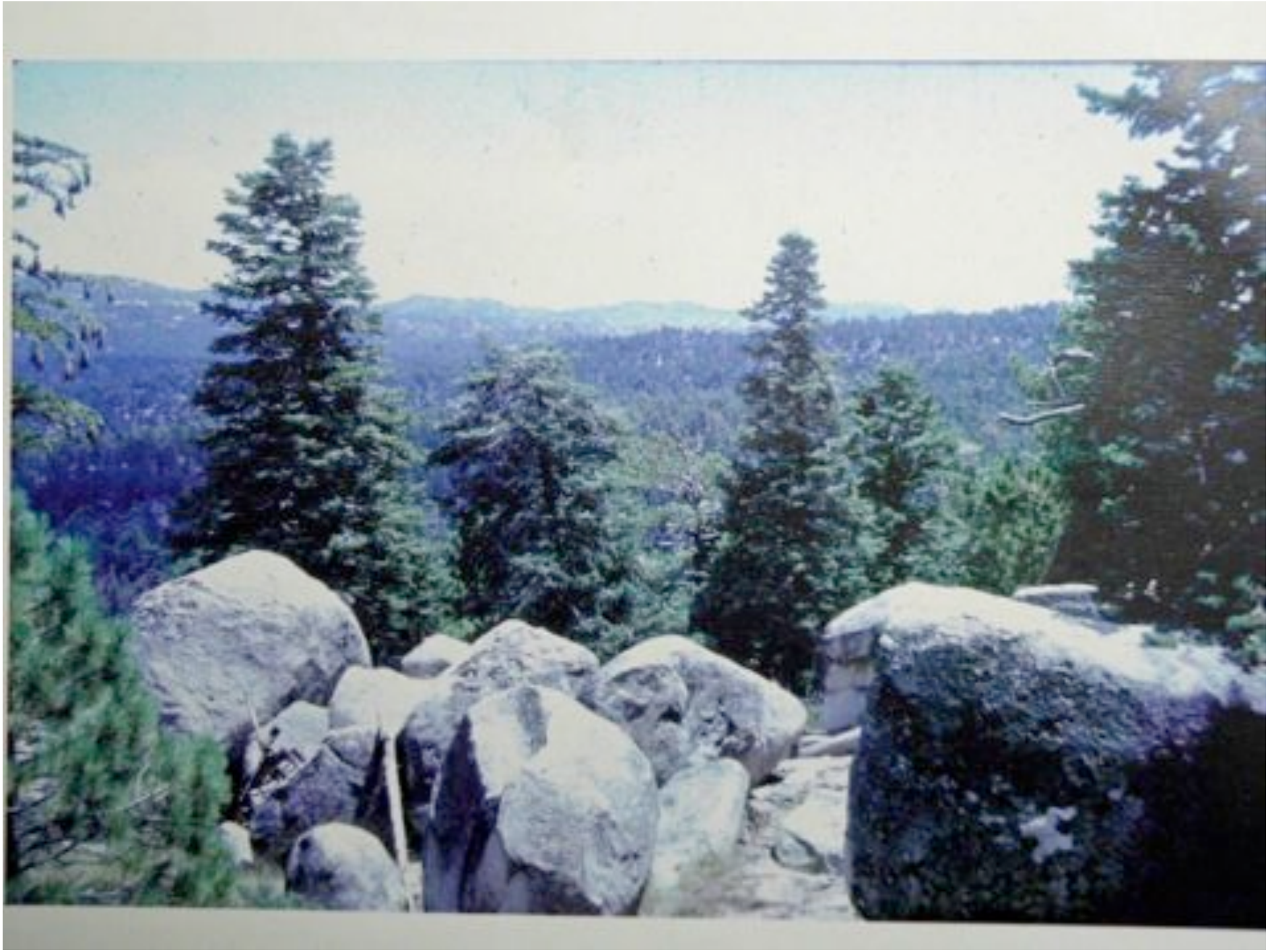


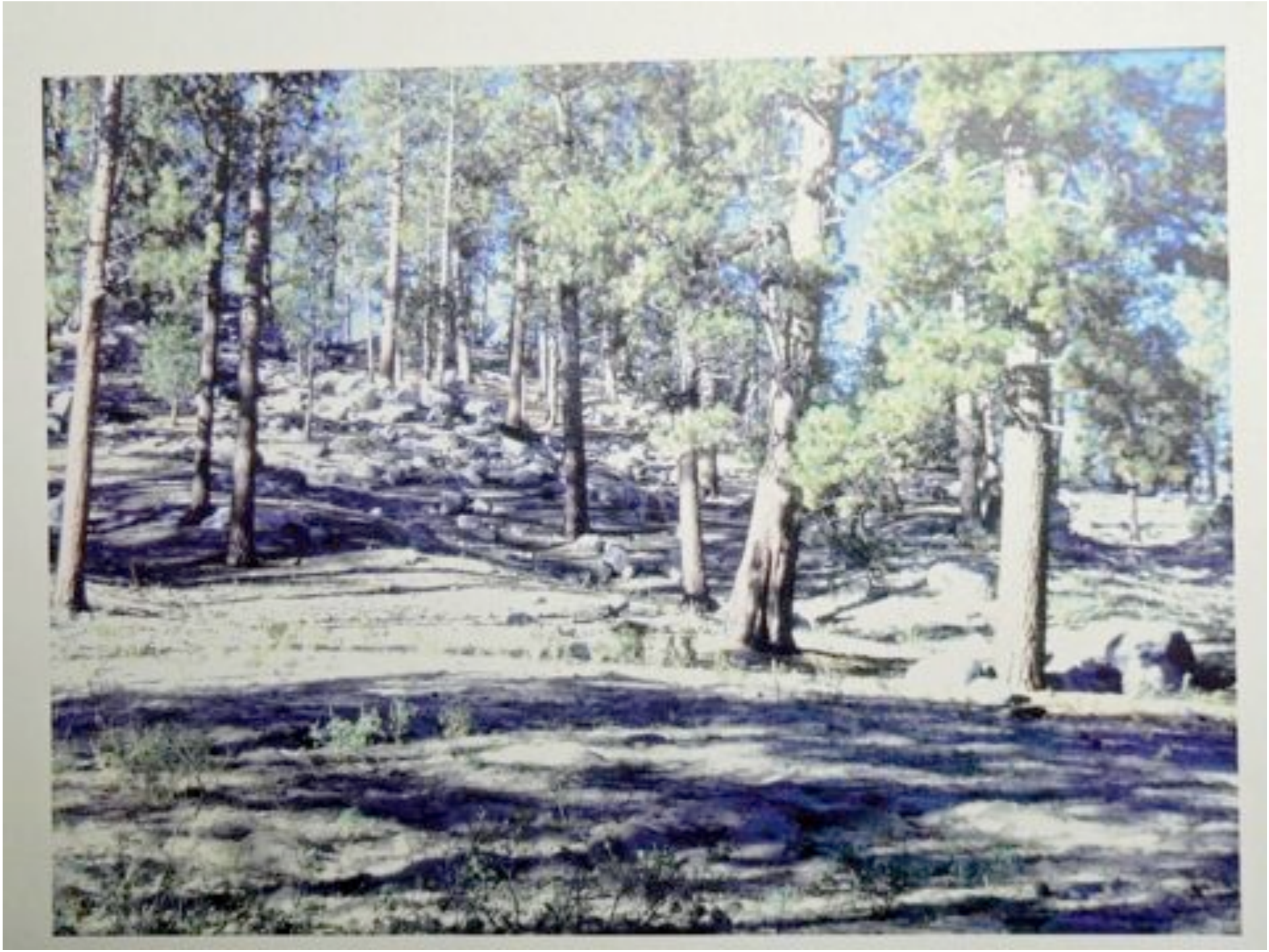
FIG. 1. Forest conditions in the study area in 1876 at Spooner Summit, on the east shore of Lake Tahoe, Carson Range, Nevada, USA (photo by C. E. Watkins; published with permission of the Nevada Historical Society). Note