

FSK, 1966

The Resources Agency of California  
Department of Fish and Game

STREAM DAMAGE SURVEYS - 1966<sup>1/</sup>

LEONARD FISK, Inland Fisheries Branch  
and  
ERIC GERSTUNG, Region 2; RICHARD HANSEN, Region 1;  
and JOHN THOMAS, Region 3; Water Projects

SUMMARY

Four stream drainages were surveyed during July 1966 to determine the extent of damage from past logging and other activities. The streams are the Garcia River, Mendocino County; Redwood Creek, Humboldt County; North Fork of Battle Creek, Shasta County; and Middle Fork of Mokelumne River, Calaveras County.

A total of 328 miles was surveyed. Of this, 108 miles (33%) were severely damaged, 27 miles (8%) were moderately damaged, 127.5 miles (39%) were lightly damaged, and 65.5 miles (20%) were undamaged.

The most severe damage occurred in Redwood Creek and the Garcia River, both in the redwood forests of the Coast Range.

In the North Fork of Battle Creek and in Forest Creek, tributary to the Middle Fork of Mokelumne River, there was five times the poundage of trout per unit area in undamaged control sections as in severely damaged areas.

In Forest Creek, water temperatures increased about 0.5° F. per mile in well-shaded areas, compared to 1.5 to 2.0° F. per mile in unshaded areas.

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<sup>1/</sup> Submitted August 1966.  
Inland Fisheries Administrative Report No. 66-10.

## INTRODUCTION

The Department of Fish and Game is greatly concerned about the loss of good stream habitat due to poor watershed management practices, which have been causing serious damage for many years. Logging, road building, dam construction, and overgrazing are all involved.

Stream damage in California is not new. Testimony given to the Senate Interim Committee on Stream and Beach Erosion (Senator A. A. Way, Chairman) in 1956 indicated that 925 miles of streams had been damaged or destroyed by early 1955. The estimate by the end of 1956 was over 1,000 miles of streams damaged.

A survey in 1962 indicated 33 streams totalling about 55 miles, were damaged that year.<sup>2/</sup>

In order to define the present extent of damage in a preliminary way, four streams were surveyed during July 1966. They include the Garcia River, Mendocino County; Redwood Creek, Humboldt County; North Fork of Battle Creek, Shasta County; and Middle Fork of Mokelumne River, Calaveras County.

We believe these streams are reasonably representative in their areas. They were surveyed by making observations in and along the stream channels. Information concerning each section of each stream was recorded on stream survey forms, and included observations on degree of siltation, amount of shelter, cover, pools, debris and barriers in the stream channel, extent of streamside canopy, numbers of diversions, fishes present, and causes of damage. From information collected, the various stream sections were classified as follows: severely damaged, moderately damaged, lightly damaged, or undamaged.

Classification was based on the following criteria:

Severely damaged:

- (a) 75-100 percent of the stream bottom was covered with silt,
- (b) streamside canopy and pools were totally eliminated, or
- (c) there was a total loss of shelter for fish.

Lightly damaged:

- (a) 50 percent or less of the bottom was covered with silt, together with a partial loss of pools or streamside canopy,
- (b) shelter was partially removed,
- (c) pools were eliminated,
- (d) canopy was removed, or
- (e) debris was present and abundant in stream channel.

Moderately damaged:

Intermediate between the lightly and severely damaged categories.

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<sup>2/</sup> Calhoun, Alex and Charles Seeley  
1962. Logging damage to California streams in 1962. Calif. Dept. Fish and Game, Inland Fish. Admin. Rept. No. 63-2, 15 pp. (Mimeo.)

#### ACKNOWLEDGMENTS

John Thomas surveyed the Garcia River, Richard Hansen supervised the surveys of Redwood Creek and North Fork of Battle Creek, and Eric Gerstung surveyed the Middle Fork of Mokelumne River.

#### RESULTS

A total of 328 miles was surveyed. Of this, 108 miles were severely damaged, 2 miles were moderately damaged, and 127.5 miles were lightly damaged (Table 1). Only 65.5 miles, 20 percent of the total, are undamaged at the present time. One third of the total has been severely damaged.

Of the four drainages surveyed, Redwood Creek showed the most severe damage, followed by the Garcia River. Significantly, both of these streams are in the Redwood Region of the Coast Range. Steep slopes of highly erodible materials are characteristic of this region.

