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## Frost Injury to Bitterbrush in Eastern California

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**ABSTRACT:** Widespread dieback of *Purshia tridentata*, on the Inyo National Forest in eastern California in the spring of 1964, was caused by a severe 3-day frost with daily minimums down to 13°F. An unusually warm 9-day period with temperatures up to 70°F., which preceded the frost by a week, had induced the bitterbrush to break dormancy and start shoot elongation when the frost occurred. Damage to the bitterbrush caused reductions in the current range allotments. This is the first report of so severe a frost injury in this area.

Bitterbrush (*Purshia tridentata* (Pursh.) D. C.), a high value forage plant, is one of the major sources of food for domestic sheep and cattle in eastern California. It is also a mainstay of the diet of deer that inhabit the range. In the spring of 1964, a widespread dieback of bitterbrush was noted on ranges between Lee Vining and

Bishop. Further spread could adversely affect the carrying capacity of the ranges and result in decreases in range allotments on National Forest land. Because of its potentially serious effect, the dieback was of concern to both range and wildlife managers.

The cause of the dieback was not readily apparent; hence its future effect on the range could not be predicted. The Inyo National Forest asked plant pathologists from the Pacific Southwest Forest and Range Experiment Station to diagnose the problem and estimate the future impact of dieback on bitterbrush on the affected ranges.

### Extent of Damage

An inspection of the dieback areas revealed that damage varied considerably -- both in the degree of damage to individual plants and in the percent of severely damaged plants in the different areas. Damage was not severe on south slopes and areas with good air drainage, where only an occasional plant with a few dead buds and twigs was observed. The greatest and most widespread damage occurred on north slopes and in low basins, where most of the bitterbrush suffered severe dieback.



Plants of all ages were damaged, and damage to individual plants varied considerably. On lightly damaged plants only the terminal and lateral buds on the outer exposed portions of the shrubs were killed. The buds in the interior of such plants were unaffected as evidenced by their subsequent development and shoot growth. In cases of moderate damage the majority of terminal and lateral buds, twigs, and smaller branches were killed. Older branches in the interior and at the base of the shrub were not killed as evidenced by new sprouts that began developing by mid-July 1964. In a few very severe cases, the whole plant appeared dead down to the root collar, and no signs of resprouting were evident.

#### Cause of Dieback

No pathogenic organism could be found either in the field or in later laboratory examinations of the damaged tissue. All plants examined were in about the same stages of their annual development when they were damaged: the buds had just opened and were in the first stages of elongation when they were killed. No evidence of more recent damage was found. These observations suggested that this dieback was not caused by a pathogenic organism but resulted from some widespread unfavorable climatic factor that occurred in the spring just after bud break.

Frost or unusually cold weather is often the cause of such damage occurring in spring. Typically the cold period is preceded by a warm spell which induces the plant to break dormancy and start growth. During these early growth stages the actively growing tissues are much more susceptible to injury from low temperature than they are in their dormant state.

Such a weather pattern occurred in April 1964 in this area. The records of the Mono Lake weather station (fig. 1) show a warm spell of 9 days (April 9-17) when maximum daytime temperatures were all above 60° F.; during two of these days temperatures rose above 70° F. Similar weather data were reported from the Crowley Lake weather station. During this period the bitterbrush broke dormancy and buds began growing.

Six days later, an unusually cold 3-day period (April 23-25) occurred. Daily minimum temperatures of 27°, 13°, and 21° F. were recorded. The 13° F. temperature would be low enough to cause considerable damage to the young succulent tips and active cambial areas of the plant.

From the field observations and climatic records we concluded that this dieback of bitterbrush was the result of a combination of unfavorable climatic conditions: (a) an unseasonably warm period of 9 days which caused the plants to break dormancy; (b) an intervening 5-day period of moderate temperatures which allowed the plants to continue to develop; and (c) a 3-day period of extreme low temperatures which killed the actively growing succulent tissues.