the near-clearcut logging of the forest and the presence of cut stumps that served as the basis for the presettlement-forest reference reconstruction.

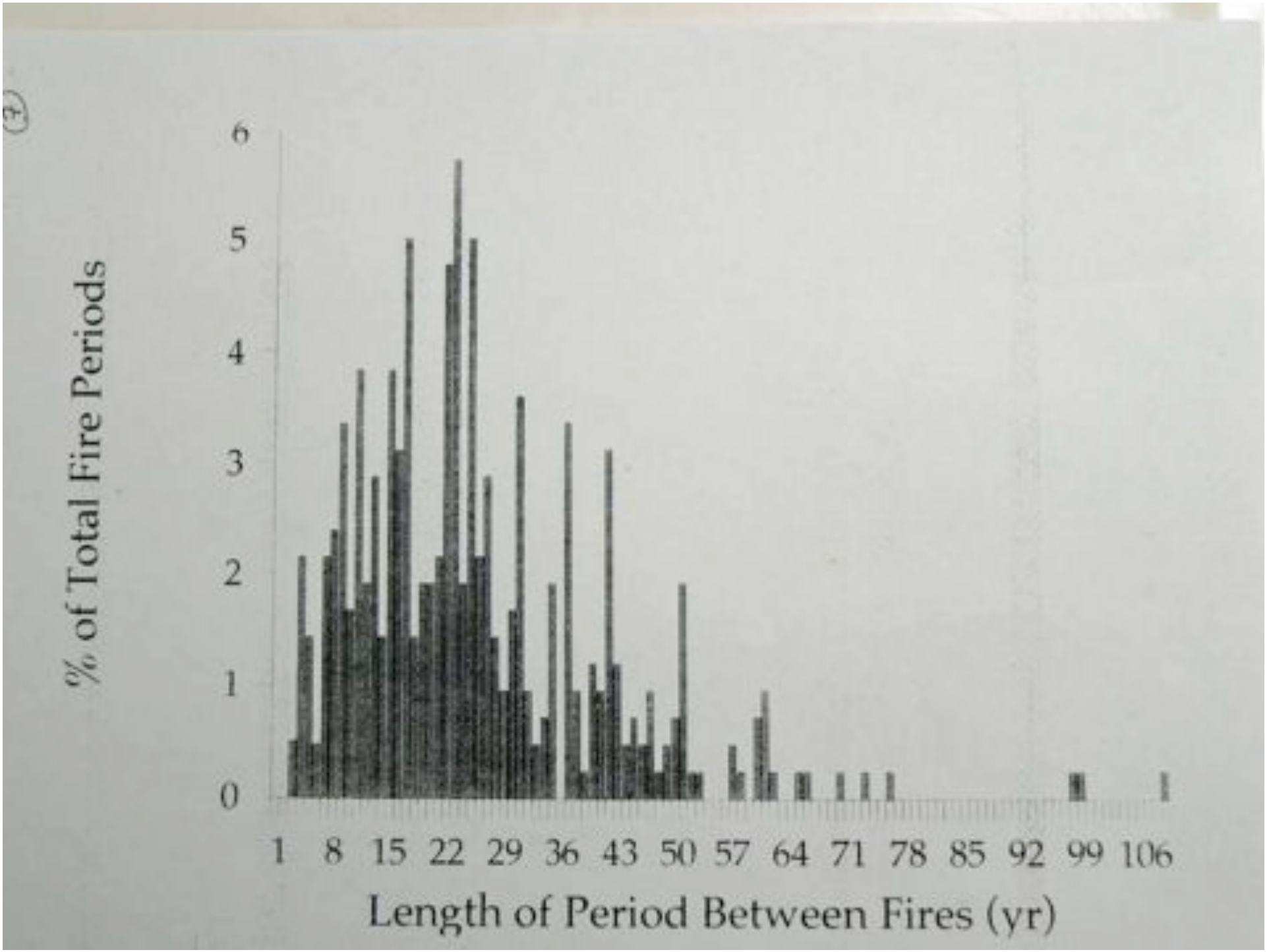

40°
39°
38°
37°
36°
35°
34°
33°
ELLSWORTH'S
Inventory Area, 1900-1
0 50 100 150 200 250 300 350 400
Kilometers