Most of the damage to the North Fork of Battle Creek and the Middle Fork of Mokelumne River was classed light. These streams, in the Cascade Range and the Sierra Nevada respectively, are in areas with gentler slopes and generally less erodible soils than those of the Coast Range.

Figures 1, 2, 3, and 4 show locations of damaged and undamaged areas.

#### FISH POPULATION SAMPLING

Fish populations were sampled in sections of the North Fork of Battle Creek and Forest Creek, tributary to the Middle Fork of Mokelumne River, to determine the numbers and weight of trout in undisturbed and in damaged sections of the streams. Results from both streams indicate approximately five times as much trout by weight, in undamaged streams as in severely damaged sections (Tables 2 and 3). Figure 5 portrays graphically the pounds of trout per acre in the various damaged sections of Forest Creek. Both streams were sampled with an electroshocker in 200- or 300-foot sections.

#### WATER TEMPERATURES

The effect of removal of the streamside canopy on water temperatures was measured in Forest Creek, Calaveras County. Complete removal of shade resulted in undesirable temperatures. During the late July-early August period, water temperature ranged from 70 to 73° F. in shaded portions. In the unshaded portions, temperatures increased to 75 to 78° F.

Temperatures increased about 0.5° F. per mile in shaded portions of the stream, but increased from 1.5 to 2.0° F. per mile in the cleared or partially cleared areas. Figure 6 shows the results of a series of temperature measurements made in Forest Creek within a period of about one-half hour.

TABLE 1

Stream Damage

Stream	Total miles	Severely damaged	Moderately damaged	Lightly damaged	Undamaged
Garcia River	104	37	15	37	15
Redwood Creek	84	64	4.5	6	9.5
North Fork Battle Creek	86	5	2.5	46.5	32
Middle Fork Mokelumne River	54	2	5	38	9
Totals	328	108	27	127.5	65.5

TABLE 2

Trout Sampling, North Fork of Battle Creek, Shasta County,  
June 7, 1966

Section	Damage characteristics	Number of trout	Pounds of trout	Average pounds trout per section
1	Old logging (10 years +)	6	0.52	0.44
2	1965 logging	4	0.12	
3	1965 logging	29	0.67	
4	Undamaged	25	1.95	2.02
5	Undamaged	23	2.10	

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TABLE 3

Trout Sampling, Forest Creek, Calaveras County,  
July 25, 1966

Section	Severity of damage	Type of damage	Adult trout per mile <sup>1/2</sup>	Pounds of trout per acre
1	Undamaged	Undisturbed	280	83
2	Light	Partial loss of pools and shelter	228	40
3	Moderate	Complete loss of pools; partial loss of shelter	150	25
4	Severe	Complete loss of pools and shelter; heavy siltation	105	12

<sup>1/2</sup>Trout over 6 inches classed as adult.

## DISCUSSION

### Garcia River

Most of the severely damaged areas in the Garcia River are the result of current operations. Sidehill slopes are very steep, and many of them are laced with skid trails and logging roads. There has been little effort to keep heavy equipment out of the streambeds, and in numerous instances roads have been constructed in the stream channels, oftentimes moving the stream out of its natural channel.

The Garcia River has runs of silver salmon and steelhead rainbow trout, and some headwater streams contain resident rainbow trout. A large portion of the streams that were suitable for spawning and as nursery areas for salmon and steelhead have been severely damaged. Suckers now appear to have replaced salmonids as the dominant fish in a large section of the Garcia River. This can be attributed directly to deterioration of the stream habitat.

### Redwood Creek

Historically, Redwood Creek supported fair runs of king and silver salmon, steelhead rainbow and coastal cutthroat trout. Resident rainbow and cutthroat trout also inhabit upper reaches of the basin. King salmon spawn in the main stem of Redwood Creek, whereas the other species mainly spawn in the tributaries.

The main stem of Redwood Creek has undergone extensive change in recent years. Large amounts of sand, silt, and gravel have been deposited in the channel, and as a consequence, the streambed has widened and raised. Pools are almost nonexistent. During low flows, the water is exposed to direct sunlight almost throughout the entire length of stream. Streamside vegetation is presently too far from the live stream to be of much benefit. The river channel is largely unsuitable as a nursery for young salmon and steelhead in its present condition.