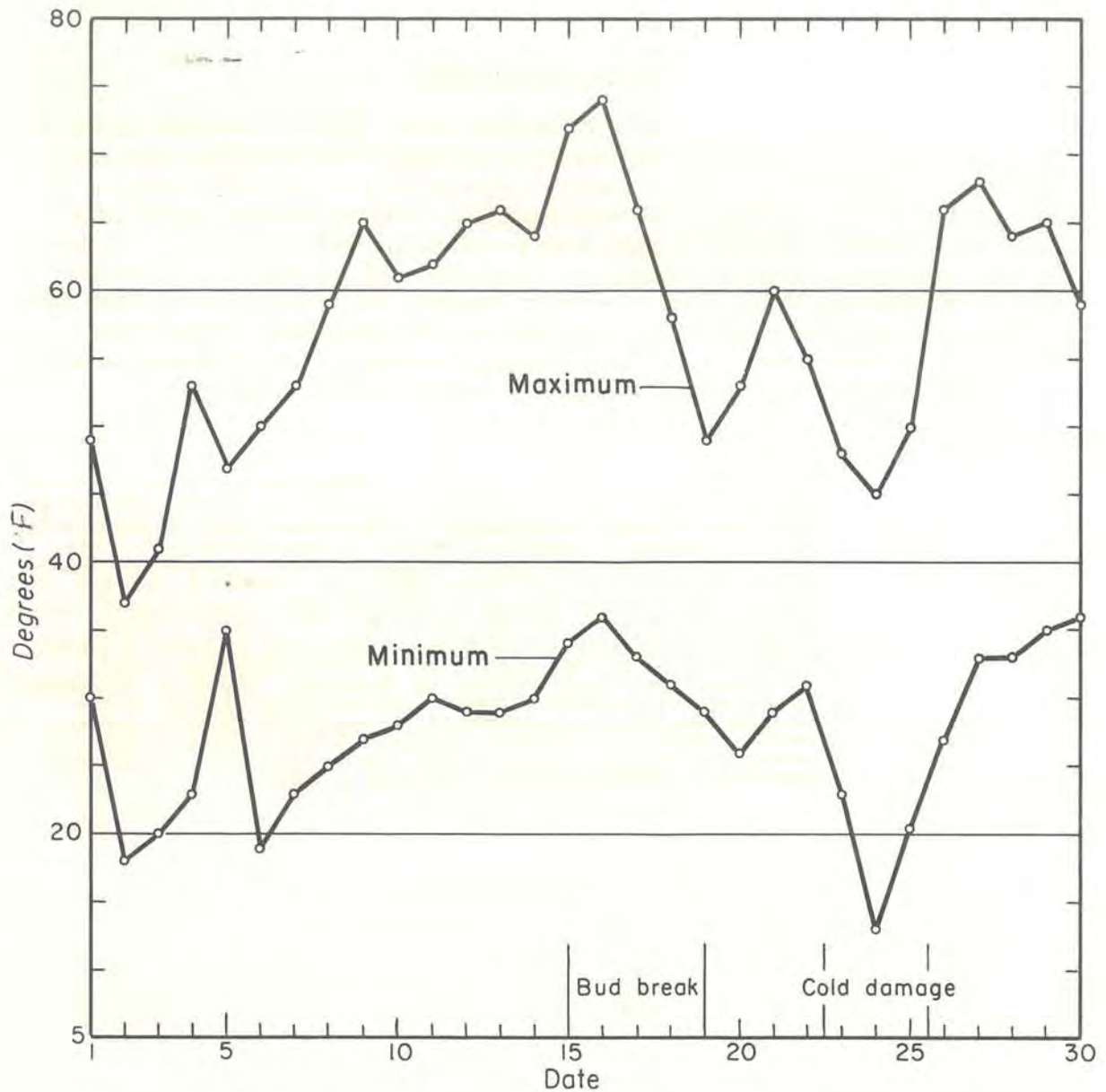


Figure 1.--Daily minimum and maximum ambient temperatures recorded at the Mono Lake weather station, April 1964.

This is the first report of frost injury to bitterbrush in this area of California. Hormay<sup>1</sup> mentioned freezing or sudden temperature changes as possible climatic factors damaging to bitterbrush but cited no examples. Since 1943 there are no other reports of frost injury to bitterbrush. Possibly this type of damage occurs infrequently enough so that range managers need give it only temporary consideration until the range recovers from the damage.

<sup>1</sup>Hormay, A.L. Bitterbrush in California. U.S. Forest Service Calif. Forest & Range Expt. Sta. Res. Note 34, 13 pp. 1943.

### Impact on Range

About 22, 000 acres of rangelands were affected by this dieback. In some areas the dieback was serious enough to reduce the carrying capacity of the range; in two areas it was so severe that the season of use on the current allotments was reduced. Observations made after July 1964 showed that the range was recovering satisfactorily. It may be that the more severely damaged areas should continue to have reduced use during 1965. Any decision depends on the rates at which the damaged plants recover and killed plants are replaced. Other than forcing the restricted use of land during recovery, this dieback should have only slight impact on the future productivity of the range.

#### The Authors

RICHARD S. SMITH, JR., is studying problems of forest diseases and their control, with headquarters in Berkeley. Born in Somerville, N. J., he earned a bachelor's degree in forestry at Utah State University (1958), and doctor's degree in plant pathology (1963) at the University of California, Berkeley. ROBERT F. SCHARPF, also a member of the Station's forest disease research staff in Berkeley, is a native of St. Louis, Mo. A forestry graduate (1954) of the University of Missouri, he holds a master's degree in forestry (1957) and a doctorate in plant pathology (1963) from the University of California, Berkeley. EDWARD R. SCHNEEGAS, serves as the principal assistant to the staff officer on the Inyo National Forest responsible for range and wildlife management. A wildlife management graduate of Chico State College, he joined the Forest Service in 1961 after working for the California Department of Fish and Game from 1955 to 1961.