CHANGES IN PERCENT MORTALITY AS A FUNCTION OF TIME, SIZE CLASS AND FOREST TYPE








% of Total Fire Periods
0
1
2
3
4
5
6
1 8 15 22 29 36 43 50 57 64 71 78 85 92 99 106
Length of Period Between Fires (yr)

SOURCES OF DATA ON MODERN OLD-GROWTH MIXED-CONIFER FOREST REMNANTS

"THE PINERY," NE OF CHICO (250 HA)
(CURRENTLY BEING STUDIED BY ALAN TAYLOR)

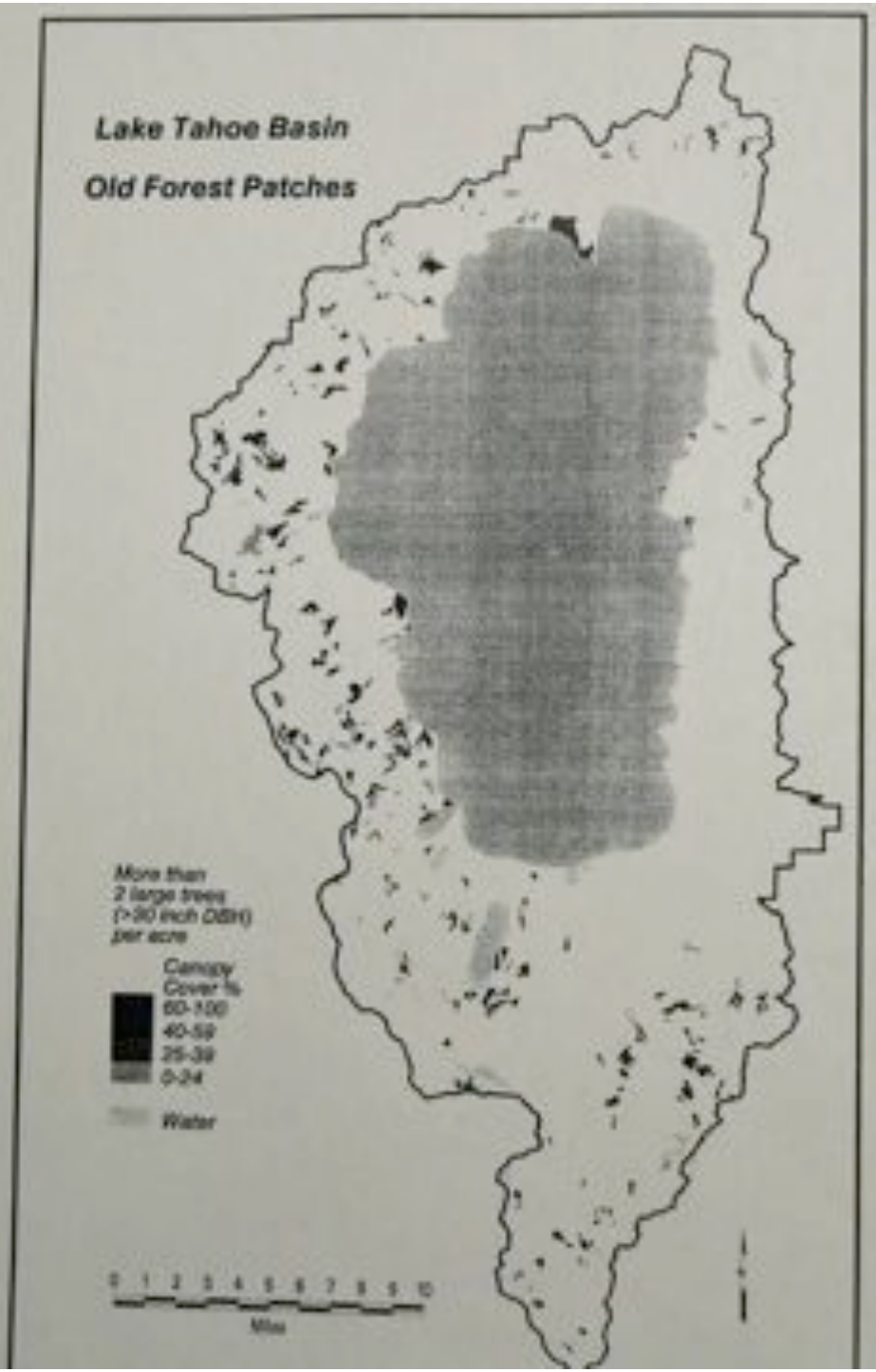
EMPIRE CREEK, SE OF CHICO (300 HA)
(CARMIA FELDMAN)