Both man-made and natural conditions have contributed to the deterioration of Redwood Creek. Major floods in 1955, 1964, and 1965 washed enormous amounts of material into the main stem, filling pools and widening the channel. Logging activities, particularly the construction of roads and skid trails and the removal of vegetative ground cover, have been a major factor contributing to increased erosion and land slippage.

### North Fork of Battle Creek

Resident trout, both rainbow and brown, are important game fish in the North Fork of Battle Creek drainage. The Department of Fish and Game stocks catchable-sized rainbow trout in several streams in the area surveyed to provide recreation to the many anglers who fish here.

Logging has been conducted since the 1800's in the Battle Creek drainage; however, because of a number of factors, erosion problems are not as great here as in many other localities. Extensive damage does not generally occur due to any particular disturbance, although there was one bad operation along the creek in 1965. Damage due to logging has been localized and relatively minor in this area as a whole.

Middle Fork of Mokelumne River

Resident rainbow and brown trout are found in this drainage. Catchable-sized rainbow trout are also planted in several stream sections. All of the streams flowing through lands logged in the last 20 years have been damaged to some degree. Most of the damage has been caused by heavy equipment operations within the stream channels, and by removal of the streamside canopy. In this drainage, no stream disturbance other than siltation from upstream logging operations was noted on U. S. Forest Service lands.