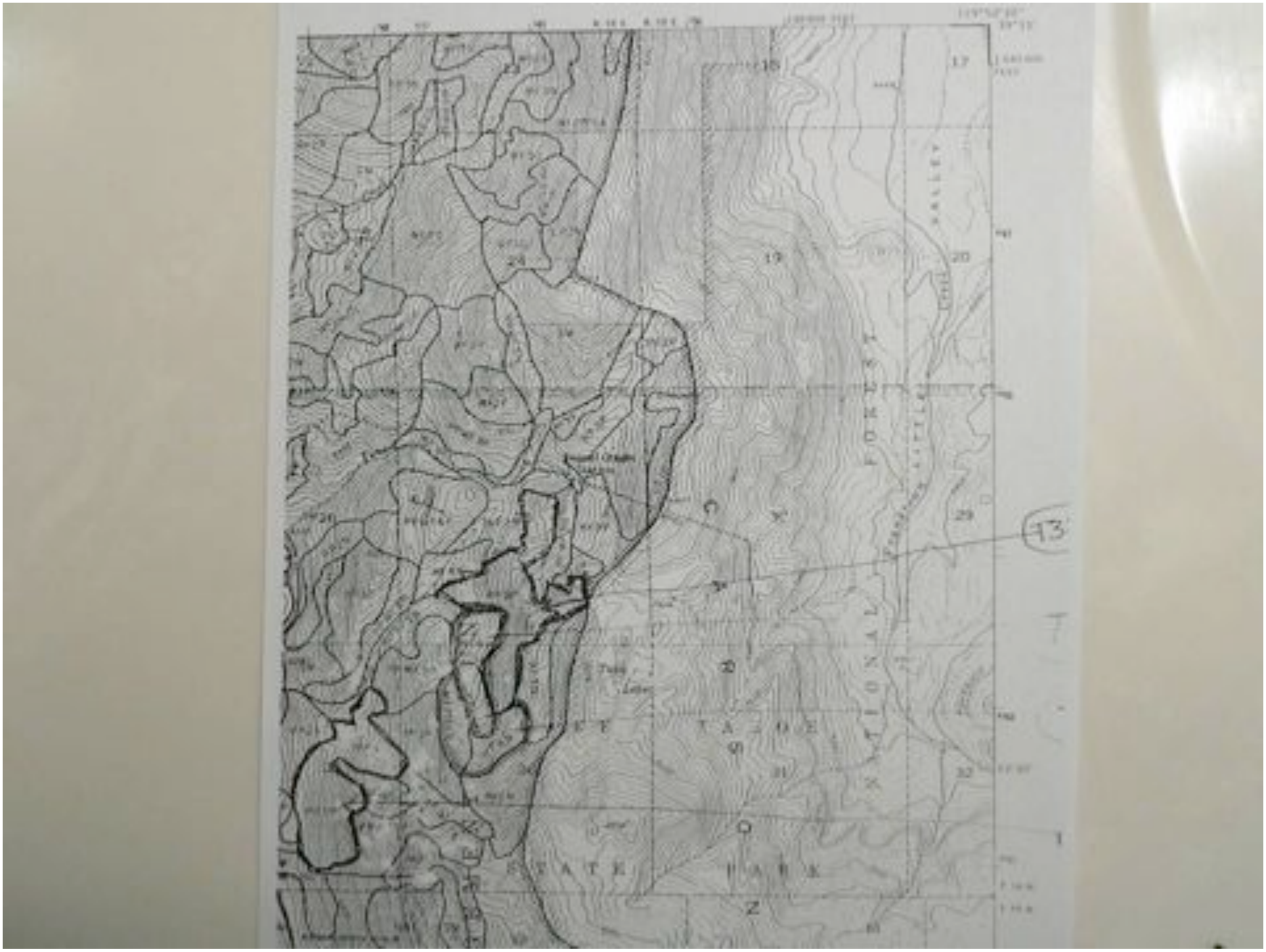
SAILOR BASIN (400 HA) AND PLACER COUNTY BIG TREES (50 HA),
BOTH SE OF YUBA CITY
(MICHAEL BARBOUR, CARMIA FELDMAN)

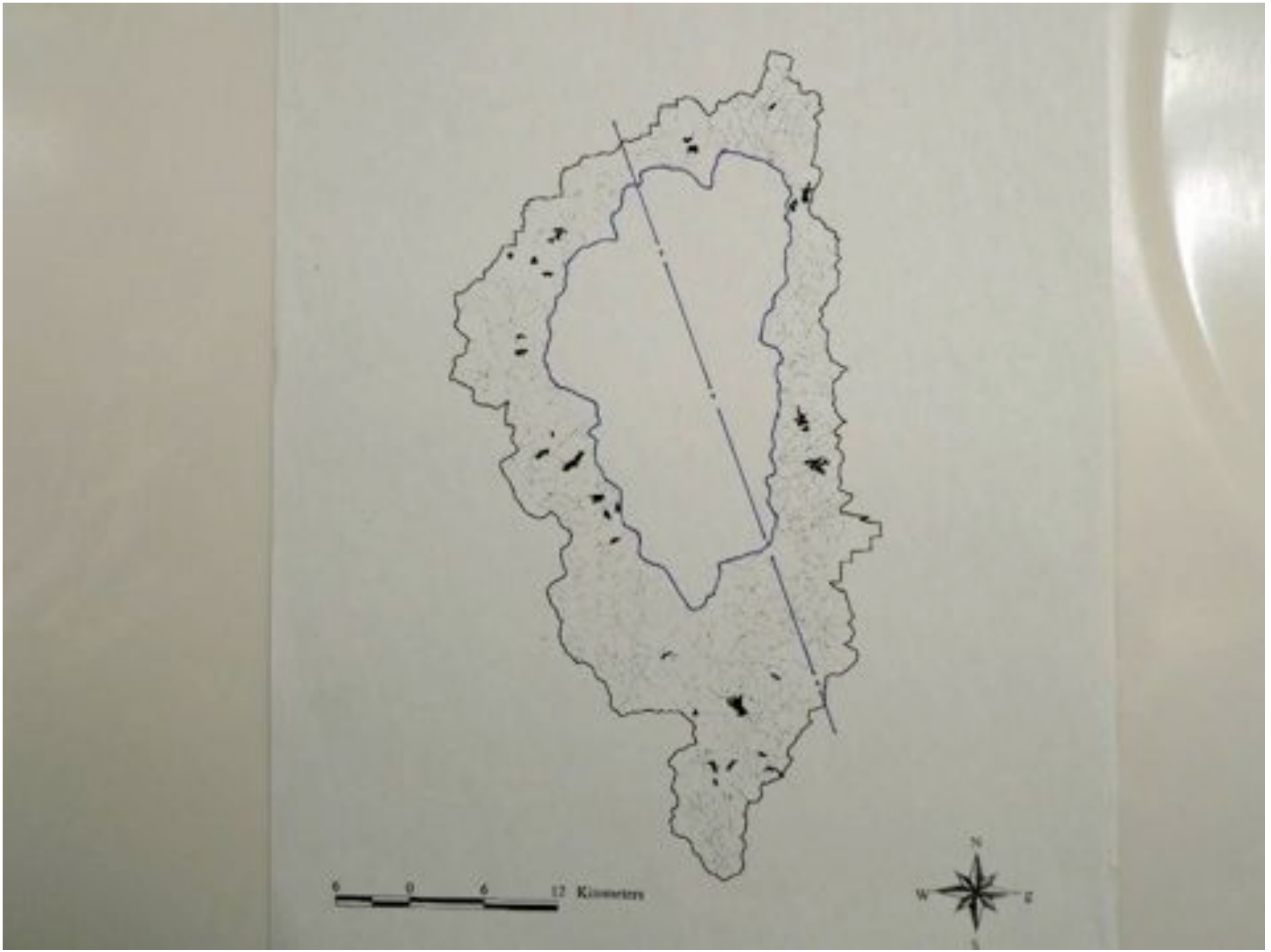
LAKE TAHOE WATERSHED (1000 HA)
(MICHAEL BARBOUR, ELISE KELLEY)

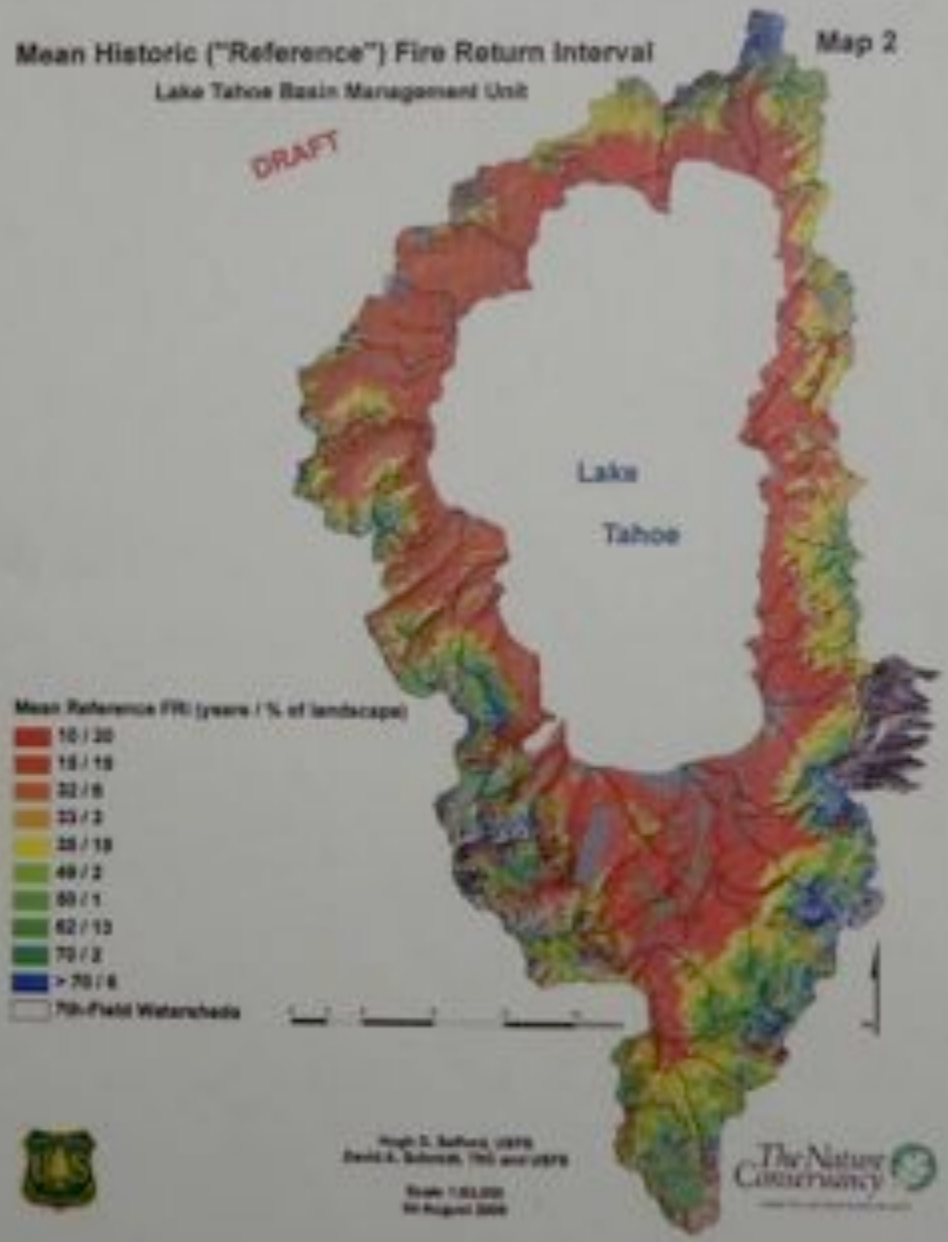
ASPEN VALLEY, YOSEMITE NP (250 HA)
(CARMIA FELDMAN)

TEAKETTLE EXPERIMENTAL FOREST,
SE OF FRESNO (5000 HA)
(MALCOLM NORTH, TOM RAMBO, ROB FIEGENER)


Lake Tahoe Basin
Old Forest Patches
More than
2 large trees
(>30 inch DBH)
per acre
Canopy
Cover %
60-100
40-59
25-39
0-24
Water
0 1 2 3 4 5 6 7 8 9 10
Miles


93
NATIONAL FOREST
STATE PARK


6
0
6
12 Kilometres
N
W
E


Mean Historic ("Reference") Fire Return Interval
Lake Tahoe Basin Management Unit
Map 2
DRAFT
Lake
Tahoe
Mean Reference FRI (years / % of landscape)
10 / 20
15 / 15
22 / 8
33 / 3
35 / 15
49 / 2
59 / 1
62 / 13
70 / 2
> 70 / 6
7th-Field Watersheds
The Nature Conservancy

FOREST TRAITS IN TAHOE AND BAJA CALIFORNIA

Trait	Tahoe 2nd-growth	Tahoe old-growth	Baja old-growth
disease incidence	39%	23%	12%
mortality	29%	22%	15%
tree density/ha	644	350	117
ratio of pine:fir	1:9	1:3	2:1

HOW MUCH OLD-GROWTH IS ENOUGH?