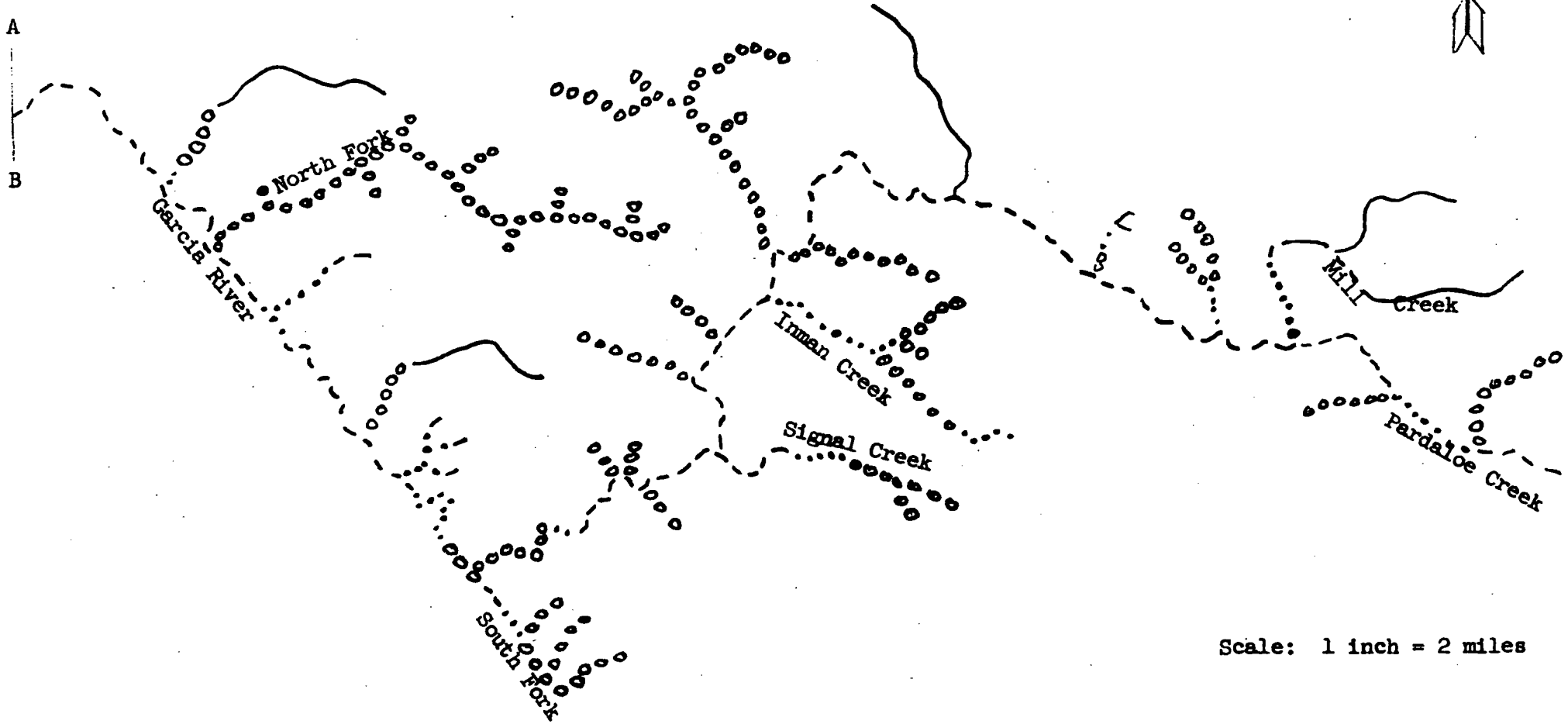
CONCLUSIONS

1. Logging operations are damaging streams throughout much of northern California.
2. The most serious damage is being done in the Coast Range.
3. Most of the damage results from removal of vegetation along the stream banks and on the hillsides, and heavy equipment operations in the stream channels.
4. Excessive erosion fills pools and makes stream habitat less suitable for trout and salmon.
5. Removal of the streamside canopy results in increased temperatures that approach the lethal limit for trout.
6. Trout populations are reduced significantly in severely damaged streams.





- ○ ○ ○ ○ Severely damaged
- ..... Moderately damaged
- - - - - Lightly damaged
- Undamaged



Scale: 1 inch = 2 miles

FIGURE 1. Garcia River, Mendocino County, stream damage.