CURRENTLY IN TAHOE BASIN = 5-6%

CURRENTLY IN SIERRAN NATIONAL FORESTS = 13%

ONE NATIONAL FOREST ECOLOGIST'S GUESS = 40%

CURRENTLY IN SIERRAN NATIONAL PARKS = 55%

TRPA GUIDELINES PROPOSE = 80%

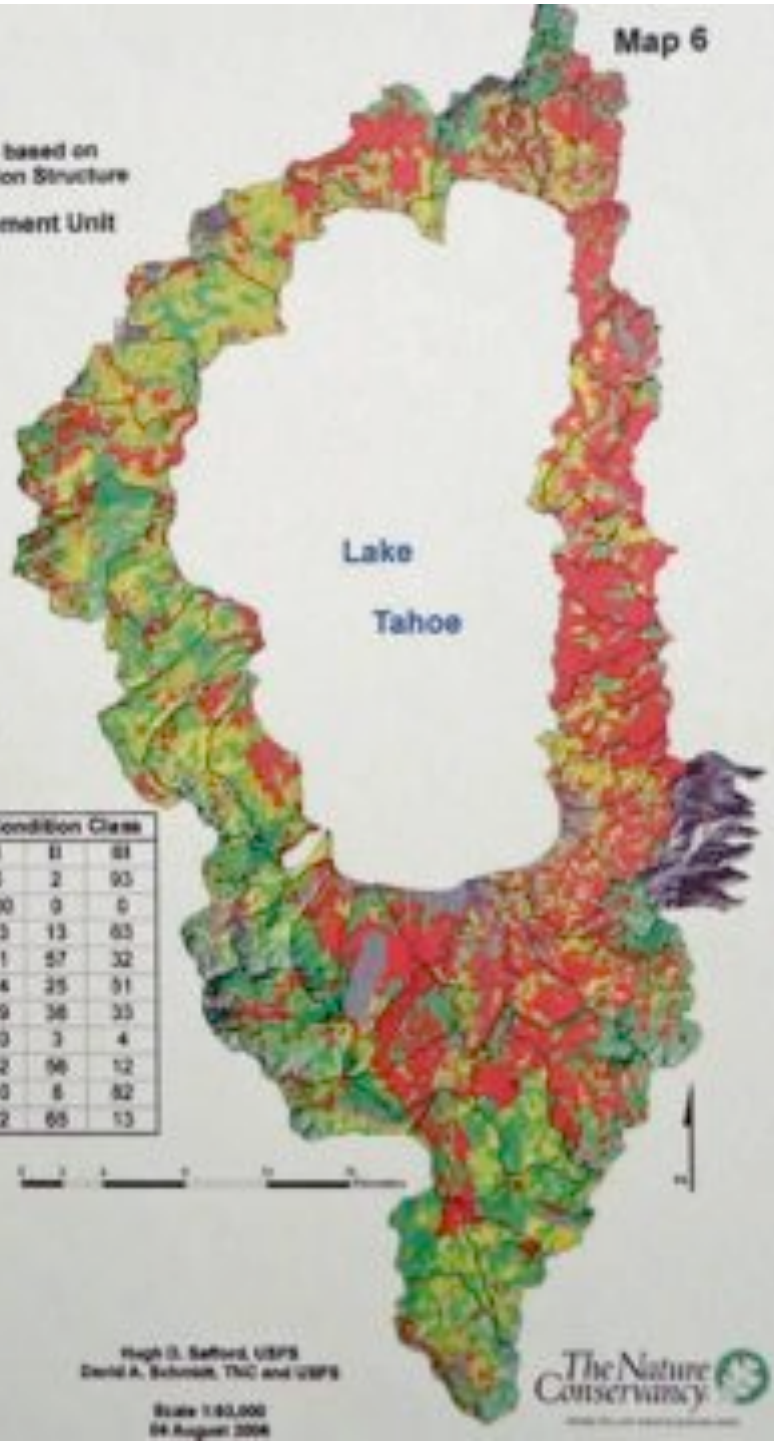
Map 6

FRCC(VS)

Fire Regime Condition Class based on departure from historic Vegetation Structure

Lake Tahoe Basin Management Unit

DRAFT



FRCC (% of landscape)

- I (within HRV; 30)
- II (moderate departure; 33)
- III (severe departure; 37)
- 7th-Field Watersheds

Percent of Landscape	Condition Class		
By8	I	II	III
Aspen	5	2	93
Montane Chaparral	100	0	0
Sagebrush	23	13	63
Yellow Pine (East Side SN)	11	57	32
Red Fir/White Fir	24	25	51
Red Fir/W. Western Pine	29	38	33
Subalpine	93	3	4
White Fir/Mixed Conifer	32	56	12
Lodgepole Pine (cold, wet)	10	8	82
Lodgepole Pine (subalpine, dry)	22	65	13

Hugh D. Safford, USFS
David A. Schmidt, TNC and USFS

Scale 1:63,000
04 August 2006

The Nature Conservancy

WHAT IS THE MODERN OLD-GROWTH MIXED-CONIFER FOREST LIKE?

(SOURCES: PINERY, EMPIRE CREEK, SAILOR BASIN, PLACER COUNTY BIG TREES, TAHOE BASIN, ASPEN VALLEY, TEAKETTLE EXPERIMENTAL FOREST, FIA PLOTS)

- SURFACE FIRE REGIME:
  FIRE RETURN INTERVAL = >600 YR
  POTENTIAL FOR CATASTROPHIC CROWN FIRE
  VERY HIGH; UNSTABLE ECOSYSTEM
- TREE DENSITY/HA = 530
- SAPLING:TREE DENSITY RATIO = 1.5:1
- AGE (SIZE) DISTRIBUTION = NEG EXP
- SHRUB + HERB COVER = 10%
- STANDING DEAD TREES = 20-25%
- DISEASE INCIDENCE (TAHOE) = >20%
- COARSE WOODY DEBRIS BIOMASS = 27
  (METRIC TONS PER HA)

SUGGESTED MINIMUM CRITERIA FOR OLD-GROWTH STATUS IN THE TAHOE BASIN

>5 snags of >76 cm dbh/ha
>10 living trees > 76 cm dbh
>25 living trees >40 cm dbh
>40% canopy cover
<400 trees >1 cm dbh (except white fir)
<625 such trees for white fir forest
<35% cover by shrubs + herbs
<10% live trees with disease symptoms
<20% of all trees dead
*Maximum kg/ha annual litter drop
*A particular range or ratio of [C, N, P] in litter or topsoil
*Presence (or minimum abundance) of certain groups of soil microbes

---

*data still being analyzed

IMPACT OF NATIVE CALIFORNIANS

WERE NATIVE CALIFORNIAN TECHNOLOGIES CAPABLE OF CREATING WIDESPREAD ECOLOGICAL CHANGE?

YES (FIRE)

WERE SETTLEMENTS OF ADEQUATE DURATION TO CAUSE PERMANENT EFFECTS ON THE LANDSCAPE?

YES (9000-10,000+ YR)

WAS POPULATION DENSE ENOUGH TO HAVE WIDESPREAD ECOLOGICAL IMPACTS?

PROBABLY (90,000-100,000 INDIVIDUALS, 3000 PERMANENT SETTLEMENTS, 5000 SEASONAL SETTLEMENTS EACH AFFECTING 3 SQUARE MILES)

WHICH ACTIVITIES HAD THE GREATEST IMPACT ON THE LANDSCAPE?

BASKETRY, CORDAGE, FIREWOOD, FOOD

From: M.K. Anderson and M.J. Moratto,SNEP, vol II

PLANT MATERIALS NEEDED PER ITEM

ITEM	PLANT SPP	NO. STEMS
BURDEN BASKET	RHUS TRILOBATA	1200
SIFTER BASKET	"	1000
SEED BASKET	C. CUNEATUS	378
GILL NET	APOCYNUM & ASCLEPIAS SPP	60,000 (3,665 m)
DIP NET	"	39,450 (2,405 m)
DEER NET	"	35,000 (2,134 m)

From: M.K. Anderson and M.J. Moratto,SNEP vol II pp 187-206, 1996

FILM SCREENING

THE TEAKETTLE EXPERIMENT

Executive Producer: Malcolm North

"Starring" UC Davis research by:
Michael Barbour, Rob Fiegener, Matt Hurteau, Doug Kelt, Patricia Maloney, Marc Meyer, Malcolm North, Tom Rambo, David Rizzo, Tom Smith, and Rebecca Wayman.

FRIDAY, MAY 11, NOON TO 1:00 PM

THE BARN, LARGE CONFERENCE ROOM

Forest "health" cannot be restored through thinning alone. This documentary summarizes ten-years of collaboration between forest managers and scientists from multiple disciplines to prove the benefits of prescribed burning as the essential means for restoring fire-suppressed forests. This documentary has increased awareness that overcrowded forests are subject to disease, pests and catastrophic wildfires.

Teakettle project director Malcolm North, Department of Plant Sciences, USDA Forest Service Sierra Nevada Research Center, is offering FREE copies of this interactive DVD at the screening, which will conclude with a Q & A on forest management and outreach.