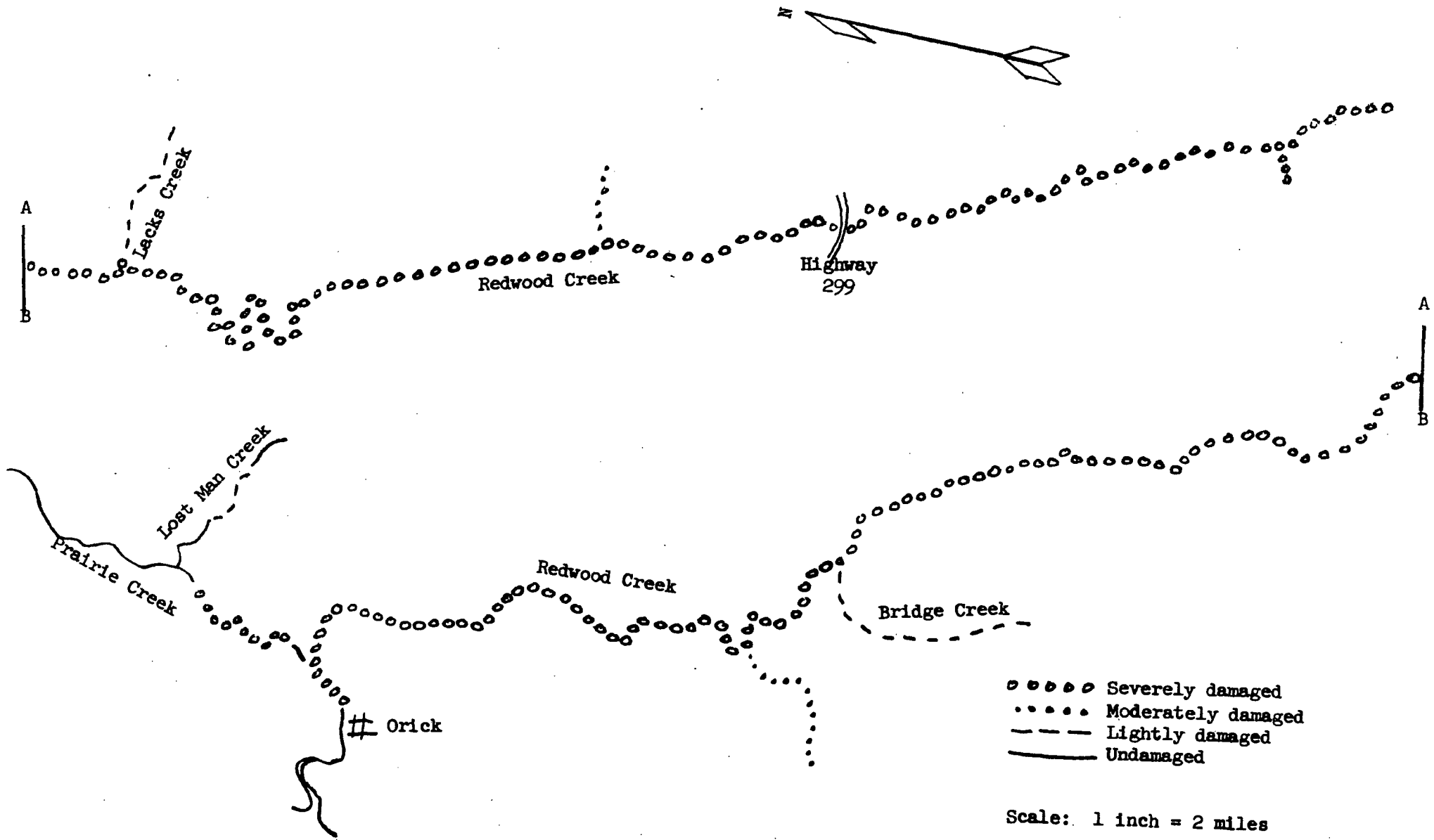


FIGURE 2. Redwood Creek, Humboldt County, stream damage.

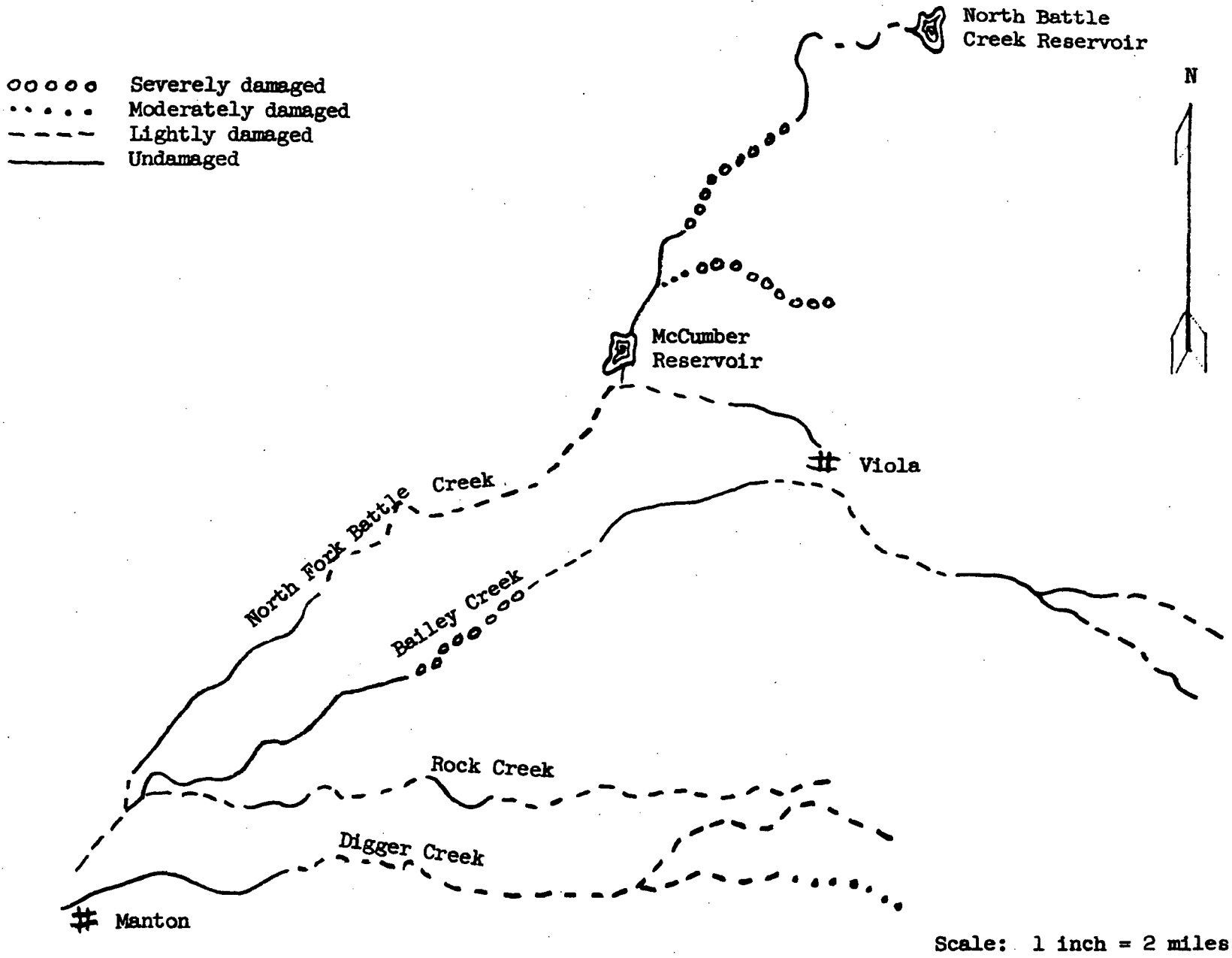


FIGURE 3. North Fork Battle Creek, Shasta County, stream damage.

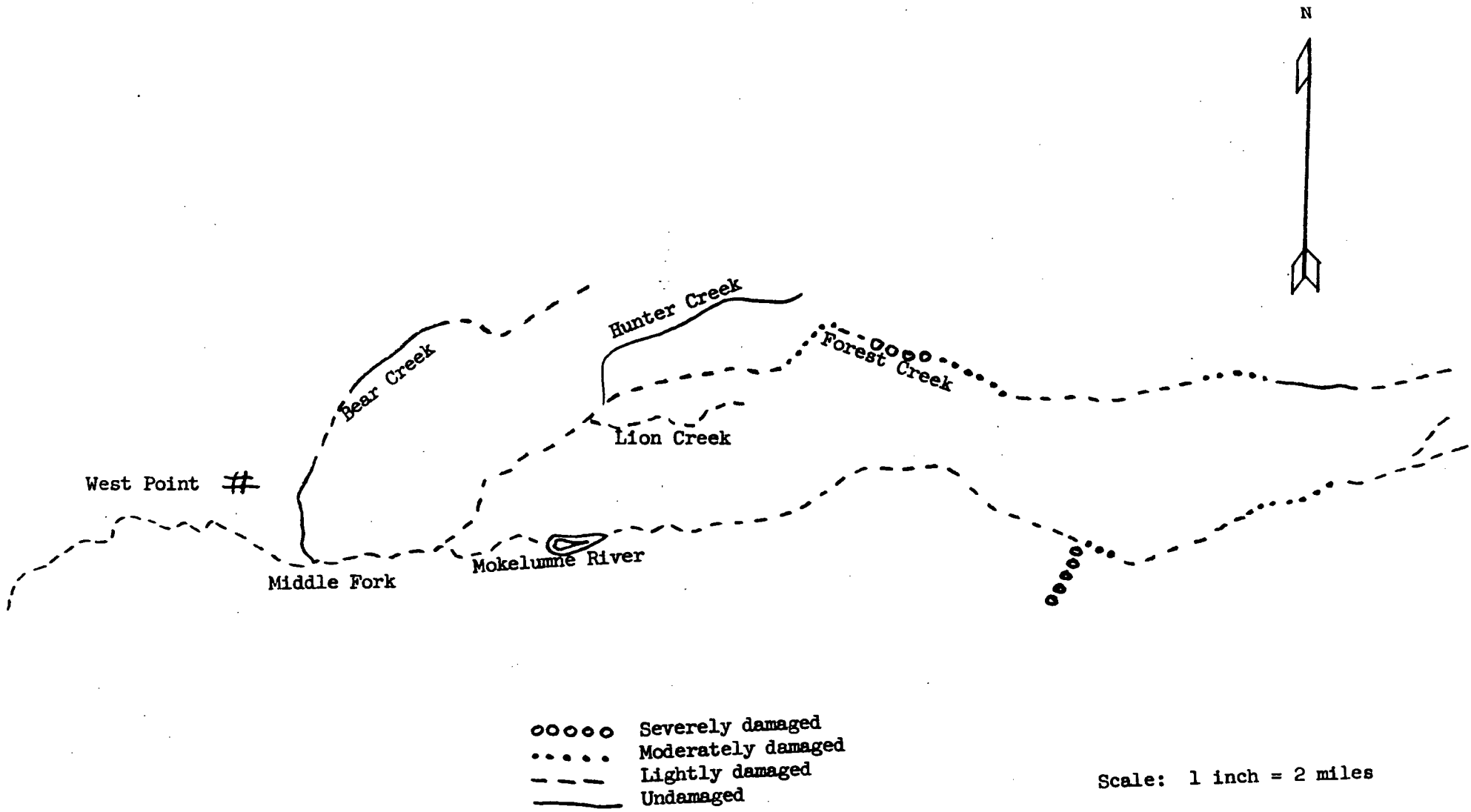


FIGURE 4. Middle Fork Mokelumne River, Calaveras County, stream damage.