Screening sponsored by the John Muir Institute of the Environment

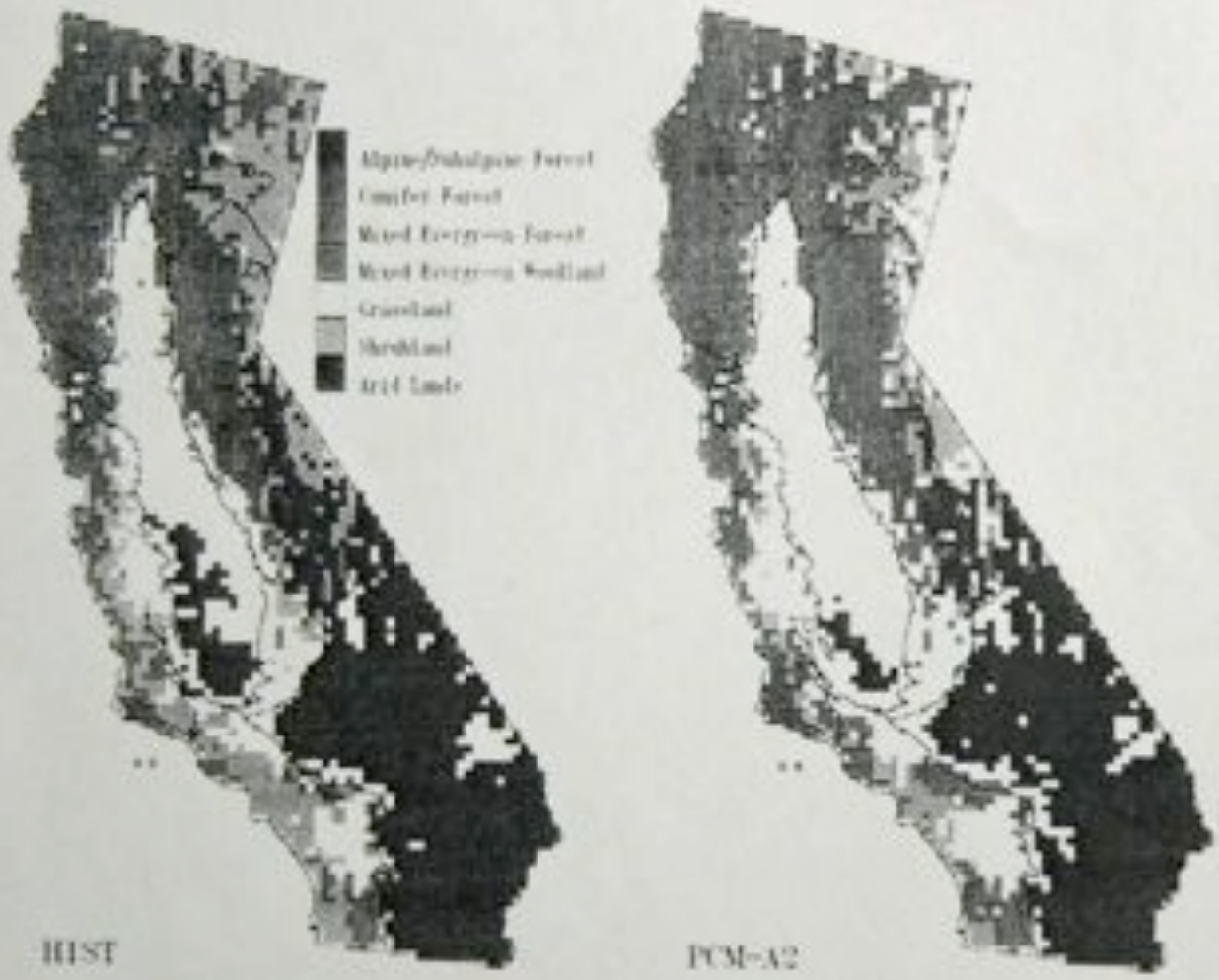
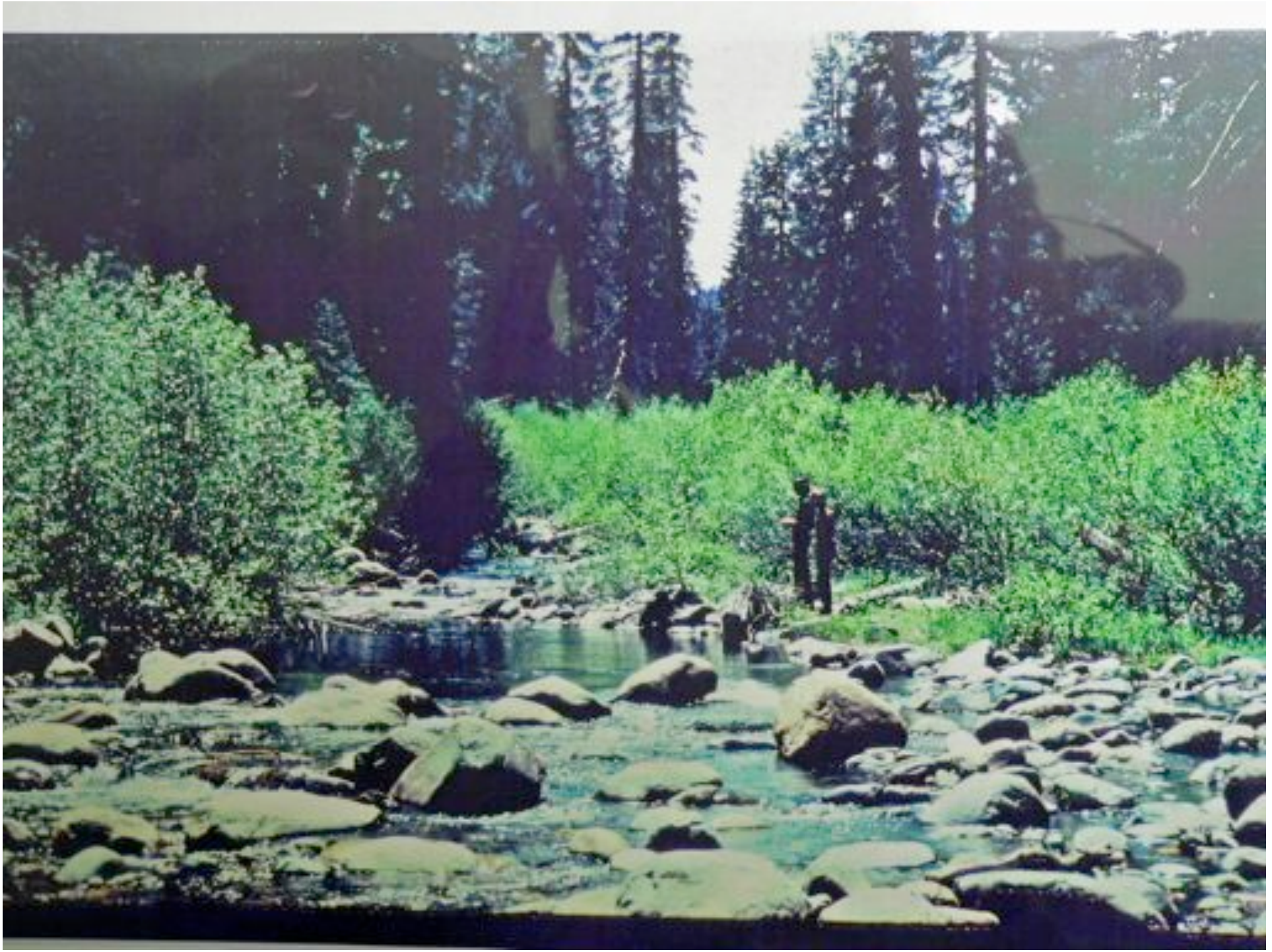



Figure 1. Distribution of the vegetation classes simulated for the historical (1961–1990) and PCM-A2 future period (2070–2099). The vegetation class mapped at each grid cell is the most frequent class simulated during the time period.