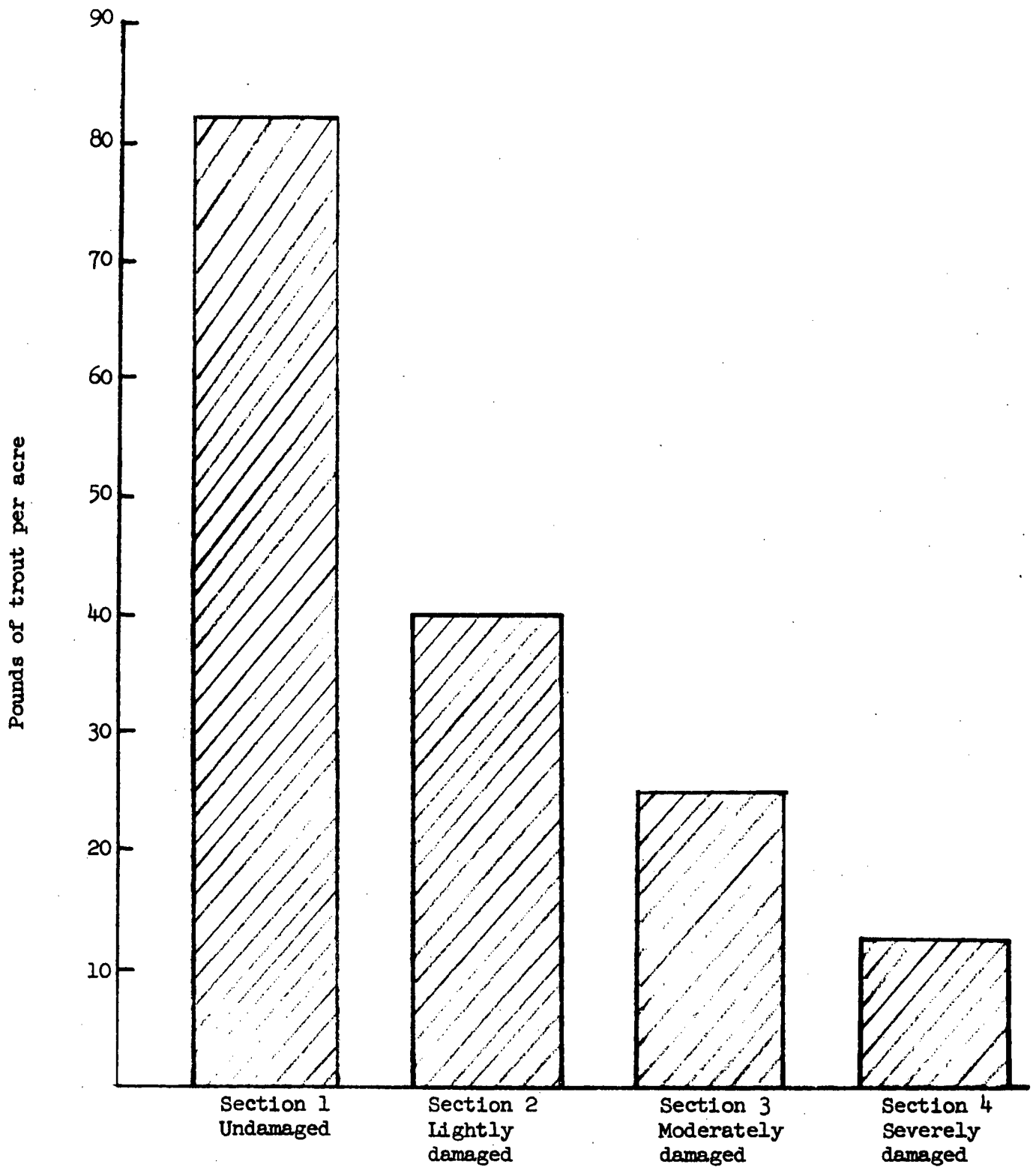


FIGURE 5. Trout populations from damaged sections of Forest Creek, Calaveras County, July 25, 1965.

Air temperature - 85° F.

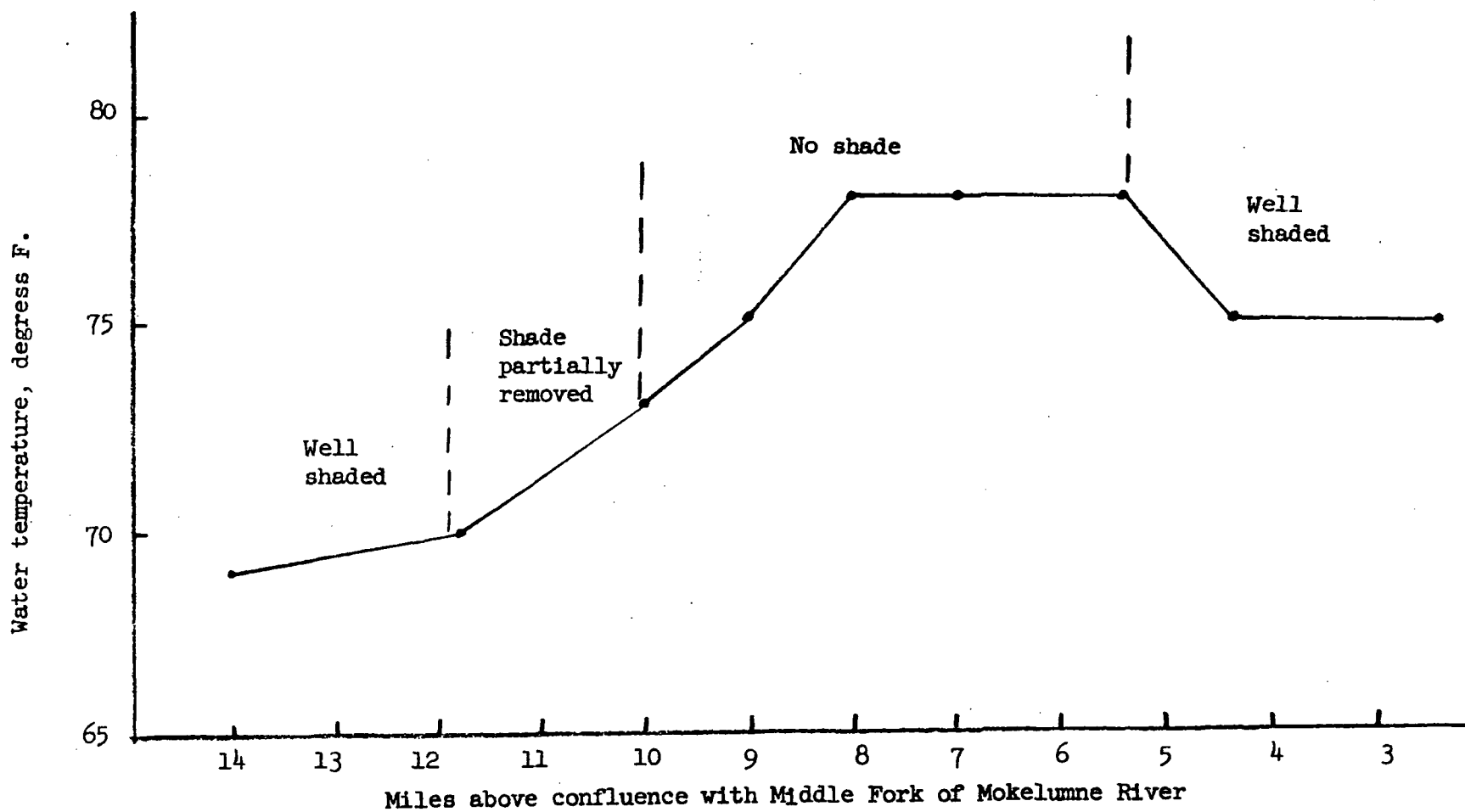


FIGURE 6. Relationship between stream canopy and stream temperatures. Forest Creek, Calaveras County, August 2, 1966, 4:00 p.m.